



Independent Environmental Monitoring Agency

P.O. Box 1192, Yellowknife NT X1A 2R2 • Phone (867) 669 9141 • Fax (867) 669 9145

Website: www.monitoringagency.net • Email: monitor1@yk.com

TECHNICAL REPORT

Jay Project

EA1314-001



**Submitted to the
Mackenzie Valley Environmental
Impact Review Board**

July 2015

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EXECUTIVE SUMMARY

The Independent Environmental Monitoring Agency was established in 1997 as an environmental watchdog for the Dominion Diamond Ekati Corporation's Ekati Mine. We have participated in the Jay Project environmental assessment from the beginning.

Our most important issues are finding ways to reduce the impacts of the Jay Project on the Bathurst caribou herd which has declined a lot, and making sure that the water released by the Jay Project is safe for Lac du Sauvage by ensuring there are good plans in place if predictions are not accurate.

We are also concerned about the new approach to the Jay Project waste rock pile and whether it will freeze. Dust from the Jay Project traffic is also an issue we believe needs careful attention.

Although the DDEC believes that the impacts of the Jay Project are not significant, the Agency is of the view that there is a lot of uncertainty around some of the predictions, a lack of details on some monitoring programs to detect changes, and the need for better plans to take actions when monitoring results give early warning signs of potential problems. The Agency believes that Measures are required to prevent a significant adverse impact to the environment from the Jay Project.

We believe the Review Board should recommend Measures to the Responsible Ministers to require:

- DDEC make the Jay Project environmental footprint as small as possible by choosing road routes carefully, better dust control, and make the esker crossing as small as possible;
- DDEC, with other partners, research the causes of the zone of caribou avoidance of the Ekati Mine and take action to reduce the size of that zone for the Jay Project;
- DDEC conduct caribou surveys to calculate the zone of avoidance around the Jay Project on an annual basis to measure the effectiveness of its caribou protection measures;
- DDEC work with others to prepare a plan to compensate for or off-set the impacts to caribou from the Jay Project;
- DDEC prepare a plan to manage water from the Jay Project that includes detailed options if predictions are not accurate or if there are early signs of potential problems;
- DDEC develop a plan to properly handle and store Lac du Sauvage sediments that contain relatively high levels of mercury;
- DDEC include larger fish such as whitefish and trout as part of its aquatic effects monitoring program for the Jay Project;
- DDEC prepare further information on dust impacts from the Jay Project to fish spawning areas;
- DDEC evaluate the effects of the Jay Project on current and future lakes to be used to compare against impacted waters;
- DDEC evaluate the impacts of its proposed wastewater on zooplankton and plankton communities and how those changes may affect fish;
- DDEC prepare detailed plans for monitoring, management and options to manage problem drainage from the Jay waste rock pile with early warning signs and distances from waterbodies;
- DDEC revise its air emissions and dust plan to set levels that result in specific actions to reduce dust and other air pollution;
- DDEC include monitoring of dust, snow and lichen in the areas most likely to be affected by the Jay Project air pollution; and
- DDEC and others to whom Measures and suggestions have been directed, report annually and publicly on what progress has been made.

1.0 INTRODUCTION

1.1 Organization of the Technical Report

This Technical Report is organized following the guidance provided by the Mackenzie Valley Environmental Impact Review Board (Review Board) as follows:

- Executive Summary is a one-page plain language overview of this submission;
- Section 1 provides background information on the Independent Environmental Monitoring Agency (Agency) and our involvement to date in this Environmental Assessment;
- Section 2 is the list of general subjects we have raised during this process to date;
- Each of the next set of sections (3-7) set out issues starting with those that are key lines of inquiry, moving to subjects of note and closing with a few other matters. For each section there is an issue statement, summary of the Developer's conclusions, the Agency's conclusions, a summary of the evidence and rationale, finishing with Agency recommendations regarding Measures and suggestions; and
- Section 8 draws some overall conclusions and summarizes our recommendations, and some observations about the next steps.

The Agency looks forward to the Technical Reports from the other parties and the response from DDEC. We may wish to change, modify and bring forward additional issues and recommendations at the public hearing based on our review and analysis of these additional submissions.

References in this Technical Report are to the documents filed on the Public Registry using the numbers assigned by the Review Board (e.g. [PR#74](#) Terms of Reference). Where the Agency has used additional reference material, we have appended them to this submission so these documents will now form part of the public registry for this proceeding.

1.2 Background on the Independent Environmental Monitoring Agency

The Agency has participated in environmental management and regulation of the Ekati Diamond Mine for over 18 years. The Agency was established in 1997 through a legally-binding Environmental Agreement covering the Ekati Diamond Mine. Our mandate as set out in the Environmental Agreement is as follows:

- to provide an integrated approach to achieve the purposes of the Agreement;
- to serve as a public watchdog of the regulatory process and the implementation of this Agreement;

- to compile and analyze available relevant environmental data, in order to review, report, or make recommendations concerning:
 - the environmental effects monitoring program respecting short-term, long-term and cumulative impacts, carried out by DDEC pursuant to the Agreement;
 - government compliance monitoring reports and DDEC self-assessment reports pursuant to regulatory instruments and the Agreement;
 - Environmental Plans and Programs;
 - Annual Reports and Environmental Impact Reports;
 - monitoring, regulatory and related management programs and activities of Canada and the GNWT; and
 - the integration of traditional knowledge and experience of the Aboriginal Peoples into Environmental Plans and Programs;
- to participate as an intervenor in regulatory and other legal processes respecting environmental matters;
- to provide an accessible and public repository of environmental data, studies and reports relevant to the Monitoring Agency's responsibilities;
- to provide programs for the effective dissemination of information to the Aboriginal Peoples and the general public on matters pertaining to the Monitoring Agency's mandate;
- to provide an effective means to bring to DDEC and governments the concerns of Aboriginal Peoples and the general public about the Project and the monitoring and regulation of the Project; and
- to participate as an intervenor, as appropriate, in the dispute resolution process under this Agreement.

We are a non-profit society under territorial legislation with our own funding through the Agreement. We report to our society members (the Tlicho Government, Akaitcho Treaty 8 (Yellowknives Dene First Nation and Lutsel K'e Dene First Nation), North Slave Metis Alliance, Kitikmeot Inuit Association, GNWT, Canada and Dominion Diamond Ekati Corp.) and although our Directors are appointed by these members, once appointed we operate independently. Our Directors are knowledgeable and experienced in various fields such as wildlife, fisheries, water, environmental assessment and related fields. We have extensive experience with and knowledge of environmental management at the Ekati Diamond Mine. We have a mandate to participate as an intervenor in regulatory and other legal processes respecting environmental matters.

We intend to bring this experience to all stages of this environmental assessment as seen by our participation to date in the preliminary screening, review of the company's proposed terms of reference and at the Yellowknife technical scoping session. We have reviewed the Developer's Assessment Report and submitted Information Requests as directed by the Review Board through the on-line registry system. We intend to

participate in Technical Sessions, prepare a Technical Report and appear at the Public Hearing. Our Directors and staff have much beneficial experience and expertise that we would be pleased to bring forward for the Review Board and other parties.

1.3 IEMA Involvement in the Environmental Assessment to Date

The Agency has been involved at every stage of the Jay Project through engagement directly with DDEC and through the environmental assessment as follows:

- November 20, 2013 Letter from the Agency to the WLWB on the preliminary screening recommending referral to an environmental assessment on the basis of likely public concern and potential for significant adverse environmental impact;
- December 17, 2013 Comments from the Agency on DDEC's Draft Terms of Reference for the environmental assessment;
- January 7-8, 2014 Agency Directors and staff participate in the Review Board scoping session;
- January 14, 2014 Agency staff observe the Behchoko scoping session;
- January 30, 2014 Agency applies to the Review Board for party status and is later granted such status;
- February 10, 2014 Agency submits comments to the Review Board on the Draft Terms of Reference;
- July 2, 2014 Agency submits comments to the Review Board on the amended Draft Terms of Reference (DDEC dropped Cardinal pipe);
- December 11-12, 2014 Agency Directors and staff participated in the DDEC Information Session on the Developer's Assessment Report;
- January 19, 2015 Agency Director participates in Caribou Technical meeting on invitation of the Review Board;
- February 12, 2015 Agency submits first round Information Requests (IRs) to parties to the environmental assessment;
- March 30, 2015 Agency responds to Review Board first round IRs directed to all parties;
- April 20-24, 2015 Agency Directors and staff participated in the Review Board Technical Sessions;
- May 22, 2015 Agency Director and staff participate in the DDEC workshop on the Wildlife Road Mitigation Plan;
- June 5, 2015 Agency submits second round IRs;
- June 25-26, 2015 Agency Directors and staff participate in the DDEC Jay Project Environmental Management Plans workshops;
- July 20, 2015 Agency Directors and staff participate in DDEC air quality management workshop; and
- July 2015 Agency submits its Technical Report to the Review Board.

The Agency is planning to participate in the September 2015 public hearing by providing a presentation, making ourselves available for questions and asking questions of other parties.

1.4 Scoping of the Jay Project

This environmental assessment started to consider the proposed Jay-Cardinal Project from DDEC. DDEC dropped Cardinal in May 2014. The Terms of Reference were subsequently amended to remove the Cardinal project, but continued to reference the Jay open pit and underground project. The Developer's Assessment Report is silent with respect to underground operations and the Developer has not considered any of the potential impacts from an underground operation at the Jay Pit as part of this environmental assessment. The Agency anticipates that a water licence for the Jay Project would reflect the scope of the Jay Project without any underground operations.

Underground operations at Jay may be considered 10 or more years into the future, should the Jay Project proceed. Should underground operations be considered at a future date, the impacts of such operations, particularly with regard to water management of the expected higher TDS water, will require consideration subject to Part V of the *MVRMA* and other governing legislation at that time. The implications for closure planning for the entire site may also need to be reconsidered. The additional experience from the Jay Project open pit operations may also be helpful with respect to assessing impacts to caribou from future underground mining at Jay.

2.0 LIST OF GENERAL SUBJECTS REVIEWED

The Agency's major focus in the Technical Report is on two of the key lines of inquiry—impacts on caribou and aquatic resources (water and fish). The related sections of the Terms of Reference are highlighted to show that this work is within the scope of the Environmental Assessment and brought added value to the process.

1. The precarious state of the **Bathurst caribou herd** and the location of the Jay Project in an important area for caribou post-calving, summer and fall habitat and migration are of particular concern for the Agency. We are interested in design options that limit the physical and ecological footprint, caribou mitigation measures, and means of offsetting potential impacts. These are all matters ([PR#74](#)--Terms of Reference, s.7.3.3 Impacts to caribou from project components) relevant to adaptive management and cumulative effects management in relation to significant adverse (cumulative) impacts from the Jay Project on caribou.
2. **Water and wastewater management** for the Jay Project relies heavily on modelling with no successful site specific water management experience using meromixis, or a discharge mixing zone. The Agency is particularly concerned about contingencies with careful monitoring and early indicators to allow sufficient lead time to avoid significant adverse impacts ([PR#74](#)--Terms of Reference, s. 7.3.1.1 Impacts to water quality from project components).

In our Technical Report we also raise a number of subjects of note including;

- Waste Rock and Seepage Management, and
- Air Quality and Dust.

The Agency Technical Report closes with some other matters and process observations, followed by our overall conclusions, including a summary of our recommendations.

3.0 CARIBOU

3.1 Significant Adverse Cumulative Impact

3.1.1 Issue Statement

The Terms of Reference ([PR#74](#)) states that the “*Review Board will make ultimate determinations of significance after considering all the evidence on the public record later in the environmental assessment*” (s. 4.2; pg 17). The Developer argues that the results of the DAR indicate that there are no significant adverse effects from the Project or significant adverse cumulative effects on caribou and wildlife ([PR#132](#) DAR Section 12.6.2, pg 12-135). The Agency disagrees with this conclusion (as noted in [PR#305](#) DAR-IEMA-IR-36), given the precipitous decline of the Bathurst herd and that the Developer has not been able to conclusively demonstrate the absence of an effect of development contributing to this decline. Given this uncertainty, the issues are whether the cumulative effects from the Jay Project and other activities are significant, and whether the Developer has considered all mitigation options to reduce any and all impacts to caribou resulting from human activities that will be further intensified with the Jay Project.

3.1.2 Developer’s Conclusions

The Developer concludes that the cumulative impact from the Jay Project and other activities is not significant, and that “*incremental and cumulative changes to measurement indicators from the Project and other developments should have no significant adverse effect on self-sustaining and ecologically effective barren-ground caribou populations*” ([PR#132](#) DAR Section 12.6.2, pg 12-135; response to [PR#305](#) DAR-IEMA-IR-36).

3.1.3 Agency’s Conclusions

The Agency is not convinced that DDEC’s conclusion is sound because modelling suggests declines in pregnancy rates and calf survival under the cumulative effects scenario (with Sable), and exposure by up to 40% of the cows to the zones of influence (ZOI) annually (response to [PR#461](#) DAR-MVEIRB-IR2-08).

3.1.4 Evidence and Rationale

The Agency believes there is an existing significant adverse (cumulative) impact on the Bathurst caribou herd, which has resulted in the collapse of the herd population from over 450,000 animals in the mid to late 1980s to possibly 15,000–20,000 animals in 2014 ([PR#132](#) DAR Section 12.2.2.3, pg 12-22; as referenced in [PR#305](#) DAR-IEMA-IR-30, Boulanger J, Croft B, Cluff D. 2014b. Trends in size of the Bathurst caribou herd can also be inferred from the 2014b. Trends in size of the Bathurst caribou herd from the 2014 calving ground reconnaissance survey. Integrated Ecological Research. July 31, 2014;

<http://www.cbc.ca/news/canada/north/n-w-t-stops-issuing-remaining-bathurst-caribou-tags-1.2880037>)). This is a very great decline: >95%. Therefore, the Agency is concerned that the proposed development will result in an additional reduction in pregnancy rate in a herd that is already declining and possibly below historical lows encountered in the past. The current low abundance of the Bathurst herd has been caused by a combination of a largely natural cyclic decline in herd abundance (Zalatan et al. 2006), with the decline intensified as a result of human harvest (Boulanger et al. 2011 as referenced in the DAR Section 12 [PR#132](#)) and human development on the range of this herd (e.g., Dyer et al. 2002 as referenced in the DAR Section 12 [PR#132](#); Johnson et al. 2005 as referenced in the DAR Section 12 [PR#132](#); Nellemann et al. 2010; Panzacchi et al. 2013). Human development within the range of the Bathurst herd may have had a role in the decline through disturbance, increased energy costs, and reductions in the available habitat, contributing to declining pregnancy and reduced calf survival (response to [PR#305](#) DAR-MVEIRB-15:Table 15-3). There is uncertainty regarding how much of this population decline is caused by human activities.

DDEC argues this cumulative effect is not significant ([PR#132](#) DAR Section 12.6.2, pg 12-135). We argue as follows. DDEC's modelling has predicted a 2% decline in pregnancy rates (fecundity) and a 3.9% decline in calf survival at the Reasonably Foreseeable Development (RFD 1) stage (including Sable) that can be attributed largely to industrial development; the Jay Project (Application 1) will contribute a projected 0.15% decline in fecundity and 0.3% decline in calf survival ([PR#132](#) DAR Section 12.4.2.3.1, pg 12-115: Table 12.4-27). Upwards of 40% of cows may be exposed to ZOIs from development annually (response to [PR#305](#) DAR-MVEIRB-IR2-08). Thus, modelling suggests there are reasonable grounds to expect an anticipated cumulative impact. The absence of our ability to detect a measureable change does not indicate there is no effect; it is more a function that monitoring has not been able to detect an effect when it is likely real. The Developer has not been able to conclusively demonstrate the absence of an effect. At a time when the Bathurst caribou herd is in a precarious status, any additional stress will constitute a significant adverse impact and a precautionary approach is required.

Even if the science is uncertain, the Agency is of the view that the Board should take a precautionary approach. The use of the precautionary principle is required of DDEC by the Environmental Agreement ([PR#411](#) Section 1.2 d) and is addressed by DDEC in the DAR ([PR#102](#) DAR Section 6.1.2, pg 6-1). The precautionary approach, in this context, we construe to mean that we assume the effect is caused (in part) by the cumulative impact of existing (and past) human activities in the region (Bathurst caribou range) when combined with the impacts from the proposed Jay Project, and the Developer and responsible government agencies should respond accordingly.

The impacts to caribou from the proposed Jay Project are significant for various reasons. First, while barren-ground caribou are not now *Species at Risk Act* (SARA) listed as

threatened or endangered, any >95% decline in a sub-population (herd) is highly worthy of conservation concern. Barren-ground caribou are currently listed as 'sensitive' in the NWT (Working Group on General Status of NWT Species. 2011. NWT Species 2011-2015 – General Status Ranks of Wild Species in the Northwest Territories, Department of Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT. 172pp.

http://www.nwtspeciesatrisk.ca/sites/default/files/pdf/NWT_Species_2011_2015.pdf).

Assessments of barren-ground caribou status at the federal (Committee on the Status of Endangered Wildlife in Canada, or COSEWIC) and territorial (Species at Risk Committee) levels are currently in progress (decisions are likely in 2016); thus there is uncertainty about the outcome. Second, and at least as important for the Agency, the Bathurst herd is an important source of country food for Aboriginal peoples in the region and the low population is having an adverse effect on their ability to obtain caribou (http://www.enr.gov.nt.ca/sites/default/files/yellowknives_dene_and_gnwt_sign_agreement.pdf; <http://www.cbc.ca/news/canada/north/n-w-t-stops-issuing-remaining-bathurst-caribou-tags-1.2880037>).

The Jay Project would expand the ZOI and so would adversely affect the herd. The Jay Project will result in the addition of high levels of traffic along the Jay and Misery roads, which will extend the effects on caribou movement through that corridor for at least a decade. It also interferes with the ability of the herd to use the esker between Misery and the Jay pipe for movement and migration. These effects may not be great on their own, but they would make an existing significant adverse effect (slightly) worse. Hence, the result is a significant adverse impact. The argument here is that, if you make a significant adverse impact worse (even slightly), it is still a significant adverse effect, especially when a Valued Ecosystem Component is vulnerable and less resistant to impacts.

3.1.5 Recommendations

For the reasons noted above, the Agency recommends that the Review Board make a determination that there would be a significant adverse cumulative impact of the Jay Project on the Bathurst caribou herd pursuant to s. 128(1)(b) of the *Mackenzie Valley Resource Management Act (MVRMA)*. The Agency suggests that there are some measures that could and should be adopted. The principle is that cumulative effects require cumulative solutions and that these measures if undertaken would result in a greater reduction in existing effects on Bathurst caribou than the Jay Project would create. The Agency recommends the following Measures to the Review Board pursuant to s. 128(1)(b)(ii) of the *MVRMA*:

Measure 1:

To prevent a significant adverse impact to caribou, DDEC shall implement further measures minimize the ecological disturbance footprint for the Jay Project as follows:

- selection of the Jay haul road route that minimizes disturbance to high quality caribou habitat ([PR#305](#) DAR-IEMA-IR-28 and [PR#356](#) Anne Gunn's proposed routing);
- additional mitigation to reduce the effect of haul truck and other traffic on caribou (e.g., more rigorous dust management, including adaptive management triggers for additional dust suppression; more precautionary traffic management to reduce sensory disturbance); and
- investigate and implement an esker crossing that involves selection of less critical habitat, one-way traffic, buried power lines, and other innovative approaches.

Measure 2:

To prevent a significant adverse impact to caribou, DDEC, with other mine operators and GNWT where possible, shall develop and implement a collaborative research program designed to identify the causes of the Zone of Influence (ZOI) for caribou avoidance. The research findings will then be implemented to reduce the size of the ZOI on caribou. The results of the research program are to be summarized and reported annually to all interested parties as part of DDEC's annual report under its Wildlife Effects Monitoring Program. A target date for development of the research program is one year following the acceptance of the Measures by Responsible Ministers and implementation of the research results to reduce the ZOI within five years. DDEC shall commit to using the results of the research for the existing Ekati Mine.

The Agency notes that research alone does not provide mitigation. Only the effective implementation of mitigation measures by those contributing to adverse effects on the Bathurst herd (e.g., DDEC at the existing Ekati Mine, Diavik) would constitute cumulative effects mitigation.

3.2 Zone of Influence**3.2.1 Issue Statement**

The Terms of Reference states that for caribou the Developer should “*assess... ..the indirect disturbance effects to available habitat through lowered habitat suitability*” ([PR#74](#)

Section 7.3.3; pg 33). The issue is whether the Ekati Mine is causing an increasing disturbance impact on caribou that will be further intensified with the Jay Project.

3.2.2 Developer's Conclusions

Citing the upper portion of Figure 3 Appendix C ([PR#466](#)), the Caribou Zone of Influence Technical Task Group. 2015: pg 28; see figure below), which provides annual Zone of Influence (ZOI) estimates from post-calving aerial survey data, the Developer concluded that there was no statistical temporal variation in the ZOI calculated annually from 2003–08 ([PR#461](#) response to DAR-IEMA-IR2-06). Coupled with the statement that the herd was relatively stable at approximately 32,000–35,000 individuals between 2009 and 2012, the Developer concluded that generation of annual estimates from 2009 and 2012 aerial survey data is unlikely to change the ZOI demonstrated and the results of the DAR ([PR#461](#) response to DAR-IEMA-IR2-06).

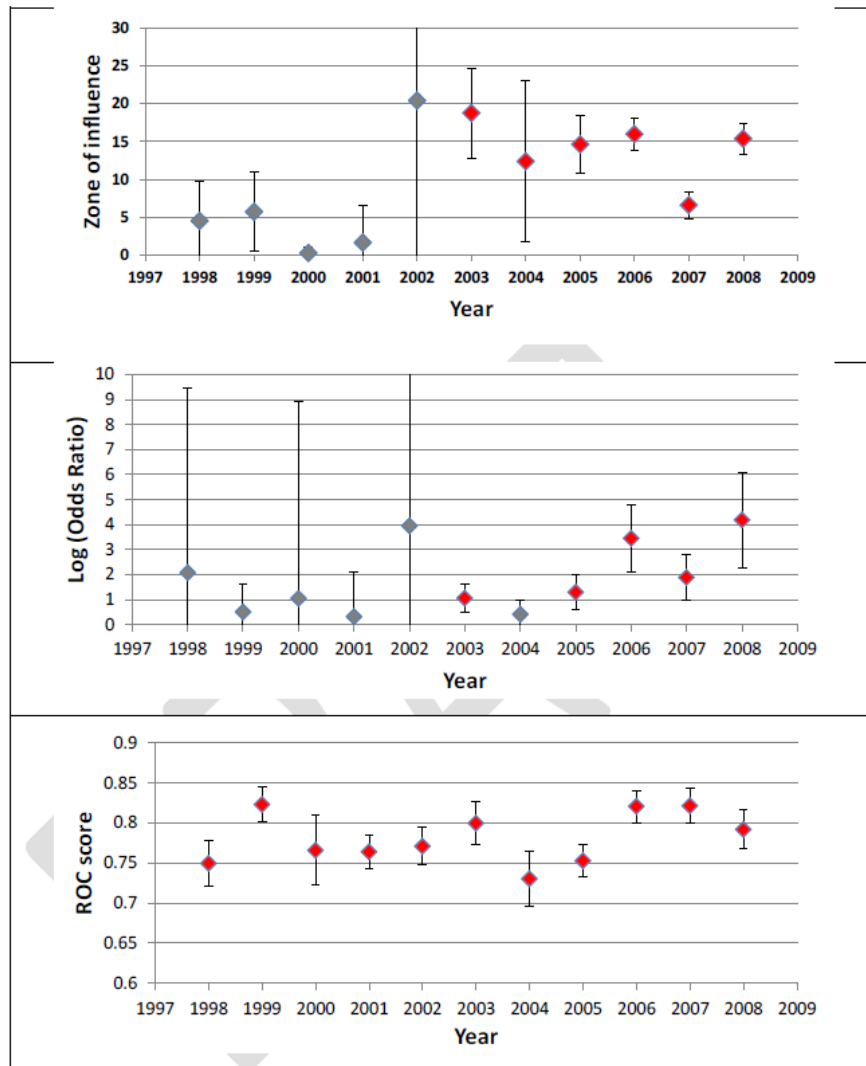


Figure 3: Estimated zone of influence, magnitude of zone of influence (Log(Odd ratio) and goodness of fit (ROC score) for yearly zone of influence estimates for Ekati and Diavik. Confidence limits are given as error bears. Estimates that were not statistically significant are shown in grey.

3.2.3 Agency's Conclusions

The Agency believes that two additional years of analysis of the ZOI would benefit the assessment because:

- 1) there is sufficient uncertainty in the trend in ZOI over time;
- 2) these two years coincide with the lowest abundance of the Bathurst herd recorded (2009 to 2012); and
- 3) the conclusions drawn by the Developer ignore that the trend in the *magnitude* of the ZOI over time is in fact increasing.

3.2.4 Evidence and Rationale

Boulanger et al. (2012) [as referenced in [PR#132](#)] determined a 14-km ZOI for caribou surrounding the Ekati and Diavik mines from 2003–08. More recent analyses (using R code analysis – programming conducted in the R package) have enabled more efficient determination of ZOI on an annual basis that can be used to examine trends in ZOI distance and magnitude over time ([PR#466](#) Appendix C in The Caribou Zone of Influence Technical Task Group. 2015). The upper graph from Figure 3 from that report (see above) does show some stability and estimate precision in ZOI distance from 2005 to 2008, except for 2007 which is significantly lower than most years. Two additional years (2009 and 2012; response to [PR#305](#) DAR-IEMA-IR-24) of aerial survey data are available beyond the analyses of Boulanger et al. (2012) [as referenced in [PR#132](#)] and more recently in Appendix C in The Caribou Zone of Influence Technical Task Group (2015) [[PR#466](#)] which can be used to further assess trends in indirect disturbance effects and reduced habitat suitability.. The 2009 aerial surveys observed the highest and the 2012 surveys the lowest numbers of caribou since 2006 ([PR#461](#) response to DAR-MVEIRB-IR2-08: Table 8-1), providing data that will explore the ZOI for a wide difference of caribou densities within the survey area. The Agency believes that analysis of 2009 and 2012 aerial survey data would reduce uncertainty in the ZOI value used in the DAR, clarify trend over time, and reduce uncertainty regarding potential impacts of the Project on caribou.

The Developer's response to DAR-IEMA-IR2-06 ([PR#461](#)) does not recognize the fact that while the annual *distance* of ZOI may not have varied to a large degree between 2003 and 2008 (2007 being an exception among the 6 years examined), the *magnitude* of the ZOI increased steadily from 2004 to 2008 (see middle graph in Fig. 3 above). The magnitude is determined by the odds ratio, and is essentially the effect size or steepness of gradient of caribou distribution from the development footprint to the ZOI boundary (the ZOI boundary is the distance from development where relative caribou abundance does not differ from that based on habitat alone – in other words, the distance where there is no measureable influence of development). Higher odds ratios indicate a larger difference in caribou abundance between development and the edge of the ZOI boundary. The

increasing trend in magnitude suggests that Ekati and Diavik mine activity from 2004 to 2008 is resulting in comparatively fewer caribou in proximity to development over time compared with areas beyond the ZOI. Analyses of 2009 and 2012 aerial survey data will add two additional, more recent, and critical data points to trends in ZOI distance and magnitude, which are a direct reflection of past caribou mitigation practices from the mines.

Since the last annual analysis of the aerial survey data in 2008 (7 years ago), the Bathurst herd has declined further. The fact that Bathurst herd estimates in 2009 and 2012 were the lowest recorded during the aerial survey period adds greater urgency to these analyses, since herd resilience is likely reduced with declining abundance ([PR#132](#) DAR section 12.6.1.2, pg 12-128). Although dust has been suggested as a main mechanism driving the ZOI (Boulanger et al. 2012) [as referenced in [PR#132](#)], the actual mechanisms are unknown. Additional stress or impacts, if not monitored and detected, could result in significant adverse impacts that are difficult to detect.

3.2.5 Recommendations

The Agency notes that DDEC and Diavik have carried out collaborations in the past and that such collaboration is very desirable for cumulative effects management. To reduce uncertainty and public concerns regarding mine impacts and clarify trends in both the distance and magnitude of the ZOI surrounding the mines, the Agency makes the following recommendations for Measures to the Review Board to prevent a significant adverse from the Jay Project on caribou:

Measure 3:

To obtain information needed to prevent a significant adverse impact to caribou, DDEC shall analyze estimates of ZOI distance and magnitude from the 2009 and 2012 aerial survey data from the combined Ekati-Diavik study area using the new R code analysis. These estimates should be reported within the 2015 Wildlife Effects Monitoring Program report.

Measure 4:

To obtain information needed to prevent a significant adverse impact to caribou, DDEC shall undertake aerial surveys to monitor relative caribou distribution and abundance and measure the effectiveness of mitigation measures for caribou currently in use for Ekati and proposed for the Jay Project. The aerial survey study area should be enlarged to include the extensions related to the proposed Jay Project and reasonably foreseeable Sable footprints. Given new analytical techniques, survey timing will be established in collaboration with interested parties but designed to track trends over time. DDEC shall produce estimates of ZOI distance and magnitude for the Jay Project (including the entire Ekati Mine) for the combined Ekati-Diavik study area using the new R code analysis. The results of the aerial surveys and analysis of the ZOI are to be reported annually (as appropriate) as part of DDEC's Wildlife Effects Monitoring Program reports, and will serve as means of measuring the effectiveness of Jay Project caribou mitigation measures.

3.3 Compensatory Mitigation (Off-Setting)**3.3.1 Issue Statement**

The Terms of Reference states that the Developer should “*identify and evaluate any proposed mitigation measures as to their technical and economic feasibility to reduce the predicted impacts and discuss constraints, uncertainties and implementation challenges to the effective use of the proposed measures and clearly identify all mitigation commitments*” ([PR#74](#) Section 4.1; pg 16). The issue is whether Dominion has considered all mitigation options to reduce any and all impacts to caribou resulting from the development that will be further intensified with the Jay Project. The Agency suggests that compensatory mitigation should be considered given the perilous state of the Bathurst herd, and can be used to enhance monitoring and mitigation of disturbance to caribou.

3.3.2 Developer's Conclusions

The Developer concluded that the DAR has shown there are “*no significant adverse effects from the Project on caribou and wildlife, [and] therefore, no offset mitigation has been proposed*” ([PR#461](#) response to DAR-IEMA-IR2-04). The Developer provides a standard mitigation hierarchy which includes avoid, minimize, reclaim and offset, stating that they avoid, minimize, and reclaim to a sufficient extent ([PR#461](#) response to DAR-IEMA-IR2-04).

3.3.3 Agency's Conclusions

The Agency does not accept the Developer's conclusion that there will be no significant adverse effects from the Project as concluded from the DAR. Impacts to caribou are caused by the current operations at the Ekati Mine and other projects, and the Developer has not been able to conclusively demonstrate the absence of an effect. The Agency believes that there are significant adverse (cumulative) impacts from the proposed project and that, the Developer should use the entire suite of accepted mitigations to reduce and eliminate impacts, including use of off-setting or compensatory mitigations.

3.3.4 Evidence and Rationale

The Developer has acknowledged that the mine has created a zone of influence (ZOI) around the development footprint ([PR#461](#) response to DAR-MVEIRB-IR2-06: Map 6-1), within which relative caribou abundance is less than would be expected if the mine did not exist. The magnitude (effect size) of the ZOI appears to be increasing over time ([PR#466](#) The Caribou Zone of Influence Technical Task Group 2015: Appendix C: Fig. 3). The Developer has also acknowledged that the Misery Road is not fully permeable to caribou movement ([PR#305](#) response to DAR-IEMA-IR-25). Thus impacts to caribou currently exist, but our ability to measure those changes at the demographic level may be limited by our monitoring.

The fact that the Developer states that the Project will use mitigation that avoids, minimizes, and reclaims adverse effects associated with all caribou and wildlife pathways identified for the Project ([PR#305](#) response to DAR-MVEIRB-IR-90: Table 90-1) does not rule out the use of compensatory mitigation. Given the perilous state of the Bathurst herd, every effort to reduce all impacts to caribou should be considered. Table 90-1 in response to DAR-MVEIRB-IR-90 ([PR#305](#)) suggests that reclamation will be conducted as stated in the existing Ekati Mine Interim Closure and Reclamation Plan (ICRP), but most of this reclamation will occur near the end of mine life ([PR#435](#) BHP Billiton. 2011. Ekati Diamond Mine: Interim Closure and Reclamation Plan. Prepared by BHP Billiton Canada Inc. Yellowknife, Northwest Territories); thus short-term measures to further mitigate impacts on caribou from reclamation are limited or may even be pushed back by 10 or more years ([PR#305](#) response to DAR-IEMA-IR-21, Ekati Diamond Mine, Northwest Territories, Canada NI43-101 Technical Report. Table 21-6, pg. 21-10; see below). Should the Jay Project proceed, DDEC's own table below shows a significant shift in expenditures and related closure activities back to the period 2032-2034 rather than 2022-2024 in the currently approved ICRP.

Table 21-6: Reclamation Cost Estimate

Fiscal Year	Reclamation excluding Jay \$ Millions	Reclamation including Jay \$ Millions	Jay Net Reclamation Impact \$ Millions
2016	—	—	—
2017	2	2	—
2018	2	2	—
2019	2	2	—
2020	2	2	—
2021	6	5	(1)
2022	111	5	(106)
2023	29	5	(24)
2024	44	4	(40)
2025	6	4	(3)
2026	6	4	(3)
2027	6	4	(3)
2028	6	4	(3)
2029	6	4	(3)
2030	6	4	(3)
2031	6	4	(3)
2032	4	74	70
2033	4	28	25
2034	4	43	40
2035	0.1	6	6
2036	0.1	6	6
Post-2036 to 2044	1	43	43
Totals	254	251	(3)

There are examples of projects that have successfully used off-setting as mitigation. In BC, the Environmental Assessment Certificate for the Peace River Coal Inc. Roman coal mine issued in 2012 required a Caribou Mitigation and Monitoring Plan which followed the hierarchy of avoid, minimize, restore on-site, and offset (http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_308_34868.html). As means of off-setting the areas of caribou habitat directly and indirectly affected by the

mine, and of off-setting modelling that predicted reduced future population growth because of the cumulative development within the herd range, the Proponent was required to secure areas of high quality caribou habitat under tenure by industry that could not be developed, and contribute a sum of money (\$2.5 million) to an endowment for caribou management, to be used for a variety of mitigation and monitoring activities (e.g., caribou and wolf monitoring, maternal penning).

A key question for the Review Board is whether caribou will be better off (or no worse off) as a result of the Jay Project. The Agency believes that a compensatory or off-setting plan to reduce or eliminate impacts to caribou from the Jay Project is essential.

3.3.5 Recommendations

The Agency believes DDEC can take specific and measureable actions to off-set the adverse impact of the Jay Project on caribou. For example, DDEC could increase efforts at timely reclamation of the parts of the Ekati Mine that are no longer in use (e.g., Old Camp, Fox waste rock piles and pit, Cell B of the Long Lake Containment Facility). DDEC should also carefully consider the timing and phasing of any further exploration and development within its mining claims while the Bathurst caribou herd remains in a precarious state.

To avoid a significant adverse cumulative effect of the Jay expansion and to reduce public concerns regarding mine impacts and provide additional mitigation to offset the effects from the Jay Project on caribou, the Agency makes the following recommendation to the Review Board for a Measure:

Measure 5:

To prevent a significant adverse impact to caribou and to reduce public concern with the Jay Project, DDEC shall prepare a Compensatory Mitigation (Off-Setting) Plan for caribou. The purpose of the Plan is to enhance the ability of the Bathurst caribou herd to recover to its previous abundance as measured through reductions in energy loss, positive changes in calf production and survival. To the extent possible, the Plan should be developed collaboratively with interested parties, and shall be a condition of a land use permit for the Jay Project. The Plan should be prepared and circulated by DDEC to the Wek'eezhii Renewable Resources Board, GNWT and affected Aboriginal governments within one year of the acceptance of the Report of Environmental Assessment and shall be in place before construction commences on the Jay Project.

4.0 WATER

DDEC proposes a “use-protection” approach to aquatic resources with regard to its proposed Jay Project. DDEC believes this approach is consistent with the original Panel Review conducted for the Ekati Mine.

In all cases of potential water quality impacts to Lac du Sauvage and Lac de Gras, the Monitoring Agency believes the basic consideration should be a ‘waste minimization’ and ‘non-degradation’ approach. This is more consistent with the Mackenzie Valley Land and Water Board approved Water and Effluent Quality Policy and the Canadian Council of Ministers of the Environment (CCME) guidelines or site-specific water quality objectives (SSWQO) values. We suggest that DDEC keep as close as possible to baseline (pre-mine-development) water quality conditions in water bodies to be affected, rather than maintaining existing conditions that may have changed as a result of current mining activities.

The significance determination for water and aquatic resources should be based on these waste minimization and non-degradation approaches. These concepts are especially important when contemplating the proposed 200 m-radius mixing zone in Lac du Sauvage for Jay Project effluent, as it has the potential to create a significant adverse impact on this relatively shallow but productive arctic tundra lake that is the headwaters for the Coppermine River, the drinking water source for the community of Kugluktuk.

With the above concepts in mind, the Agency offers the following input on the aquatic environment for the Review Board’s consideration.

4.1 Surface Water and Minewater Management

4.1.1 Issue Statement

The revised Terms of Reference for the Jay Project ([PR#74](#) sec. 7.3.1.1 paragraph 7) directed DDEC to, in predicting impacts to water quality from the Jay Project, “describe and evaluate contingent water treatment alternatives that may be required prior to discharge of effluent into the environment during all project phases with an analysis of:

- use of existing Lynx and Misery pits;
- mechanical water treatment options; and
- other water treatment options.”

4.1.2 Developer’s Conclusions

DDEC has proposed a surface and mine water management strategy which utilizes storage capacity in the Lynx and Misery Pits once mining of these pits has ceased. The

Developer states that multiple lines of evidence support establishment of vertical stratification of the water column in the Misery Pit. According to DDEC, the stratification, or meromixis, will result in the physical separation of clean surface water suitable for discharge into Lac du Sauvage (i.e., meets established water quality criteria) and bottommost iron-enriched water that will remain in the pit.

4.1.3 Agency's Conclusions

In the event that surface or mine water quantity and quality trends differ significantly from predictions outlined in the Developer's Assessment Report (DAR), or in the event meromixis does not result in surface water quality in Misery Pit that meets discharge criteria established for the operations, the Agency is concerned that successful implementation of one or more of the adaptive management strategies requires adequate lead time and early indicators of success or failure, to provide adequate protection to the waters of Lac du Sauvage.

The Agency is also concerned that the commitments made by DDEC to monitor the water in Misery Pit and its commitment to adaptive management are not in themselves sufficient to prevent or avoid significant adverse impacts to the aquatic environment of Lac du Sauvage should meromixis not occur. Adequate details and timeframes for the development, design, construction and implementation of the specific adaptive management strategies have not been identified in the documentation provided. Except for maintaining storage contingencies in Misery Pit and King Pond, each of the proposed strategies would require significant pre-planning and lead time for successful implementation.

4.1.4 Evidence and Rationale

In response to the Review Board's directions, DDEC developed an outline of a Water Management Plan for surface and mine water through the construction, operations and closure phases of the Project. The outline is summarized by DDEC in sec. 8.3 of the DAR ([PR#107](#)). It describes utilizing the capacity of the Misery and Lynx Pits to temporarily store surface and minewater from the Jay Pit for approximately the first five years of operations. For the remainder of operations (approximately 2024 to 2029), minewater would be discharged year round from the surface of Misery Pit to Lac du Sauvage by pipeline and multi-port submerged diffuser once established discharge criteria are met.

In response to DAR-EC-IR2-01 ([PR#461](#)) and DAR-GNWT-IR2-04 ([PR#461](#)), DDEC committed that no discharge of water from the Misery Pit to Lac du Sauvage would occur **if the minewater is acutely toxic** (emphasis added). As part of this commitment, DDEC agreed to monitor the water in Misery Pit throughout early operations (i.e., when there is no discharge to Lac du Sauvage) and late operations (i.e., during the discharge period).

DDEC also committed in Appendix 3A of the DAR ([PR#95](#) sec. 8.3 - Adaptive Management) that data collected as part of the monitoring program would be used to assess the need for adaptive management strategies should trends in surface water and mine water quantity and quality differ from expectations. No specific triggers for early warning or actions were identified.

Appendix 3A of the DAR ([PR#95](#)) states the adaptive management strategies may involve improvement or modifications of the proposed Water Management Plan, or temporary use of contingency allowances including the following:

- Maintain a storage contingency allowance in Misery Pit and the existing King Pond;
- Maintain pumping and a pipeline between the Misery and Lynx Pits throughout the operations stage;
- Increase storage capacity in the Jay runoff sump and mine inflows sump;
- Direct discharge to the environment from the Jay runoff sump if water is found to meet established discharge criteria;
- Use of storage capacity available at the Ekati site including construction of a pumping and pipeline system from the Misery site to the Ekati site; and
- Treatment of parameters of concern prior to discharge to Lac du Sauvage.

DDEC reiterated its commitment to these adaptive management strategies in its response to DAR-MVEIRB-IR2-23 ([PR#461](#)). No timeframes were provided other than “if water quality monitoring within the Misery pit indicates conditions differ from DAR predictions and represent a potential risk to the receiving environment, Dominion Diamond will **implement** management strategies ...” (emphasis added).

The Agency is concerned that a stable meromixis condition in the Misery Pit, which is the primary determining factor in successfully establishing a barrier to chemicals of concern in the bottommost water depths from entering the water column, has not been successfully demonstrated by DDEC at the Ekati Mine. The limited monitoring to date of the minewater and processed kimberlite in Beartooth Pit do not demonstrate meromixis or that a clean water cap can be placed over minewater in a pit and that it will stay in place.

4.1.5 Agency Recommendation

The Agency is concerned with the uncertainties associated with meromixis in Misery Pit and the lack of specific timeframes and triggers for adaptive management based on early warnings or indicators of failure, with adequate time to implement the contingencies listed above. A detailed analysis of each of the above contingencies with associated lead times is necessary. For example, the design and construction lead times for water treatment

should be set out, or the storage capacities and period of time each option will allow continued operations should be fully developed by DDEC to ensure there is no significant adverse impact to aquatic resources from the Jay Project. The Agency is of the view that the uncertainties around meromixis and contingencies should lead the Review Board to significance determination that the Jay Project will likely have a significant adverse impact on aquatic resources pursuant to s. 128(1)(b) of the MVRMA.

The Agency recommends the Review Board adopt the following Measure:

Measure 6:

To prevent a significant adverse impact to water quality, DDEC shall develop and submit to the Wek'eezhii Land and Water Board for approval, a revised Water Management Plan for the Jay Project within two years of initiating de-watering operations of the Jay pit. The Plan shall include:

- Identification of specific surface and minewater management contingencies including capacities (in terms of effluent volumes and mine production as expressed in operating days);
- Design, construction and implementation timing for each identified surface and mine water management contingency option;
- Detailed monitoring of water quality and quantity to enable early detection of success or failure; and
- Associated adaptive management trigger thresholds for implementation of contingencies.

4.2 Mercury Contamination

4.2.1 Issue Statement

Overburden soils and lakebed sediments removed from within the diked portion of Lac du Sauvage will be placed in the interior of the Jay WRSA for long-term management. The Government of the Northwest Territories ([PR#461](#) GNWT-IR2-13) noted that 72% of sediment samples taken from Lac du Sauvage have mercury concentrations that exceed the CCME Interim Sediment Quality Guideline (ISQG) and 2% exceed the selected Probable Effect Level (PEL).

4.2.2 Developer's Conclusions

DDEC concluded that runoff from the Jay WRSA would contain an average mercury concentration of 0.025 ug/L, with a maximum concentration of 0.04 ug/L ([PR#112](#) DAR

Appendix 8E, Site Discharge Water Quality Modelling Report Table 8E3.4-1).

4.2.3 Agency's Conclusions

Mercury is a toxic, bioaccumulative heavy metal which Aboriginal organizations have impressed on the Agency is a high-priority contaminant that they wish to keep out of pristine water bodies. The Agency is concerned that mercury in Lac du Sauvage lakebed sediment located within the proposed Jay dike footprint and removed to the Jay WRSA may re-enter the water column through seepage runoff and become bioavailable to aquatic life.

4.2.4 Evidence and Rationale

DDEC has stated ([PR#461](#) Developer's response to DAR-GNWT-IR2-13) that the range of sediment mercury concentrations in Lac du Sauvage is 0.0062 to 5.6 mg/kg as dry weight (dw), with a median value of 0.017 mg/kg dw ($n = 59$). Exceedances of the CCME Interim Sediment Quality Guideline for mercury (0.017 mg/kg dw) were measured in two samples collected from station LDS3 within the planned dike footprint in 2006, while the CCME PEL (0.486 mg/kg dw) was exceeded in one sample collected from station LDS3.

DDEC's predicted value for the average concentration of mercury in runoff from the Jay WRSA (0.025 ug/L) is approximately the same as the CCME Water Quality Guideline for the Protection of Aquatic Life criteria (0.026 ug/L). The predicted maximum concentration of 0.04 ug/L exceeds the CCME criterion by 50%.

It is unclear whether overburden and lakebed sediment that are to be managed within the Jay WRSA were included in the site runoff model ([PR#112](#) DAR Appendix 8E, Site Discharge Water Quality Modeling Report – section 3.4). The Modeling Report states the only input from the WRSA were from rock (granite, metasediments and kimberlite).

Encapsulation with waste rock will not be able to be completed if overburden moisture is too great to allow truck access onto the overburden material ([PR#461](#) DDEC Response to GNWT-IR2-17). The Agency is also concerned about uncertainties around permafrost encapsulation as a mitigation measure for the Jay WRSA as noted below in s. 5 of this Technical Report.

4.2.5 Agency Recommendation

The Agency recommends the Review Board take the following Measure to prevent a significant adverse impact to water quality from seepage that may be associated with sediments from Lac du Sauvage:

Measure 7:

To prevent a significant adverse impact to water quality, DDEC shall provide specific details to the Wek'eezhii Land and Water Board as part of any proposed water licence, as to how it plans to encapsulate mercury-laden lakebed sediments within the Jay WRSA to ensure mercury does not re-enter the Lac du Sauvage water column during operations and closure.

4.3 Lac du Sauvage Fish Monitoring

4.3.1 Issue Statement

DDEC is proposing to rely solely on small-bodied benthic fish (likely sculpin) as the only fish for monitoring of Lac du Sauvage ([PR#423](#) Dominion Diamond Conceptual Aquatic Effects Monitoring Program Design Plan for the Jay Project, draft, June 2015).

4.3.2 Developer's Conclusions

To avoid lethal sampling of VEC fish species (lake trout, lake whitefish, Arctic grayling), DDEC proposes to monitor those VEC species only when small-bodied fish start to show adverse impacts, especially in the area of contaminant loading. It believes that environmental impacts will be identified in small-bodied fish before they are detected in top predators ([PR#423](#) AEMP Conceptual Design Plan pg. 7-3), and that sculpin, having smaller home ranges, reflect contaminants they receive from the sampled lake rather than from adjoining water bodies that larger in-migrating fish are exposed to.

4.3.3 Agency's Conclusions

While the Agency understands DDEC's desire to not contribute to excessive sampling mortality of VEC fish species, fish at the upper trophic levels like trout and burbot bioaccumulate contaminants over their entire life time. The Agency is concerned that contaminant loading may be masked by the short life spans of sculpin (3 to 4 years) and may remain undetected in older trout, burbot and other VEC fish species.

4.3.4 Evidence and Rationale

Even in pristine lakes, the largest, oldest lake trout (older than 15 years) can harbour body loads of mercury in their flesh and internal organs that are above Health Canada guidelines (0.25 mg/kg for casual eaters. 0.5 mg/kg for fish eaters having several meals per week (Gantner et al. 2010 and Environment Canada website. Mercury in the Food Chain <http://www.ec.gc.ca/mercure-mercury/default.asp?lang=En&n=D721AC1F-1#Bio> Accessed July 29, 2015).

Body burdens of bioaccumulative contaminants (e.g., mercury) in water biomagnify up the food chain.

It has been impressed on the Agency just how important the health of valued fish species is to Aboriginal communities. The Ekati Diamond Mine Aquatic Response Framework Ver. 1.1 includes “tissue metal concentrations’ as a variable included within the Framework. It is important to have a consistent and transparent mechanism to address these communities’ concerns.

4.3.5 Agency Recommendation

To prevent sampling mortality of lake trout, the current AEMP contaminant monitoring for fish has developed a non-lethal method of extracting tiny plugs of muscle tissue from lake trout that can provide good heavy metals analysis in muscle without harming the sampled fish which are returned to the lake ([PR#392](#)). The Agency recommends the Review Board make the following Measure to prevent a significant adverse impact to fish from the Jay Project:

Measure 8:

To prevent a significant adverse impact to fish likely to be affected by the Jay Project, DDEC shall incorporate non-lethal testing of large-bodied fish within Lac du Sauvage in any Aquatic Effects Monitoring Program for the Jay Project.

4.4 Impacts on Fish Habitat from Dust Deposition

4.4.1 Issue Statement

The DAR focuses on potential impacts of dust on water quality and not as much on benthic quality of spawning beds, even though the DAR claims that dust is expected to settle to the bottom relatively rapidly rather than being suspended in the water column ([PR#107](#) DAR p. 8-351).

When fish eggs are coated with a thin layer of sediment it blocks oxygen from the water in getting to the developing embryo, essentially suffocating it. Sedimentation from dust deposition onto lakes can have this effect.

4.4.2 Developer’s Conclusions

DDEC concludes that dust deposition from pit development will not create a significant adverse impact to fish spawning habitat in Lac du Sauvage for two reasons: there will not

be enough dust generated to pose a threat of sedimentation impacts on the substrate of fish shoals; and wave action will keep fish habitat beneath dust deposition clear of sediment ([PR#124](#) DAR pg. 9-143).

4.4.3 Agency's Conclusions

Excessive sedimentation, if not swept off of spawning beds, has the potential of harming or destroying all eggs laid by a fish and thus the entire year's production from an affected bed. The Agency is concerned that DDEC has not sufficiently demonstrated that Total Suspended Particulate (TSP) generated through operations (e.g., use of haul roads, blasting) will not negatively impact nearby trout spawning shoals located in the vicinity of the Jay pit.

4.4.4 Evidence and Rationale

DDEC predicts TSP generated in the Jay pit to reach a maximum deposition rate of 5.12 mg/dm²/day at the pit perimeter for the Application Case ([PR#104](#) DAR Appendix 7A, Summary of Results of Air Quality Modelling Table 7A2-6). Fudge and Bodaly (1984) found that an accumulation of sediment over lake whitefish spawning beds in the range of 0.3 to 1.4 mg/dm² significantly reduced egg survival. The Agency is concerned that haul roads and pit blasting, at least in the early years of pit development before it got too deep for dust to escape, has the potential to generate dust in amounts that could create a negative impact to fish spawning on the nearest shoal(s).

DDEC has made the following assertions about dust deposition on spawning beds: *"...most of the high quality spawning habitat in Lac du Sauvage is in the 2 to 6m depth range, which is kept clean of silt and fine organic debris by wave-generated currents."* ([PR#124](#) DAR pg.9-193). *"Wave action and associated currents that often characterize high-quality shoals for spawning likely maintain shoals relatively free of sediment accumulation"* ([PR#305](#) DDEC response to IEMA IR-14 Dust deposition on Lac du Sauvage fish spawning beds). These general statements are not supported by any evidence from Lac du Sauvage.

It is reported that high-quality shoal depth in Lac du Sauvage is 2-6 m, while wave heights for mean conditions on Lac du Sauvage range from 0.3 m to 0.7 m; for a 100 yr condition max it is 1.7 m ([PR#107](#) DAR p. 8-73). Assuming the below-surface wave turbulence depth is one to two times the length of the wave height at surface (vertical turbulence beneath a wave decreases exponentially with depth to a threshold velocity required to move fine sediment as discussed in https://en.wikipedia.org/wiki/Airy_wave_theory) then wave-wash over Lac du Sauvage spawning shoals would not be expected to reach the shoals under most conditions.

The Agency could not find information in the DAR or supporting documents showing where Lac du Sauvage currents are in relation to shoal locations and the physical properties of limnological waves in the Arctic.

4.4.5 Agency Recommendation

The Agency would like to see more evidence that dust deposition will not have a significant adverse effect on fish stocks in Lac du Sauvage as a result of the Jay Project. The Agency recommends the Review Board direct DDEC to provide more evidence or, failing that, a plan to monitor spawning shoals in Lac du Sauvage that may receive dust deposited from the Jay Project, in particular shoal S4, and identify what remedial action would be taken if spawning shoals prove to be receiving dust in excess of what is considered safe for fish production.

The Agency recommends the Review Board adopt the following Measure:

Measure 9:

To support DDEC's position that dust settling on spawning shoals would be naturally swept away, DDEC shall develop and submit to the Wek'eezhii Land and Water Board the results of a model of depth of wave turbulence below the surface in Lac du Sauvage in areas likely to be affected by dust deposition from the Jay Project.

4.5 Jay Project Impacts on AEMP Reference Lakes

4.5.1 Issue Statement

Counts Lake is one of three reference lakes used in the AEMP since the program's inception. DDEC estimates Counts Lake will experience an increase of TSS of 3 mg/L due to dust deposition ([PR#461](#) DDEC response to IEMA-IR2-02). By definition, reference lakes should not receive contaminants, either water-borne or wind-borne, from a proponent's development.

4.5.2 Developer's Conclusions

The DAR is silent on this issue.

4.5.3 Agency's Conclusions

The Jay Project should not only avoid environmental impacts on the receiving environment, but also avoid disrupting the integrity of the current AEMP that is designed

to identify environmental changes that can be attributable to the Ekati Mine. While not endangering aquatic life, the anticipated increase in TSS could well compromise Counts Lake's status as a reference lake for the current AEMP and affect the future integrity of the AEMP for gauging water quality changes in impacted lakes against that of pristine lakes.

4.5.4 Evidence and Rationale

The current reference lakes (Vulture, Nanuq and Counts) continue to be an essential gauge of how lakes unaffected by the Ekati or other mines in the region compare limnologically and biologically to those affected by Ekati operations. It is desirable that each of these reference lakes not be impacted in any way by new projects at Ekati.

While this increase would not put Counts Lake waters anywhere near the current Ekati water license effluent quality control limits, it would increase TSS to levels above historic levels for Counts.

The issue of reference lakes was discussed at the June 2015 Management Plans workshop held by DDEC ([PR#460](#), pg. 6). DDEC had not considered suitable reference lakes for the Jay Project AEMP and had not considered Jay Project impacts on Counts Lake. On the suggestion of the Agency, DDEC committed to consider Daring Lake as a possible reference lake.

4.5.5 Agency Recommendation

The Agency believes that it is important to evaluate the impact of the Jay Project on Counts Lake as a reference lake for the existing AEMP and to identify additional potential reference lakes for the Jay Project AEMP. The Agency recommends the Review Board adopt the following Measure:

Measure 10:

DDEC shall evaluate the Jay Project impacts on Counts Lake as an AEMP reference lake and identify alternative lakes which could be used as reference lakes in the AEMP, or a means of continuing to use Counts should that be a better option, for the Jay Project before construction begins.

4.6 Effluent Toxicity to Zooplankton within Mixing Zone

4.6.1 Issue Statement

As identified by the GNWT ([PR#461](#) GNWT-IR2-04), there is evidence that predicted Jay effluent quality may be acutely toxic to cladocera ([PR#123](#) DAR Appendix 8H). *Daphnia*

magna exposed to undiluted effluent showed a significantly low survival rate of 45% ± 35% ([PR#123](#) DAR Appendix 8H).

4.6.2 Developer's Conclusions

The DAR claims that there will not be **acute** toxicity to any test organisms from Jay effluent (emphasis added) ([PR#123](#) DAR Appendix 8H).

4.6.3 Agency's Conclusions

The Agency is not convinced that effluent discharged at the diffuser in Lac du Sauvage will be non acutely toxic to phytoplankton, zooplankton or benthic aquatic organisms.

4.6.4 Evidence and Rationale

It appears that the toxicity tests on *Daphnia* were undertaken using warmer water (18-20°C) than currently exists in proximity to the proposed diffuser location in Lac du Sauvage. AEMP Data Reports (e.g., [PR#380](#) 2014 AEMP Data Report Fig. 3.3-3d) show maximum open-water temperatures at the 2 Lac du Sauvage stations close to the proposed Jay project are between 11 and 15°C.

DDEC's response to GNWT-IR2-04 ([PR#461](#)) did not acknowledge this methodological question (re: water temperature during toxicity testing). DDEC only stated that within the mixing zone water quality variables will potentially exceed SSWQOs and WQGs which would result in chronic toxicity, and that *Daphnia magna* will be tested for chronic and acute toxicity in actual mine water from Misery during Jay mining.

Under the *Fisheries Act*, acute toxicity is not permissible at end-of-pipe discharge point. Also, conditions in a mixing zone should not result in bioconcentration of toxic materials in pelagic or benthic organisms.

4.6.5 Agency Recommendation

The Agency recommends the Review Board make the following Measure to prevent a significant adverse impact to zooplankton from the Jay Project:

Measure 11:

To prevent a significant adverse impact to zooplankton from the Jay Project, DDEC shall evaluate the likelihood of acute toxicity to zooplankton occurring in the proposed mixing zone during operations. DDEC should also commit to reviewing the QA/QC of all future chronic and acute toxicity testing to ensure comparability of results to natural conditions in the receiving environment (i.e. use of water in toxicity testing that has the same temperature and other physical properties as water within the receiving environment).

4.7 Assessment of Taxonomic Change in Plankton**4.7.1 Issue Statement**

A shift in dominance to larger or spiny species of zooplankton may make no difference to adult fish but the larger or spiny species may be inedible by the much smaller juveniles (Brian et al. 2004, Morris and Mischke 1999). So even if the total amount of zooplankton does not change significantly in lakes affected by the Jay Project, changes in taxonomic type brought on by changes in zooplankton food (i.e., phytoplankton) can potentially adversely impact fish at the upper end of the food chain in those lakes.

4.7.2 Developer's Conclusions

Although concentrations of some metals, major ions, and TDS in Lac du Sauvage are predicted to increase significantly as a result of the Project, *"these changes are not predicted to result in adverse effects to lower trophic communities or fish health through direct exposure in the water column"* ([PR#124](#) DAR pg. 9-178).

4.7.3 Agency's Conclusions

The DAR does not recognize that significant shifts in plankton community structure can adversely affect fish health through poor nutrition. Nutrifaction that changes phytoplankton communities from edible-dominant to inedible-dominant taxa can cause changes in zooplankton communities. Shifts in zooplankton communities brought about by either phytoplankton changes or water quality degradation can impact fish nutrition, especially of younger age classes.

4.7.4 Evidence and Rationale

Near the end of operations, total phosphorus is predicted to increase to just above the phosphorus trigger range (4 to 10 µg/L) that can tip a lake's trophic status from oligotrophic to just into mesotrophic ([PR#124](#) DAR pg. 9-177). Phytoplankton biomass (modeled as chlorophyll a) would then increase. There is also a potential for other

taxonomic shifts which could potentially alter the proportion of total phytoplankton biomass available to the zooplankton community (i.e. edible vs inedible phytoplankton species).

While chrysophytes and cyanobacteria dominate Lac du Sauvage phytoplankton community under baseline conditions, this could change to other groups, such as diatoms, chlorophytes, and dinoflagellates that usually dominate mesotrophic lakes ([PR#124](#) DAR p. 9-186). This change in group dominance has uncertain but potentially adverse cascading effects up the food chain to valued fish species. The current AEMP has already demonstrated significant declines in major zooplankton taxa — cladocerans and rotifers — in small lakes immediately downstream of the Ekati mine that DDEC attributes to eutrophication ([PR#379](#) 2014 Ekati AEMP Part 1, pg. 3-129).

4.7.5 Agency Recommendation

The Agency is concerned that shifts in phytoplankton taxa would affect the food chain (i.e. zooplankton communities) to fish. Even when total biomass stays the same over time, not all changes in zooplankton taxa are benign or beneficial to fish.

The Agency recommends the Review Board adopt the following Measure:

Measure 12:

DDEC shall incorporate an annual assessment of plankton community changes based on shifts in community structure into any Jay Project Aquatic Effects Monitoring Program with the objective of determining how these changes could ultimately impact fish populations of Lac du Sauvage. Differential impacts to various fish species and age classes must be considered.

5.0 WASTE ROCK AND SEEPAGE MANAGEMENT

5.1.1 Issue Statement

The Terms of Reference s. 7.3.1.1 ([PR#74](#)) direct DDEC to “*predict the likelihood and consequences of how each of the following, alone or in combination to leach metals, create acid rock drainage, or otherwise affect water quality...waste rock management area runoff*”. DDEC is also required to “*identify any monitoring, evaluation, and adaptive management plans required to detect potential unexpected changes as well as to ensure that predictions are accurate, and if not, to proactively manage against developing adverse impacts when they (or unexpected changes) are encountered*” ([PR#74](#) Terms of Reference s. 4.1, pg. 17). DDEC has no plans to monitor the Jay Waste Rock Pile other than through seepage monitoring.

5.1.2 Developer’s Conclusions

DDEC has proposed to construct the Jay WRSA on the western shore of Lac du Sauvage ([PR#94](#) DAR s. 3.5.6, pg.3-60 to 3-63). The WRSA will cover an area of 251 hectares and will accommodate 108 million m³ of waste rock with a maximum height of approximately 57 m over the average tundra elevation. The WRSA will be set back a minimum of 100 m from Lac du Sauvage, a minimum of 30 m from streams draining into Lac du Sauvage, and a minimum of 200 m from the adjacent esker. The Developer proposes to mix the PAG rock from the Jay Pit with clean granite to form the Jay WRSA, with permafrost encapsulation as the method to prevent Acid Rock Drainage ([PR#107](#) DAR s. 8.4.2.3, pg. 8-159).

DAR, s. 8 Table 8.4-4 pg. 8-209 ([PR#107](#)) shows effects pathways and statements in relation to Jay Project activities and infrastructure. The Jay WRSA is not shown nor is seepage identified in the Table. However, DDEC appears to have included seepage and runoff from the Jay WRSA in its water quality modeling ([PR#107](#) DAR, s. 8.5.4.2.2 pg. 8-357 and 8-360). Ultimately, DDEC found “predicted changes to water quality will not cause adverse effects to aquatic life or prevent the use of the water as a drinking source” ([PR#107](#) DAR, s. 8.7.2 pg. 8-448 to 8-454).

5.1.3 Agency’s Conclusions

The Jay WRSA will be used to co-dispose up to 75 million m³ of non-potentially acid generating (non-PAG) waste rock, up to 26 million m³ of potentially acid generating (PAG) metasediment and up to 675,300 m³ of lakebed sediment. Other WRSA’s at the Ekati operation are not located adjacent to large water bodies. The Jay WRSA will be set back from Lac du Sauvage by at least 100 m and a minimum of 30 m from the streams that flow into Lac du Sauvage. While DDEC has committed through the Ekati Diamond Mine Waste

Rock and Ore Storage Management Plan V.4.1 ([PR#402](#)) to actively (collection and pumping) and passively (diversionary dams) manage seepage (sec. 5), and to monitor ground temperatures (sec. 4) in the WRSA's using ground sensing cables (i.e. thermistors). There is now evidence to suggest that thermistors will not be installed until after the operational stage of Jay Pit mining is complete. The Agency is concerned that, should acid drainage occur within the Jay WRSA during operation, or should mercury and other heavy metal contaminants begin to be released to the environment through acidic seepage, DDEC will not have the monitoring systems in place to ensure early detection and management. Furthermore, causal management or correction measures would be difficult and costly to implement once the WRSA has been constructed should acid generation begin. The Agency is of the view that there should be additional monitoring and adaptive management of the Jay WRSA in order to avoid a significant adverse impact to water quality.

5.1.4 Evidence and Rationale

Waste Rock Storage Area Design

The approach of co-disposing PAG and non-PAG waste rock and sediment has not been used before at Ekati, although this method of waste rock management has been approved for the Pigeon operations. Uncertainties regarding the lack of freezing in some areas of the current WRSA at Ekati, has led the WLWB to direct DDEC in October 2014 to develop an Ecological Risk Assessment, review its thermal monitoring of the WRSA and review the geochemical sampling of waste rock (see

http://www.mvlwb.ca/Boards/WLWB/Registry/2012/W2012L2-0001/W2012L2-0001%20-%20Ekati%20-%20Seepage%20Concerns%20-%20Board%20Directive%20-%20Oct%2027_14.pdf).

As noted in section 4.2 of this Technical Report, overburden soils and lakebed sediments removed from within the diked portion of Lac du Sauvage will be placed in the interior of the Jay WRSA for long-term management. The Government of the Northwest Territories ([PR#461](#) GNWT-IR2-13) noted that 72% of sediment samples taken from Lac du Sauvage have mercury concentrations that exceed the CCME Interim Sediment Quality Guideline (ISQG) and 2% exceed the selected Probable Effect Level (PEL).

As stated in the Developer's Conclusions (above) and sec. 3.5.6 of the DAR ([PR#94](#)), the WRSA will be set back a minimum of 30 m from any small waterbodies and streams draining into Lac du Sauvage while a 100 m setback will be established from Lac du Sauvage. Although minimal seepage from the Jay WRSA is anticipated in terms of quantity and flow, no evidence is provided by DDEC as to why these setbacks are different and to how the 30 m setback is sufficiently protective of streams and waterbodies draining into Lac du Sauvage.

Acid Rock Drainage Prevention and Mitigation

DDEC states in sec. 3.5.6 of the DAR ([PR#94](#)) that “preferentially freezing the reactive materials into permafrost provides an additional long-term environmental risk reduction, and is the approach that is already in use and effective at the Ekati Mine” ([PR#94](#) DAR s. 3.5.6, pg.3-63). However, in response to an IR from the Agency ([PR#305](#) DAR-IEMA-IR-22), DDEC stated that the “Jay Project (Project) waste rock storage area (WRSA) does not need to be frozen to maintain physical stability or for geochemical management”.

During the Information Request Technical Hearings in June 2015, DDEC suggested permafrost encapsulation within the Jay WRSA was not required as the non-PAG granite has sufficient neutralizing capability to neutralize any potential acidic seepage from the PAG metasediment ([PR#460](#), Jay Project Management Plans Workshop Summary, pg. 10-11). There is now some confusion over the mitigation strategy DDEC is proposing to prevent Acid Rock Drainage from the Jay WRSA.

Jay WRSA Performance Monitoring and Management

DAR, s. 8 Table 8.4-1 pg. 8-161 ([PR#107](#)) states “Thermistors will be installed within the waste rock storage area to monitor permafrost” as a relevant design feature or mitigation. In a discussion of the Jay WRSA at the April 2015 Technical Sessions, concern was expressed over the lack of information about locations for thermistors and the narrow setback and steep slope associated with the small stream to the north of the proposed Jay WRSA. DDEC did not commit to provide additional information on thermistor locations, including the area adjacent to this stream ([PR#354](#), pg. 184-187).

The three-year reporting cycle may be too long to report, detect and prevent problem drainage ([PR#460](#), Jay Project Management Plans Workshop Summary, pg. 10). There is no adaptive management approach, with triggers and action levels, in the Waste Rock and Ore Storage Management Plan-Conceptual Jay Amendment ([PR#427](#)) as discussed at the June 2015 Jay Project Management Plans Workshop ([PR#460](#), Management Plans Workshop Summary, pg. 10-11). Similarly, there are no triggers, no action levels and few details on adaptive management in the currently approved site-wide Waste Rock and Ore Storage Management Plan V. 4.1 ([PR#427](#), pg. 80-83).

5.1.5 Agency Recommendation

The Jay WRSA will be a major physical heritage structure resulting from the Jay Project. The practice of co-disposing non-PAG and PAG waste rock, although approved previously for the Pigeon operations, remains unproven at Ekati. The Monitoring Agency is concerned that adequate monitoring systems will not be installed in the Jay WRSA to confirm co-disposal is a safe method of waste rock management, particularly given the

relatively small 30 m setback from adjacent streams and given the co-disposal of lakebed sediments containing mercury concentrations exceeding the CCME Interim Sediment Quality Guideline. There is a lack of details on an adaptive management system for the Jay WRSA, where earlier warnings or indicators of performance success or failure, are linked to specific actions.

The Agency recommends the Review Board adopt the following Measure to prevent a significant adverse impact to water quality from the Jay WRSA pursuant to s. 128(1)(b) of the *MVRMA*:

Measure 13:

To minimize the likelihood of a significant adverse impact to aquatic resources from the Jay Waste Rock Storage Area, DDEC shall develop and submit to the Wek'eezhii Land and Water Board for approval, a revised Waste Rock and Ore Storage Management Plan within one year of initiating overburden stripping operations. The revised Plan shall include:

- relevant information for the Jay WRSA, information on the design, construction monitoring and management of the facility;
- full justification and rationale for all proposed setbacks from water bodies;
- a robust monitoring system (including thermal monitoring and/or internal water sampling) with locations identified, to provide early indicators or warnings on performance;
- an adaptive management approach with clear triggers and action levels that lead to responses or actions to prevent Acid Rock Drainage; and
- annual reporting of monitoring results including any trigger exceedances, and longer term reporting of trends.

6.0 AIR QUALITY AND DUST

6.1 Air Quality and Dust Management

6.1.1 Issue Statement

The Revised Terms of Reference ([PR#74](#)) set out project impacts to air quality as a Subject of Note in s. 7.4.1. The Developer is required to “quantify emissions (incinerator, heavy equipment etc.) and the accumulation of those emissions in the environment (dioxins, furans, metals etc.), and demonstrate the manner in which the developer will show compliance with national standards and minimize these emissions and their impacts to the environment.”

6.1.2 Developer’s Conclusions

DAR ([PR#103](#) s. 7 Air Quality, pg. 7-111) conclusions “All of the effects were classified as local in geographic extent and of medium duration because emissions and effects cease when Project activities are completed. Magnitude classifications ranged from negligible to high within the LSA. Consequently, effects to air quality were classified as not significant.” The position of the Developer did not change as a result of its updated air quality assessment ([PR#256](#) pg. 31-32).

6.1.3 Agency’s Conclusions

The Agency’s main concern around air quality impacts of the Jay Project relate to dust and proper mitigation, monitoring and management. The Agency is also concerned that dust may be one of the main drivers in the ZOI for caribou avoidance of the diamond mines. Given the size and extent of the predicted Jay Project air emissions including dust, its proximity to Lac du Sauvage and the importance of this area for caribou in particular, the Agency is of the view that Jay Project air emissions are likely to cause a significant adverse impact.

6.1.4 Evidence and Rationale

DAR ([PR#103](#) s. 7 Air Quality, pg. 7-113) “If monitoring or follow-up detects effects that are different from predicted effects, or the need for improved or modified design features and mitigation, then adaptive management will be implemented. This may include increased monitoring, changes in monitoring plans, or additional mitigation. The existing Ekati Mine Air Quality Management and Monitoring Plan can be expanded to encompass the Project.”

The DAR also predicted exceedances of NO₂ ([PR#103](#) Table 7.4-14, pg. 7-65), PM_{2.5} ([PR#103](#) Table 7.4-17, pg. 7-73), and TSP ([PR#103](#) Table 7.4-19, pg. 7-87) above the

GNWT Ambient Air Quality Standards over large parts of Lac du Sauvage extending to the eastern shore. The Review Board's Adequacy Review resulted in an update to DDEC's assessment of Jay Project impacts on air quality ([PR#256](#)) which still predicts exceedances in the above named variables and no change in the Developer's significance determination.

A number of round one IRs were filed about the need to update the 2008 Ekati Air Quality Management and Monitoring Plan to include the Jay Project ([PR#305](#) EC-IR-03, GNWT-IR-4 and IEMA-IR-41). There was a significant amount of discussion at the Technical Sessions about the need for specific monitoring and management information from the Developer for the Jay Project and how a number of older management plans covering Ekati are outdated ([PR#352](#), Technical Session transcript for April 20, 2015 pg. 121-128). The Developer agreed to prepare or update a number of management plans including one covering air quality monitoring and management in relation to the Jay Project. These were submitted to the Review Board on June 1, 2015 and included a Conceptual Air Quality and Emission Monitoring and Management Plan for the Jay Project ([PR#424](#)).

The Plan contains an adaptive management framework with triggers, action levels and the criteria required to trigger the appropriate management action. DDEC also committed to further engagement with interested parties to further develop the Plan ([PR#424](#) pg. 6-1 and [PR#489](#) pdf page 8-12). DDEC subsequently held a Jay Project management plan workshop on June 25-26, 2015 at the suggestion of the Agency. A further meeting to discuss the adaptive management response aspects of the Conceptual Air Quality and Emissions Monitoring and Management Program Design Plan was held on July 20, 2015.

The Agency commends the Developer for its responses and commitments to date regarding the management of air quality impacts from the Jay Project. The Agency has encouraged and worked with DDEC to improve its air quality monitoring and management system and is pleased to see it evolve into a sound approach. We are also very supportive of the adaptive management approach found in the Conceptual Air Quality and Emission Monitoring and Management Plan for the Jay Project ([PR#424](#)) with thresholds and specific action levels being identified. However, there are still some gaps and issues to be addressed to prevent significant adverse impacts from the Jay Project as follows.

The Agency supports the development of specific triggers for air quality monitoring results for NO₂, PM_{2.5} and TSP that will result in adaptive management responses and actions. The key will be to trigger immediate action when necessary, but recognize longer term trends with enough lead time to prevent significant adverse impacts from Jay Project operations. Threshold triggers and response actions should also be developed for dustfall, snow and lichen sampling results recognizing that the nature of the sampling schedule would be more indicative of longer term trends. GNWT's recently filed modifications ([PR#492](#)) to the Developer's proposed triggers would help accomplish this

important air quality management goal and have the Agency's support.

At the July 20, 2015 air quality management workshop, there was some discussion of the lack of protocols, clear triggers and action levels whereby dust mitigation would be required but rather are based on qualitative judgement by DDEC. For example, DDEC said that visible dust was a health and safety issue for its drivers yet no specific thresholds trigger actions other than complaints from its drivers. Specific and measureable triggers should be developed as part of the Air Quality and Emission Monitoring and Management Plan for the Ekati Mine, including the Jay Project. A Traffic Management Plan to reduce fugitive dust should be developed and should consider mitigation including vehicle spacing, cameras for monitoring amount of dust (visibility), and triggers or thresholds when dust suppressant must be re-applied.

The document *Determining Whether a Project is Likely to Cause Significant Environmental Effects* (<https://www.ceaa-acee.gc.ca/default.asp?lang=En&n=D213D286-1>) states that "The most common method of determining whether the adverse environmental effects of a project are significant is to use environmental standards, guidelines, or objectives. If the level of an adverse environmental effect is less than the standard, guideline, or objective, it may be insignificant. If, on the other hand, it exceeds the standard, guideline, or objective, it may be significant." If this test were applied comparing with the GWNT Ambient Air Quality Standards, it would appear that there may well be a significant adverse effect that would last until emissions ceased more than a decade later.

Lastly, the Agency is concerned that there is no enforceable air quality standards in the NWT and no regulatory system to manage air quality ([PR#370](#), GNWT Letter to Review Board on Enforceability of Ambient Air Quality Guidelines and, [PR#359](#) Technical Session transcript for April 20, 2015 pg. 57-77).

6.1.5 Agency Recommendation

The Agency recognizes the advances in air quality monitoring and management at the Ekati Mine over the last decade and the recent commitments by DDEC towards a robust system and engagement related to the Jay Project. However, given some of the areas of uncertainties outlined above and the lack of a regulatory framework for air quality monitoring and management in the NWT, the Agency makes the recommendation to the Review Board for a Measure to prevent significant adverse impacts to air quality from the Jay Project pursuant to s. 128(1)(b) as found in section 6.1.6 of this Technical Report.

The Agency recommends that the Review Board make the following suggestion to GNWT regarding a regulatory framework and system for air quality:

Suggestion 1:

GNWT should develop an appropriate and enforceable regulatory framework and system for air quality in the NWT as soon as possible.

6.2 Air Quality and Dust Monitoring and Monitoring Site Locations

6.2.1 Issue Statement

The Jay Project will be a significant new air emission source. Given the prevailing wind patterns and the Developer's air emission predictions, it will be important to design the air quality monitoring program to ensure that there is adequate coverage for ambient air quality monitoring, dustfall, snow and lichen sampling.

6.2.2 Developer's Conclusions

As noted above, the Developer has already concluded that air emissions from the Jay Project will not result in a significant adverse impact ([PR#256](#) pg. 31-32).

6.2.3 Agency's Conclusions

The Agency is concerned that dust may be one of the main drivers in the ZOI for caribou avoidance of the diamond mines as noted in s. 3.2 of this Technical Report and may impact fish habitat in Lac du Sauvage. The Agency is of the view that Jay Project air emissions are likely to cause a significant adverse impact and require a carefully designed monitoring program.

6.2.4 Evidence and Rationale

There is currently an extensive monitoring site array for ambient air quality, dust, snow and lichen sampling, that is largely centred on the Ekati Main Camp ([PR#390](#) Figure 2.1-1 and Figure 2.6-1). Currently there are no sampling or monitoring sites on the north or east side of Lac du Sauvage, or on the esker system near Jay.

During the July 20, 2015 air quality workshop, DDEC did not propose any specific air quality or dust monitoring sites in relation to the Jay Project other than a TSP monitoring station east of the Jay Pit; a station for dustfall, passive NO₂, lichen and snow chemistry east of the Jay Pit; as well as an additional transect for dustfall, lichen and snow chemistry

on the Jay Road ([PR#493](#) DDEC presentation July 20, 2015 Air Quality Workshop. slide 7). A consultant for DDEC commented that it might make sense to have further snow chemistry and lichen sites on the east side of Lac du Sauvage. DDEC said it would also consider passive ambient air samplers for TSP and or PM_{2.5} that could be located on the dyke or within the drained portion of Lac du Sauvage.

Given that DDEC currently samples some sites outside of its mineral claims block and the proximity of the Jay Project to the Diavik Mine and DDEC's 40% stake in that operation, it makes sense that there would be stronger cooperation and coordination of air quality monitoring and management amongst the two diamond mines.

DDEC also stated that its internal protocols for continuous ambient air quality monitoring require a review of data every 6 days and that this could potentially trigger an immediate mitigative response to any ambient air quality exceedances.

6.2.5 Agency Recommendation

The Agency recognizes the recent work by DDEC towards a robust air quality monitoring and management system and engagement related to the Jay Project. However, given some of the areas of uncertainty outlined above and the lack of a regulatory framework for air quality monitoring and management in the NWT, the Agency makes the following recommendation to the Review Board for a Measure to prevent significant adverse impacts to air quality from the Jay Project pursuant to s. 128(1)(b):

Measure 14:

To prevent a significant adverse impact to air quality, DDEC shall develop a revised Air Quality and Emission Monitoring and Management Plan for the Jay Project, collaboratively with interested parties and the GNWT before construction commences. The Plan shall include:

- specific triggers for air quality monitoring results for NO₂, PM_{2.5} and TSP that will result in adaptive management responses and actions including prevention and mitigation;
- detailed actions and responses for tiered thresholds and action levels that will include a range of lead times from immediate action when necessary, but recognize longer term trends;
- a plan and timetable to develop thresholds and actions in relation to dustfall, snow and lichen sampling results;
- plans to manage road traffic to reduce fugitive dust including vehicle spacing, cameras for monitoring amount of dust (visibility), and triggers or thresholds when dust suppressant must be re-applied;
- monitoring and sampling sites to capture dust, and sample snow and lichen on the northern and eastern shores of Lac du Sauvage and along the esker system, and other appropriate sites considering prevailing winds, habitat sensitivity and similar factors; and
- explicit quality assurance and quality control protocols to ensure data reliability and properly functioning equipment.

To ensure a more coordinated and regional approach to air quality monitoring, management and mitigation, the Agency recommends that the Review Board make the following suggestion:

Suggestion 2:

DDEC, in collaboration with GNWT and other interested parties including Diavik Diamond Mines Inc., should develop a regional approach to air quality monitoring, management and mitigation.

7.0 CONCLUSIONS

7.1 Process Observations

The Agency would like to thank the Review Board and its staff for running an efficient and effective environmental assessment process. The Agency believes that the Adequacy Review was an improvement over the Conformity Check process previously used and helped facilitate better information for this assessment.

The Agency also commends the Developer for its engagement efforts and the additional workshops and meetings it conducted outside of the formal environmental assessment. These sessions proved particularly helpful for the Agency in better understanding the proposed Jay Project, DDEC's mitigation measures, monitoring and management.

The Agency was also pleased to see significant progress made on a number of management plans for the Jay Project that will lead to site-wide improvements that we have been advocating for several years. The Caribou Road Mitigation Plan ([PR#433](#)), Conceptual Wildlife Effects Monitoring Plan ([PR#425](#)), and Conceptual Air Quality and Emissions Monitoring and Management Plan ([PM#424](#)) are important additions towards sound environmental management by DDEC at the Ekati Mine.

The Agency is not aware of any participant funding being made available for this environmental assessment. The issue of participant funding has been raised with the Agency in the past and those concerns have been noted and passed along to the federal and territorial governments in the past. We note that the Kitikmeot Inuit Association in particular raised the issue of participant funding for the Jay Project in its letter dated April 28, 2015 to the Nunavut Impact Review Board ([PR#404](#)).

Suggestion 3:

Canada and GNWT investigate and publicly report on the establishment of a permanent participant funding program for environmental assessments held under Part V of the *Mackenzie Valley Resource Management Act* within one year of the acceptance of the Report of Environmental Assessment.

7.2 Overall Conclusion

The Review Board has several options with regard to its decision on the Jay Project as set out in s. 128 of the MVRMA as follows:

128. (1) *On completing an environmental assessment of a proposal for a development, the Review Board shall,*
- (a) where the development is not likely in its opinion to have any significant adverse impact on the environment or to be a cause of significant public concern, determine that an environmental impact review of the proposal need not be conducted;*
 - (b) where the development is likely in its opinion to have a significant adverse impact on the environment,*
 - (i) order that an environmental impact review of the proposal be conducted, subject to paragraph 130(1)(c), or*
 - (ii) recommend that the approval of the proposal be made subject to the imposition of such measures as it considers necessary to prevent the significant adverse impact;*
 - (c) where the development is likely in its opinion to be a cause of significant public concern, order that an environmental impact review of the proposal be conducted, subject to paragraph 130(1)(c); and*
 - (d) where the development is likely in its opinion to cause an adverse impact on the environment so significant that it cannot be justified, recommend that the proposal be rejected without an environmental impact review.*

Based on our review of the evidence filed to date on the Jay Project public registry as summarized above, and our knowledge and experience with the Ekati Mine, the Agency recommends to the Review Board that it find there is likely to be a significant adverse impact on the environment as set out in s. 128(1)(b) of the MVRMA.

We have reached this conclusion in reviewing evidence for the key lines of inquiry, namely caribou and water, but also for some of the subjects of note for this environmental assessment, air quality, and waste rock and seepage management as it relates to water quality. In our presentations on these subject matters earlier in this Technical Report, the Agency found significant uncertainties around some of the Developer's predictions, a lack of clarity around some significance determinations, and limited details on mitigation, monitoring and management of impacts to the environment from the Jay Project. For these reasons, the Agency is of the view that there is likely to be a significant adverse impact to the environment from the Jay Project

We are mindful of the many commitments that DDEC has made during this environmental assessment and commend the Developer for these. However, some of the current site-wide Ekati Mine mitigation measures, monitoring programs and management plans, in our view, require improvements. To ensure that the commitments on some of the key lines of inquiry and subjects of note become binding on DDEC and possible future operators, and to provide for a coordinated follow-up program, we believe that a number of Measures

should be imposed by the Review Board to assist in mitigating or preventing a significant adverse impact to the environment from the Jay Project. These Measures have appeared following each of the subject matters we reviewed above.

The Agency believes that the likely significant adverse impact to the environment from the Jay Project can be largely prevented with the adoption of the Measures we have recommended and with careful and collaborative follow-up actions, including a rigorous regulatory review. We encourage the adoption of our Measures as a comprehensive package to better manage the Valued Ecosystem Components identified as key lines of inquiry and subject of notes throughout this assessment. We look forward to working with the Developer and all the other interested parties to implement the Measures and suggestions from the Review Board and the commitments made by the Developer.

The Agency makes one final recommendation for a Measure to ensure that all the Measures, suggestions and commitments are tracked, reported on and implemented.

Measure 15:

DDEC and other parties to whom Measures and suggestions have been directed, shall report annually on progress made on the Measures, suggestions and commitments recorded in the Report of Environmental Assessment for the Jay Project. DDEC's annual reporting on Measures, suggestions and commitments is to be included in the Annual Report now submitted pursuant to the Environmental Agreement and water licence.

7.3 Summary of Recommended Measures and Suggestions

For the convenience of the Review Board and other parties, the Agency's recommended Measures and suggestions are compiled below:

Measures

1. To prevent a significant adverse impact to caribou, DDEC shall implement further measures minimize the ecological disturbance footprint for the Jay Project as follows:
 - selection of the Jay haul road route that minimizes disturbance to high quality caribou habitat ([PR#305](#) DAR-IEMA-IR-28 and [PR#356](#) Anne Gunn's proposed routing);
 - additional mitigation to reduce the effect of haul truck and other traffic on caribou (e.g., more rigorous dust management, including adaptive management triggers for additional dust suppression; more precautionary traffic management to reduce sensory disturbance); and

- investigate and implement an esker crossing that involves selection of less critical habitat, one-way traffic, buried power lines, and other innovative approaches.
2. To prevent a significant adverse impact to caribou, DDEC, with other mine operators and GNWT where possible, shall develop and implement a collaborative research program designed to identify the causes of the Zone of Influence (ZOI) for caribou avoidance. The research findings will then be implemented to reduce the size of the ZOI on caribou. The results of the research program are to be summarized and reported annually to all interested parties as part of DDEC's annual report under its Wildlife Effects Monitoring Program. A target date for development of the research program is one year following the acceptance of the Measures by Responsible Ministers and implementation of the research results to reduce the ZOI within five years. DDEC shall commit to using the results of the research for the existing Ekati Mine.
 3. To obtain information needed to prevent a significant adverse impact to caribou, DDEC shall analyze estimates of ZOI distance and magnitude from the 2009 and 2012 aerial survey data from the combined Ekati-Diavik study area using the new R code analysis. These estimates should be reported within the 2015 Wildlife Effects Monitoring Program report.
 4. To obtain information needed to prevent a significant adverse impact to caribou, DDEC shall undertake aerial surveys to monitor relative caribou distribution and abundance and measure the effectiveness of mitigation measures for caribou currently in use for Ekati and proposed for the Jay Project. The aerial survey study area should be enlarged to include the extensions related to the proposed Jay Project and reasonably foreseeable Sable footprints. Given new analytical techniques, survey timing will be established in collaboration with interested parties but designed to track trends over time. DDEC shall produce estimates of ZOI distance and magnitude for the Jay Project (including the entire Ekati Mine) for the combined Ekati-Diavik study area using the new R code analysis. The results of the aerial surveys and analysis of the ZOI are to be reported annually (as appropriate) as part of DDEC's Wildlife Effects Monitoring Program reports, and will serve as means of measuring the effectiveness of Jay Project caribou mitigation measures.
 5. To prevent a significant adverse impact to caribou and to reduce public concern with the Jay Project, DDEC shall prepare a Compensatory Mitigation (Off-Setting) Plan for caribou. The purpose of the Plan is to enhance the ability of the Bathurst caribou herd to recover to its previous abundance as measured through reductions in energy loss, positive changes in calf production and survival. To the extent

possible, the Plan should be developed collaboratively with interested parties, and shall be a condition of a land use permit for the Jay Project. The Plan should be prepared and circulated by DDEC to the Wek'eezhii Renewable Resources Board, GNWT and affected Aboriginal governments within one year of the acceptance of the Report of Environmental Assessment and shall be in place before construction commences on the Jay Project.

6. To prevent a significant adverse impact to water quality, DDEC shall develop and submit to the Wek'eezhii Land and Water Board for approval, a revised Water Management Plan for the Jay Project within two years of initiating de-watering operations of the Jay pit. The Plan shall include:
 - Identification of specific surface and minewater management contingencies including capacities (in terms of effluent volumes and mine production as expressed in operating days);
 - Design, construction and implementation timing for each identified surface and mine water management contingency option;
 - Detailed monitoring of water quality and quantity to enable early detection of success or failure; and
 - Associated adaptive management trigger thresholds for implementation of contingencies.
7. To prevent a significant adverse impact to water quality, DDEC shall provide specific details to the Wek'eezhii Land and Water Board as part of any proposed water licence, as to how it plans to encapsulate mercury-laden lakebed sediments within the Jay WRSA to ensure mercury does not re-enter the Lac du Sauvage water column during operations and closure.
8. To prevent a significant adverse impact to fish likely to be affected by the Jay Project, DDEC shall incorporate non-lethal testing of large-bodied fish within Lac du Sauvage in any Aquatic Effects Monitoring Program for the Jay Project.
9. To support DDEC's position that dust settling on spawning shoals would be naturally swept away, DDEC shall develop and submit to the Wek'eezhii Land and Water Board the results of a model of depth of wave turbulence below the surface in Lac du Sauvage in areas likely to be affected by dust deposition from the Jay Project.
10. DDEC shall evaluate the Jay Project impacts on Counts Lake as an AEMP reference lake and identify alternative lakes which could be used as reference lakes in the AEMP, or a means of continuing to use Counts should that be a better option, for the Jay Project before construction begins.

11. To prevent a significant adverse impact to zooplankton from the Jay Project, DDEC shall evaluate the likelihood of acute toxicity to zooplankton occurring in the proposed mixing zone during operations. DDEC should also commit to reviewing the QA/QC of all future chronic and acute toxicity testing to ensure comparability of results to natural conditions in the receiving environment (i.e. use of water in toxicity testing that has the same temperature and other physical properties as water within the receiving environment).
12. DDEC shall incorporate an annual assessment of plankton community changes based on shifts in community structure into any Jay Project Aquatic Effects Monitoring Program with the objective of determining how these changes could ultimately impact fish populations of Lac du Sauvage. Differential impacts to various fish species and age classes must be considered.
13. To minimize the likelihood of a significant adverse impact to aquatic resources from the Jay Waste Rock Storage Area, DDEC shall develop and submit to the Wek'eezhii Land and Water Board for approval, a revised Waste Rock and Ore Storage Management Plan within one year of initiating overburden stripping operations. The revised Plan shall include:
 - relevant information for the Jay WRSA, information on the design, construction monitoring and management of the facility;
 - full justification and rationale for all proposed setbacks from water bodies;
 - a robust monitoring system (including thermal monitoring and/or internal water sampling) with locations identified, to provide early indicators or warnings on performance;
 - an adaptive management approach with clear triggers and action levels that lead to responses or actions to prevent Acid Rock Drainage; and
 - annual reporting of monitoring results including any trigger exceedances, and longer term reporting of trends.
14. To prevent a significant adverse impact to air quality, DDEC shall develop a revised Air Quality and Emission Monitoring and Management Plan for the Jay Project, collaboratively with interested parties and the GNWT before construction commences. The Plan shall include:
 - specific triggers for air quality monitoring results for NO₂, PM_{2.5} and TSP that will result in adaptive management responses and actions including prevention and mitigation;

- detailed actions and responses for tiered thresholds and action levels that will include a range of lead times from immediate action when necessary, but recognize longer term trends;
 - a plan and timetable to develop thresholds and actions in relation to dustfall, snow and lichen sampling results;
 - plans to manage road traffic to reduce fugitive dust including vehicle spacing, cameras for monitoring amount of dust (visibility), and triggers or thresholds when dust suppressant must be re-applied;
 - monitoring and sampling sites to capture dust, and sample snow and lichen on the northern and eastern shores of Lac du Sauvage and along the esker system, and other appropriate sites considering prevailing winds, habitat sensitivity and similar factors; and
 - explicit quality assurance and quality control protocols to ensure data reliability and properly functioning equipment.
15. DDEC and other parties to whom Measures and suggestions have been directed, shall report annually on progress made on the Measures, suggestions and commitments recorded in the Report of Environmental Assessment for the Jay Project. DDEC's annual reporting on Measures, suggestions and commitments is to be included in the Annual Report now submitted pursuant to the Environmental Agreement and water licence.

Suggestions

1. GNWT should develop an appropriate and enforceable regulatory framework and system for air quality in the NWT as soon as possible.
2. DDEC, in collaboration with GNWT and other interested parties including Diavik Diamond Mines Inc., should develop a regional approach to air quality monitoring, management and mitigation.
3. Canada and GNWT investigate and publicly report on the establishment of a permanent participant funding program for environmental assessments held under Part V of the *Mackenzie Valley Resource Management Act* within one year of the acceptance of the Report of Environmental Assessment.

8.0 REFERENCES

The following new references appear in this Technical Report (those without an internet link provided in the text). All other references have been used by DDEC in its submission or are documents that have already been filed on the Review Board public registry for the Jay Project. Electronic copies of this new evidence has been filed with the Review Board along with this Technical Report.

Brian D., S. Graeb, John M. Dettmers, David H. Wahl and Carla E. Cáceres. 2004. Fish Size and Prey Availability Affect Growth, Survival, Prey Selection, and Foraging Behavior of Larval Yellow Perch, Transactions of the American Fisheries Society, Volume 133, Number 3, pg. 504-514.

Fudge R.J.P., and R.A. Bodaly. 1984. Post-impoundment winter sedimentation and survival of lake whitefish (*Coregonus c/upeaformis*) eggs in southern Indian Lake, Manitoba. Canadian Journal of Fish Aquatic Sciences, Volume 41, pg. 701-705.

Gantner, N., D.C. Muir, M. Power, D. Iqaluk, J.D. Reist, J.A. Babaluk, M. Meili, H. Borg, J. Hammar, W. Michaud, B. Dempson and K. R. Solomon. 2010. Mercury concentrations in landlocked arctic char (*Salvelinus alpinus*) from the Canadian arctic. part ii: influence of lake biotic and abiotic characteristics on geographic trends in 27 populations. Environmental Toxicology and Chemistry, Volume 29, Number 3, pg. 633–643.

Morris, J.E. and C. C. Mischke. 1999. Plankton Management for Fish Culture Ponds Department of Animal Ecology. Iowa State University. Technical Bulletin Series #114 USDA Cooperative State Research, Education and Extension Service USDA Grant #95-38500-1410.

Nellemann, C., Vistnes, I., Jordhøy, P., Stoen, O.G., Kalternforn, B.P., Hanssen, F & Helgeson R. 2010. Effects of cabins, trails and their removal for restoration of reindeer winter ranges. Restoration Ecology. 18(6): 873-881.

Panzacchi, M. and B. Van Moorter and O. Strand. 2013. A road in the middle of one of the last wild reindeer migration routes in Norway: crossing behaviour and threats to conservation. Rangifer, Volume 33, Special Issue Number 21, pg. 15-26.