A Review of the 2017 Diavik Diamond Mine Wildlife Monitoring Report

Prepared for

Environmental Monitoring Advisory Board

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Prepared by

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Executive Summary

Summary and Recommendations

In this review on behalf of The Environmental Monitoring Advisory Board (EMAB or the Board), Management and Solutions in Environmental Science (MSES) assesses the procedures and results of the 2017 Wildlife Monitoring Report (WMR; Golder 2018). The annual data collection is mandated to follow a Wildlife Monitoring Program (WMP), developed in 2002, which determined the testable questions and the objectives that need to be addressed through the life of the project. The WMP is a requirement of the Diavik Environmental Agreement which is an agreement between Diavik Diamond Mine Inc. (DDMI), local Indigenous groups and the federal and territorial governments that formalizes Diavik's environmental protection commitments. Review of the WMRs assists the Board in partially fulfilling its mandate as outlined in the Diavik Environmental Agreement. Since 2004, MSES reviewed the WMRs to evaluate how the WMP was and is adhered to. In the course of 2010, MSES participated in several communications with DDMI and other parties where a number of recommendations were discussed in workshops and other venues to adapt the data collection in light of the information available at the time (Handley 2010). These recommendations, in part, altered the objectives of the 2002 WMP which are now reflected in the WMRs since 2011. Specific to grizzly bear, the monitoring objective was revised once again at a March 2013 Wildlife Monitoring Workshop hosted by the GNWT (GNWT 2013). In 2018, MSES participated in a conference call with Golder, DDMI, and EMAB representatives on 22 February 2018, the Slave Geological Province Wildlife Monitoring Workshop from April 24-26, 2018 (2018 SGP Wildlife Monitoring Workshop) and received additional wildlife monitoring material, including:

- Responses to EMAB (MSES) Comments on 2016 WMP and 2017 WCAR, and GNWT's ENR Comments on 2017 WCAR (Golder 2017a).
- Recommendations for ENR from EMAB's review of Diavik's 2016 Wildlife Monitoring Program Report and 2014-2016 Comprehensive Analysis Report (GNWT 2017).
- Establishment of Wildlife Monitoring Program Terms of Reference (EMAB 2018).
- Analyses of Wolverine DNA Mark-Recapture Sampling in the Northwest Territories 2004-2015 (Efford and Boulanger 2018).

Information from these additional sources is considered and incorporated into this report. Below we have summarized our key review findings for the 2017 WMR.

The overall area of disturbance (km^2) remained at or below predicted levels in 2017, with four vegetation types (Ecological Land Classifications (ELC)), riparian shrub, esker complex, bedrock complex, and boulder complex, at or slightly exceeding the predicted loss.

Direct loss of caribou habitat is still in line with the original predictions. However, the Project may be contributing to indirect loss of caribou habitat through changes in vegetation next to the Mine site. Indirect habitat loss for caribou was not addressed in the 2017 WMR.

The mean population size of the Bathurst caribou herd has decreased between 1996 (349,000) and 2015 (16,000 to 22,000) resulting in fewer caribou monitoring opportunities over time relative to the Diavik mine site. The population decrease also corresponds with changes in Bathurst caribou seasonal range

patterns including an overall contraction of their range and a delay in their southern (fall) migration to below treeline. Caribou from the Beverly/Ahiak herd are also reported in the Diavik study area in more recent years. Aerial surveys for caribou have not been completed since 2012. Based on previous detailed analyses, there appears to be a zone of influence (ZOI) for caribou occurrence, where caribou are more likely to occur at about 14 km from the Mine than closer to the Mine. In the 2017 WCAR, DDMI evaluated the caribou aggregation at 14 km using a regression analysis to evaluate the relationship between caribou density and nearest distance to the Ekati or Diavik Mine footprint. This analysis of caribou density implies that there may not be a ZOI but more rigorous analyses were requested for the density approach to ZOI evaluation. In the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis was presented which evaluates ZOI on an annual basis using GPS collar data (possible because of the availability of a computer package that can efficiently estimate breakpoints on an annual basis). This approach could be used to analyze ZOI for the 2018 season for the Diavik mine. A Government of the Northwest Territories (GNWT) Caribou ZOI Technical Task Group was led by ENR in 2014 to discuss conditions under which aerial surveys should be resumed. A ZOI Draft Guidance Document was developed in March 2015 that outlines the conditions under which monitoring ZOI is technically appropriate. DDMI has not yet received recommendations and direction from ENR regarding ZOI evaluation. We expect that ENR will recommend that in 2019, ZOI monitoring (either via aerial surveys or collar data analysis) will resume given that Diavik will be commencing aboveground mining in the A21 pit in 2018.

Caribou behaviour data were collected but not analyzed in the 2017 WMR. DDMI will not undertake additional analyses of ground-based behavioural data until they deem that sufficient data are available. A comprehensive analysis of caribou behaviour data was last completed in 2011. Diavik and Ekati are cooperating on behavioural data collection, but combined data and analyses have not been presented as there seem to be issues relating to data compatibility. We understand that Ekati will be shifting their data collection to include more group scans in future years which will improve data compatibility. During the 2018 SGP Wildlife Monitoring Workshop, ENR presented information on their caribou behaviour pilot project. The intention was for the government to standardize protocols, pool datasets on behaviour, and coordinate field efforts; however, no timelines were provided for the development of standardized protocols. There is now a five-year gap in caribou behavioural data analysis (2012-2017) due to insufficient near-Mine data.

Analysis of caribou collar data with respect to seasonal movement was included in the 2017 WMR. In 2017, male and female caribou distribution followed the predicted pattern for the northern (deflected west of East Island) and southern migrations (deflected east of East island). Over the long-term, caribou are following the predicted pattern for the northern migration; however, not for the southern migration. For 12 of the 22 years measured (1996-2017), there is a departure from predictions for the southern migration (55% travelled west of Lac de Gras). We have asked for additional details and made recommendations regarding the statistical methods used in the analysis. DDMI offered some discussion on potential causes for these new distributions, but in general, a constructive discussion regarding adaptive management, taking the most recent data and analyses into account, would be useful for future project-specific and regional management of impacts to caribou.

For grizzly bears, little new information was provided. Both mortality and habitat loss remain at or below the levels predicted. The 2017 incidental data seem to suggest that the occurrence of grizzly bears near the Mine is increasing over time. . However, it appears as though a single bear is responsible for the

majority of the observations and has a home range that includes the mine. Given that grizzly bear mortality predictions have not been exceeded and past DNA results suggest a stable or increasing population, project-specific impacts of the mine on grizzly bears are likely minimal. Results from the 2017 grizzly bear hair-snagging data collection are expected in mid-2018.

For wolverine, there appears to be support for the prediction that mining related mortalities are not expected to alter wolverine population parameters in the Lac de Gras area. A comprehensive analysis of wolverine track data was last completed in 2017 which showed that the probability of wolverine occurrence has increased over time in the Diavik mine study area. An analysis of wolverine hair snagging data (Efford and Boulanger 2018), found that the average density at three northern sites (Daring Lake, Diavik and Ekati mines) declined between 2004 and 2015. The most prominent decline occurred at the Daring Lake site with a weaker decline over time for Diavik study area alone. Given this decreasing wolverine population over time, the increasing wolverine track density over time (2003-2016) at Diavik mine is not simply a function of an increasing population. A possible explanation is that that wolverines are attracted to the mine area because of the new more northerly distribution of caribou due to their recent range contraction. Alternatively, the mine could be attracting wolverines; however, there are no clear trends over time in days with wolverine visitations, days deterrents were necessary, relocations, or mortalities.

There do not appear to be any new findings or changes of note regarding the presence and productivity of falcons. Two active peregrine nests were observed in 2017.

Past monitoring data seemed to indicate that fox presence was decreasing and perhaps levelling off in recent years; however, it has increased again in 2017, though not as high as 2014 levels. In 2017, observations of wildlife (fox and wolverine) were highest for the Waste Transfer Area (WTA). Misdirected attractants (food and food packaging) appear to be higher in 2017 compared to 2016 levels on both the WTA and the Landfill area, while the number of misdirected attractants for the A21 Area (new dike) decreased compared to 2016 levels. While the overall effect of waste management in the A21 area appears to be positive (fox and wolverine numbers are lower than in 2016), the WTA appears to be attracting higher numbers of wolverine and fox compared to 2016. This may be contributing to wildlife presence and possible habituation near the Mine site.

As expected, there was no new information regarding the abundance and species composition of waterfowl and shorebirds in the 2017 WMR. It had been agreed that the waterfowl monitoring program be discontinued in December 2013, but CWS did recommend that DDMI re-start the waterbird/shorebird monitoring program at the Mine reclamation stage.

As expected, no wind farm associated bird mortality information was presented in the 2017 WMR. Given the low likelihood of avian-turbine strikes, due to location and size of the wind farm, and the absence of bird mortalities in 2013, we agreed with DDMI's recommendation to discontinue monitoring the wind farm using 2013 methods and to instead monitor for bird mortalities as part of the overall site compliance monitoring program.

In the past, the measurements have adequately addressed the predictions at hand and the analysis of the data yielded a great deal of credible information about the effectiveness of mitigation measures. However,

there are some widening gaps in data collection, analysis, and reporting, particularly relating to caribou. Below, we present some highlights for the Boards' consideration; several are re-stated here from previous yearly reviews as they await future detailed data analyses. We recommend that the following issues be addressed:

1. Please discuss how the information gained from various caribou datasets could be used in terms of mitigation and adaptive management for the Diavik Mine in particular and for other future projects in the region in general. Although some discussion occurred during the 2018 SGP Wildlife Monitoring Workshop, no decisions were made, and more discussion regarding potential adaptive management actions was deferred to an unspecified future date. This discussion should be prioritized.
2. Please give careful consideration to the interpretation of the 14 km ZOI presented in Boulanger et al. (2012). The 14 km distance, based on presence-absence data, may actually demonstrate an aggregation of caribou that would not exist without the mines. A 2017 analysis of caribou density implied that there may not be ZOI but more rigorous analyses were requested for the density approach to ZOI evaluation. In the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis was presented which evaluates ZOI on an annual basis using GPS collar data. Diavik should consider using the GPS collar data approach to analyze ZOI for the 2018 season. Given that aboveground mining in the A21 pit will commence in 2018, Diavik should resume ZOI monitoring in 2019. Diavik should confirm the status and form of caribou ZOI monitoring prior to the 2019 WMP monitoring season.
3. There is now a five-year gap in caribou behavioural data analysis (2012-2017) due to insufficient near-Mine data. Although Ekati and Diavik are cooperating on data collection, some data may not be compatible. We emphasize the importance of these data in understanding the influence of the Mine on caribou and the mechanism that lead to the avoidance of the Mine vicinity. To potentially address the small sample size within 5 km of the Mine, we ask DDMI to:
    a. Move forward on collaboration and coordination of efforts, including both data collection and analysis, of the caribou behaviour monitoring program. Based on a June 14th, 2018 conference call, we understand that Ekati will be shifting their data collection to include more group scans in future years. This will allow for a combined analysis of behavioural data from both the Ekati and Diavik mine in the future. If possible, please confirm that this coordination of survey types will happen for the next reporting period.
    b. Upon our review of DDMI's Response (14 June 2018) to EMAB's Letter regarding the Establishment of Wildlife Monitoring Program Terms of Reference, we recommend that DDMI provide summaries for activities other than just feeding time, particularly activities with a high energetic cost.
    c. Given that the feeding data presented by DDMI (DDMI's Response on 14 June 2018) do not appear to show the same pattern, we recommend DDMI comment on why there might be a difference in the pattern between 2011 and 2018 and discuss whether they implemented a change to mine protocol that may have minimized the impacts on caribou behaviour.
    d. Given that the two mines have agreed to cooperate, please provide the current sample sizes for behavioural data, perhaps in Table format, including information on:

i. Mine operator (Ekati vs Diavik)
ii. Type of scan (focal vs group)
iii. Season
iv. Distance from mine
v. Year

e. Please analyze a DDMI-Ekati combined dataset for the next reporting period, using all behavioural data available to date, to test how caribou behaviour changes as a function of distance from the Mine. This is particularly relevant given the change to above-ground mining at the Diavik mine**.**

f. Provide a description of how non-parametric statistics have been or could be used in the analysis of behavioural data.

4. Please address the following in future detailed analysis of caribou occurrence and behavioural data:

   a. Clearly state the assumption of no yearly variation in caribou behaviour if the data are insufficient to detect annual variation.

   b. In the event that collaboration on/sharing of behaviour data between operators occurs, please be explicit about all assumptions made in future analyses.

5. DDMI should complete an analysis of the indirect (in addition to the currently presented direct) footprint effect on caribou habitat for understanding the true effects on caribou and for determining future mitigation measures. This is particularly relevant given the effects of dust deposition on local plant species, which affects both forage species composition and elevated metal concentrations in lichen near the Mine. DDMI indicated that the ZOI analysis for caribou captures the effect of indirect habitat loss. It appears that indirect habitat loss is implicitly incorporated into the ZOI modelling, but not explicitly measured on the ground. For that reason, no mitigation measure of the indirect habitat loss is discussed, to the best of our knowledge.

6. Please provide information on the statistical independence of the data used in the caribou distribution analysis and a discussion of the potential response actions to the departure from the prediction regarding the southern migration of caribou and changes to the timing of the migration. Please consider the use of TK to help uncover causes for unanticipated changes to the caribou southern migration and to develop adaptive mitigation measures.

7. Please address the possibility that grizzly bears may be becoming habituated and their presence on the site may be on the rise. We await the results of 2017 grizzly bear hair snagging data collection that can help with determining whether increases in grizzly bear observations near the Diavik mine are having population-level consequences for grizzly bears.

8. Please use recently available information from the DNA hair snagging program (2018) to support conclusions in the 2019 WMP report regarding the alteration of wolverine population parameters.

9. Please evaluate whether the increase in fox and wolverine observations in the WTA in 2017 persists in future years.

10. Please explore the reasons for the higher levels of misdirected food waste in the WTA and Landfill areas as this may be contributing to wildlife presence and possible habituation near the Mine site.

11. Please discuss the results showing an effect of the Mine on vegetation structure in reclamation and revegetation studies and discuss the implications for wildlife recolonization in terms of the likelihood for re-establishment of natural or pre-disturbance vegetation and wildlife communities. The Mine closure plan and proposed reclamation activities should ensure that forage species palatable to caribou be part of the mix of species (at a natural ratio) in the reclaimed landscape.
12. We recommend that the established three-year monitoring schedule for a comprehensive analysis of vegetation and lichen data be continued in order to capture changes in vegetation and lichen parameters. With a return to above-ground mining activities scheduled for 2018, dust deposition and metal concentrations in lichen are likely to increase again.
13. Please provide responses to the detailed questions and comments (presented in bold font) in the body of this review report.
14. Except for our recommendations listed above, we are in agreement with the recommendations listed in the 2017 WMR and do not recommend any actions additional to providing the information requested above.
15. We recommend that the Board accept the 2017 WMR with the understanding that the above listed questions and recommendations will be addressed in a timely fashion via communications and workshops by DDMI in the coming year. The responses to our questions and recommendations are necessary to maintain and improve the understanding of the effects of the Mine on wildlife. Furthermore, we understand that detailed data analyses are required, as identified in our review, and that these analyses will be conducted in the near future.

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1.0 Introduction

The Environmental Monitoring Advisory Board (EMAB or the Board) for the Diavik Diamond Mine Inc. (DDMI) Project requested that Management and Solutions in Environmental Science Inc. (MSES) review and assess the procedures and results of the 2017 Wildlife Monitoring Report (WMR; Golder 2018). A WMR is completed annually while a Wildlife Comprehensive Analysis Report (WCAR) has been completed every three years and submitted as a separate report. In the future, comprehensive analyses will be completed every three years but included within the annual WMR rather than as a stand-alone document. The WMR communicates the findings of surveys conducted during 2017 as well as DDMI's recommendations for future activities. In 2018, MSES participated in a conference call with Golder, DDMI, and EMAB representatives on 22 February 2018, the Slave Geological Province Wildlife Monitoring Workshop from April 24-26, 2018 (2018 SGP Wildlife Monitoring Workshop) and received additional wildlife monitoring material. Information from the workshop and the additional material are incorporated into this report and include the following:

- Responses to EMAB (MSES) Comments on 2016 WMP and 2017 WCAR, and GNWT's ENR Comments on 2017 WCAR (Golder 2017a).
- Recommendations for ENR from EMAB's review of Diavik's 2016 Wildlife Monitoring Program Report and 2014-2016 Comprehensive Analysis Report (GNWT 2017).
- Establishment of Wildlife Monitoring Program Terms of Reference (EMAB 2018).
- Analyses of Wolverine DNA Mark-Recapture Sampling in the Northwest Territories 2004-2015 (Efford and Boulanger 2018).

The annual data collection is mandated to follow a WMP, developed in 2002, which determined the testable questions and the objectives that need to be addressed through the life of the project. The WMP is a requirement of the Diavik Environmental Agreement which is an agreement between DDMI, local Indigenous groups and the federal and territorial governments that formalizes Diavik's environmental protection commitments. Review of the WMRs assists the Board in partially fulfilling its mandate as outlined in the Diavik Environmental Agreement. Since 2004, MSES reviewed the WMRs and WCARs to evaluate how the WMP was and is adhered to. In the course of 2010, MSES participated in several communications with DDMI and other parties where a number of recommendations were discussed in workshops and other venues to adapt the data collection in light of the information available at the time (Handley 2010). These recommendations, in part, altered the objectives of the 2002 WMP which are now reflected in the WMRs since 2011.

Based on its annual reviews of past WMRs and detailed data analyses (WCARs), MSES submitted numerous recommendations for EMAB and DDMI to consider. The present report takes past recommendations and discussions as well as the altered WMP objectives into account. Here, we review how DDMI addressed the above discussions and previous recommendations in the 2017 WMR.

In our review below, for the ease of identifying our recommendations and requests, we highlight the **text in bold** where we specifically request actions from DDMI.

2.0 General Observations

2.1 Objectives of the Wildlife Monitoring Program

The objectives of the WMP v.2 were developed in 2002 and DDMI has anchored its monitoring reports on these objectives. For more clarity, below we re-state the objectives set forth in the WMP v. 2 of 2002 to emphasize that these objectives are the foundation and focus of our review, and that the methods and results in the 2017 WMR, are reviewed in light of these objectives, as amended in 2010.

"The objectives of the wildlife monitoring program are to:

a. Verify the accuracy of the predicted effects determined in the Environmental Effects Report (Wildlife 1998) and the Comprehensive Study Report (June 1999); and

b. Ensure that management and mitigation measures for wildlife and wildlife habitat are effective in preventing significant adverse impacts to wildlife."

A number of specific questions that have been tested in the course of the years of monitoring have been found to be either largely answered or ineffective for the testing of mitigation effectiveness, prompting discussions about adapting the objectives of data collection in light of current information (Handley 2010). Specific to grizzly bear, the monitoring objective was revised once again at a March 2013 Wildlife Monitoring Workshop hosted by the GNWT (GNWT 2013). The new grizzly bear and wolverine objectives are to provide estimates of grizzly bear and wolverine abundance and distribution in the Diavik Wildlife Study Area over time. The new barren ground caribou monitoring program objectives are to determine whether the zone of influence changes in relation to changes in Mine activity and whether caribou behaviour changes with distance from the mines. The new objectives of the falcon monitoring program are to contribute data to the Canadian Peregrine Falcon Survey (CPFS), identify any pit wall or infrastructure nesting sites, determine nest success and deterrent effectiveness, and determine cause of any Mine-related raptor mortalities.

2.2 The State of Current Information

The 2017 WMR includes a discussion of effects on wildlife from the previous year and a new analysis of changes to caribou distribution. Detailed analyses for barren-ground caribou and wolverine were completed in 2017 (WCAR; Golder 2017b); however, DDMI will not undertake other analyses until they deem that sufficient data are available (e.g. caribou behaviour). Other programs have had data collection suspended (e.g., caribou aerial surveys or evaluating Zones of Influence (ZOI)) or have adopted an alternative study design (e.g. grizzly bear hair snagging for evaluating abundance and distribution). Grizzly bear and wolverine hair snagging programs are not intended to assess Mine-related effects.

For the reader of this review, however, we re-state some of the highlights in the previous years' reviews, in addition to results from the current review, as this is the currently best available information on trends and data quality:

- The detailed analyses conducted in past years were generally well presented and informative. We would like to note that some of the recommendations made in previous years have been

incorporated into past analyses. We would like to commend the authors for including more detail in the analytical results when sufficient data were available.

- Caribou habitat loss remains at or below the levels predicted. With respect to caribou movement, based on previous detailed analyses, the general findings for caribou remain relatively unchanged, namely that there appears to be a ZOI for caribou occurrence (presence-absence data) where caribou are more likely to occur at about 14 km from the mine than closer to the mine. A 2017 regression analysis relating caribou density to distance from the mines (Ekati and Diavik) implied that there may not be ZOI; however, more rigorous analyses were requested for the density approach to ZOI evaluation. In the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis was presented which evaluates ZOI on an annual basis using GPS collar data. This approach could be used to analyze ZOI for the 2018 season for the Diavik mine. As far as caribou behaviour is concerned, a potentially important finding was that caribou groups with calves spend less time feeding and resting within 5 km of the mine than farther away. This suggests that caribou behaviour and potentially the energy balance of young caribou is affected within that distance. DDMI will not undertake additional analyses of ground-based behavioural data until they deem that sufficient data are available. Finally, regarding caribou distribution, caribou migration patterns are continuing as predicted for the northern migration; however, over the long-term, the southern migration appears to have occurred further west and more recently has remained further north than anticipated.
- For grizzly bears, both mortality and habitat loss remain at or below the levels predicted. Incidental observations suggest there may be an increasing number of grizzly bear occurrences, number of days with bear visitations, and number of days with deterrent actions over time. Given that grizzly bear mortality predictions have not been exceeded and past DNA results suggest a stable or increasing population, project-specific impacts of the mine on grizzly bears are likely minimal. Results from the 2017 grizzly bear hair-snagging data collection are expected in mid-2018.
- For wolverine, mortality due to the Mine remains low. A comprehensive analysis of wolverine track data was last completed in 2017 which showed that the probability of wolverine occurrence has increased over time in the Diavik mine study area. An analysis of wolverine hair snagging data (Efford and Boulanger 2018), found that the average density at three northern sites (Daring Lake, Diavik and Ekati mines) declined between 2004 and 2015. Given this decreasing wolverine population, the increasing wolverine track density (2003-2016) at Diavik mine is not simply a function of an increasing population. A possible explanation is that that wolverines are attracted to the mine area because of the new more northerly distribution of caribou due to their recent range contraction. Alternatively, the mine could be attracting wolverines; however, there are no clear trends over time in days with wolverine visitations, days deterrents were necessary, relocations, or mortalities.
- Past monitoring data seemed to indicate that fox presence was decreasing and perhaps levelling off in recent years; however, it has increased again in 2017, though not as high as 2014 levels. In 2017, observations of wildlife (fox and wolverine) were highest for the Waste Transfer Area (WTA). Misdirected attractants (food and food packaging) appear to be higher in 2017 compared

to 2016 levels on both the WTA and the Landfill areas, while the number of misdirected attractants for the A21 Area (new dike) decreased compared to 2016 levels.

- For falcons, the new objectives (in 2010) aiming at contributing data to the Canadian Peregrine Falcon Survey (CPFS) seemed reasonable as they potentially contribute to a better regional understanding of falcon populations. However, the CPFS was discontinued in the NWT in 2015; therefore, DDMI will no longer be providing nest site occupancy and productivity data to the Canadian Wildlife Service (CWS). Pit walls and other infrastructure are still monitored for nesting raptors and nest monitoring data are still contributed to ENR every 5 years.

While DDMI has incorporated some of our recommendations or questions from previous years, others remain unaddressed. Table 1 summarizes the current status of our 2017 recommendations.

Table 1: Actions by DDMI in Response to Recommendations that were developed in 2017 or carried over from previous years.

Recommendations/Questions in 2017	Action by DDMI
Vegetation and Wildlife Habitat	
The 2013 Comprehensive Vegetation and Lichen Monitoring Program report concludes that "*the Mine may be having local-scale effects on plant species composition*". The report does not suggest any strategies that could mitigate these effects. Please consider if and how these potential project effects could be mitigated.	A comprehensive analysis of vegetation and lichen data was last completed as an Appendix of the 2016 WMR. The same conclusion was reported. DDMI responded that impacts are within the range predicted because of mitigation they've already implemented – i.e. mitigation is successful (Golder 2017a). If the initial prediction is accurate, then additional mitigation is not required. **This request is satisfied.**
The 2013 Comprehensive Vegetation and Lichen Monitoring Program report stated that mercury concentrations were statistically lower near the Mine than farther away in both 2010 and 2014. No discussion on this finding was presented. Please discuss possible causes of this pattern in mercury concentrations and what effects this may have on caribou ingesting lichen far from the Mine.	A comprehensive analysis of vegetation and lichen data was last completed as an Appendix of the 2016 WMR. No discussion regarding this concern was provided and the results for mercury in Figure 3.3-2 appear to show that mercury is lower in the far field than near the Mine for 2010 (opposite of the results noted in the 2013 report). An explanation should be provided.
DDMI concluded that "*given that the majority of metals concentrations have decreased below concentrations reported in the 2010 risk assessment, a follow up risk assessment based on 2016 data is not required*". The risk assessment did not include information on any changes in the concentrations of metals present in caribou and humans pre- and post-exposure or how these levels of metals relate to the health of either caribou or humans. We recommend DDMI provide additional information that would support their conclusion that concentrations of metals in lichen are safe for caribou.	It was agreed between EMAB and MSES that it does appear that health risks to caribou are low, particularly given that the 2016 concentrations are said to be lower than previously measured and given that the caribou do not stay long in the near-field where metal concentrations are higher. Our past comments questioned some of the methods, but in the big picture, even with a potential for measurement error, the exposure risk may well be low. **This request is satisfied.**
The information collected through the vegetation monitoring program is used to test and evaluate the predicted effects of the Mine. One prediction is that	DDMI responded that the ecological relevance of the results is uncertain, and that current mitigation appears to be effective at minimizing adverse effects to

community level richness is predicted to decrease by 14% and species diversity and richness is predicted to decrease by 44%. Vascular plant species richness was actually 54% higher on heath tundra plots and 9% higher on shrub Mine plots. The report does not suggest any strategies that could mitigate these unanticipated effects. Please discuss if and how these potential project effects could be mitigated.	vegetation (Golder 2017a). Changes in vegetation structure may be a contributing factor to the observed caribou ZOI (14km) and there may be cumulative changes over time to vegetation structure. In lieu of additional mitigation measures during operations, the topic should be addressed in the Mine closure plan and proposed reclamation activities with particular attention focused on ensuring that forage species palatable to caribou be part of the mix of species (at a natural ratio) in the reclaimed landscape.
DDMI has recommended that vegetation and lichen monitoring frequency should be reduced from once every three years to once every five years, with the exception that if dust deposition values exceed 400 mg/dm^2/y, then sampling frequency may resume on a 3-year cycle. Given that above-ground mining is anticipated at the A21 Area in 2018, dust deposition and metal concentrations in lichen are likely to increase again. We recommend that the established three-year timeframe be continued in order to capture changes in vegetation and lichen parameters. In addition, we recommend DDMI provide further justification for setting 400 mg/dm^2/y as a trigger for changing monitoring frequency as compared to using a trigger associated with dust deposition rates for reference stations.	During a conference call (22 February 2018), DDMI explained that the trigger is based on average deposition that occurred between 2000-2016 on near-mine sites, which is 470 mg/dm2/y. They use a conservative 400 mg/dm2/y trigger based on this information. However, they are saying there are "no impacts" at 400 mg/dm2/y and that there is not much deviation between mine and reference sites. They noted that they do see small changes <400 but that doesn't mean there is an ecological impact on caribou. We do not agree that there are "no impacts" with a metal deposition of 400 mg/dm2/y. As long as values near the mine are above the range of "baseline" (reference station) values, there is potential for associated impacts. They are either not ecologically measurable or they are not being measured (incorrect response variables are being measured). A trigger associated with original predictions or literature regarding impacts to vegetation and lichen would be more appropriate. Golder agreed to look into the original prediction and include the information in the next WMR, including any literature that may be relevant. Confirmation of this action was also requested by EMAB (EMAB 2018). During a 6 June 2018 teleconference, DDMI indicated that the trigger for changing vegetation and lichen monitoring frequency has been changed to reference station values for dust deposition. **This request is satisfied.**
Barren-Ground Caribou	
Discuss the implications of a larger than expected effect on caribou (ZOI: predicted 3-7 km; observed 14 km) for future environmental management.	No discussion was provided in the 2017 WMR. Although some discussion occurred during the 2018 SGP Wildlife Monitoring Workshop, no decisions were made, and more discussion regarding potential adaptive management actions was deferred to the future (unspecified timing). The discussion of potential adaptive management measures is still open.
What is the actual size of the larger caribou ZOI, 14 or 28 km?	Boulanger et al. (2012) conclude a zone of influence of 14 km. In the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis was presented which evaluates ZOI on an annual basis

	using GPS collar data. This approach could be used to analyze ZOI for the 2018 season for the Diavik mine.
What is the effect of Mine closure on caribou range re-establishment? Are data collected to date sufficient to show a change of caribou distribution in light of the uncertainty of the size of the large ZOI? Also, current baseline (pre-disturbance) information is poor, rendering conclusions on changes from pre- to post-disturbance inconclusive. Does DDMI believe that the current data quality is sufficient to show a potential reversal of the effects after closure?	The issue was discussed verbally in 2013 and DDMI admitted that it is possible that the currently observed ZOIs (14 km; Boulanger et al. 2012) may have always existed. DDMI confirmed that true baselines do not exist. Using TK instead was suggested for discussion. No further discussion provided in the 2017 WMR. The topic should be addressed in the Mine closure plan and proposed reclamation activities.
We recommend that the ideas to evaluate caribou health and to ask traditional knowledge holders about the behaviours that should be included in the observation protocol should be carefully considered, particularly from the point of view that the health of wide ranging animals are a result of many factors that occur in the region through which they range. Future discussions about these ideas could be fruitful.	No discussion was provided in the 2017 WMR.
We suggest that an analysis of the indirect (in addition to the currently presented direct) footprint effect on caribou habitat may be useful for understanding the true effects on caribou and for determining future mitigation measures.	No information is presented in the 2017 WMR regarding indirect caribou habitat loss, but there is also no prediction associated with indirect caribou habitat loss. DDMI indicated that the ZOI analysis for caribou captures the effect of indirect habitat loss (22 February 2018 conference call). It appears that indirect habitat loss is implicitly incorporated into the ZOI modelling, but not explicitly measured on the ground. The recovery of vegetation near the mine should be addressed within the Mine closure plan and proposed reclamation activities with particular attention focused on ensuring that forage species palatable to caribou be part of the mix of species (at a natural ratio) in the reclaimed landscape.
DDMI recommended a reduced survey frequency for the assessment of caribou occurrence relative to the Mine site, roads, rock piles, and Processed Kimberlite Containment (PKC). We suggest that these surveys continue at least bi-weekly to ensure no caribou are present in areas that are visually obstructed to on-site staff.	DDMI recommended reducing survey frequency because of the ineffectiveness of the surveys at detecting caribou at the Mine that were not already detected by other employees and pilots. In 2017, incidental observations of caribou ranged from 1 to ~2,150 individuals on East Island. There were no reported incidents. It appears that caribou presence near the Mine is being adequately captured. **This issue is satisfied.**
Regarding the 2014 WCAR (Golder 2014): A common concern with GPS collar data is that multiple samples from the same individual may not be statistically independent of each other. That is, one response from an individual affects the probability of another response from that same individual. Clarification is needed on how caribou GPS data independence was achieved.	No new information is presented regarding this specific analysis from the 2014 WCAR. GPS collar data independence should be addressed in all future analyses.
Has the ZOI guidance document been finalized? If so, please provide the document to EMAB for their	ENR is treating the March 2015 guidance document as a "living" document that represents the best current

review. If not, please have ENR explain why not and when it is expected.	advice of the ZOI TTG (GNWT 2017). **This request is satisfied.**
What plans does DDMI have to address the caribou movement objective while they wait for guidance from ENR? Diavik should continue to monitor and verify the accuracy of the predictions in the environmental assessment and the effectiveness of mitigation measures (Article 1, 1.1(b), Diavik Environmental Agreement (2000)).	We expect that ENR will recommend that in 2019, formal ZOI monitoring will resume given that Diavik will be commencing aboveground mining in the A21 pit in 2018 (GNWT 2017). Based on the 22 February 2018 conference call, we expect that monitoring will occur using geo-fence collar data and not aerial surveys given the small number of caribou that occur within the study area in recent years and the increasing sample size from GPS collars over time (currently 50 collars – 40 female, 10 male). DDMI should confirm that status and form of caribou ZOI monitoring once ENR makes their recommendation.
We recommend DDMI provide a more detailed explanation and justification as to why they propose postponement of aerial surveys "in favour of other studies". DDMI should also indicate what "other studies" would examine regarding mechanisms that may cause caribou to avoid the Mine.	
While waiting for the ENR to determine best approaches to ZOI monitoring, will DDMI use all available caribou collar data to re-evaluate the ZOI associated with the Diavik Mine specifically?	During the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis that evaluates ZOI on an annual basis using GPS collar data was presented Diavik should consider using the GPS collar data approach to analyze ZOI for the 2018 season. Given that aboveground mining in the A21 pit will commence in 2018, EMAB recommends that Diavik should resume ZOI monitoring in 2019. Diavik should confirm the status and form of caribou ZOI monitoring prior to the 2019 WMP monitoring season
A regression analysis evaluated the relationship between caribou density and nearest distance to the Ekati or Diavik Mine footprint. The results showed that distance to a mine footprint explained very little of the variation in caribou density. To confirm this result, we recommend that DDMI present information on the power of the data to detect an effect.	DDMI provided a power analysis and concluded there is sufficient power and sample size to detect an effect (Golder 2017a). **This request is satisfied.**
There are a number of reasons to assume that the data used in the caribou density analysis do not meet the normality assumption of linear regression. We recommend that DDMI present information on the distribution of the data and the residuals from the model.	No further information on this analysis has been presented in the 2017 WMR. DDMI indicated that a new analysis that considers habitat and population size, among other factors, is underway and will be reported when complete (Golder 2017a). We anticipate this analysis will present information on the distribution of the data and the residuals, justification of the statistical methods used, and will consider a variety of confounding factors.
We have concerns about the use of a simple linear regression to examine the relationship between caribou density and distance from the mine footprint. Along with the background information on the data used in the analysis, we recommend that DDMI also provide additional details on why they chose the statistical methods they did so we can better understand the reasoning and justification underlying the analysis.	
It is highly likely that the determinants of caribou presence/absence and abundance are much more complicated than simply the distance to the mine footprints, making the detection of a ZOI more nuanced than simply linear distance from the mine.	

We recommend that future analyses using caribou density also include other potential confounding factors such as habitat associations, changes in mine activity over time, and the gregarious nature of caribou. We also recommend that DDMI evaluate the potential for non-linear relationships.	
Testing the changes in caribou behaviour will be critical for the new approach to testing the effects within the ZOI that was predicted in the Environmental Effects Report (EER; 3-7 km). Please provide an analysis of the behavioural data and comment on whether or not behavioural data collected previously can be used. How can the information on behaviour be used to adapt management actions at the Mine and in the region? A detailed technical side-bar discussion may be useful for us to better understand the assumptions and expectations by DDMI.	Analysis of caribou behavioural data was last undertaken in 2010 using data from all years. We understand that Ekati prioritized the collection of focal scan information between 2011 and 2013, while Diavik prioritized the collection of group scan information. We also understand that Ekati will be shifting their data collection to include more group scans in future years (14 June 2018 conference call[1]). This will allow for a combined analysis of behavioural data from both the Ekati and Diavik mine in the future. The discussion on adaptive management is still open.
Please clarify whether or not Ekati and Diavik are using the same behavioural data collection methods and, if so, indicate when the mines began coordinating their methods.	
Given that the two mines have agreed to cooperate, please provide the current sample sizes for near and far behavioural observations for DDMI and Ekati combined. Please provide a summary of caribou group size near and far from the mine (this could assist in the interpretation of the caribou density analysis).	DDMI reported that Ekati has collected 7 behavioural scans since 2010 (Golder 2017a). The 2017 WMR states that Diavik collected behavioural data on 32 caribou groups from 0 to 2.7 km from the Mine between January 15 and May 13 (winter season; previous data are from the summer/autumn seasons). A complete summary of current sample sizes was not provided.
If Ekati has sufficient data near-mine, please analyze a DDMI-Ekati combined dataset to test how caribou behaviour changes as a function of distance from the Mine. If data are still deemed to be insufficient, please present a power analysis indicating the target sample size for near-mine observations.	A power analysis in the 2017 WMR concluded that 55 different caribou groups are required for both near and far from mine categories in order to statistically detect a change in feeding activity. **This request is satisfied.** During the 22 February 2018 conference call, DDMI accepted that the new data can be added to the old data to update the analysis. The data would be heavily skewed toward "far from mine" categories. During a 6 June 2018 teleconference, DDMI presented some results for this analysis. More detailed information will be provided to EMAB.
Please describe if and how non-parametric statistics have or could be used in the analysis of the behavioural data.	No response has been provided in the 2017 WMR.
Given the insufficient Diavik-data near-Mine, will DDMI collect data outside of autumn and use GPS collar information to collect data opportunistically? If this is already being done, please provide a summary	DDMI has been collecting caribou behaviour monitoring data when caribou are present in the study area, including outside of autumn. Observations on 32 groups were collected in 2017 in the winter season

[1] Participants included representatives from Diavik mine, EMAB, MSES, Ekati mine, IEMA, Golder, and ENR.

of how much additional data have been collected using this protocol both near and far from the Mine.	within 0 to 2.7km of the Mine. **This request is satisfied.**
Please explain what triggers/criteria are used to initiate the collection of far from mine caribou behavioural observations.	During the 22 February 2018 conference call, DDMI indicated that collar locations and incidental observations of caribou can trigger the collection of far from mine caribou behavioural observations. **This request is satisfied.**
There was some discussion in the past about the Cumulative Impacts Monitoring Program (CIMP) leading a behaviour monitoring task group but given the lack of information on the status of this group, we recommend DDMI continue with its own monitoring, coordination with Ekati, and data analysis until such a working group is established and operational.	ENR will not be setting up a dedicated behaviour monitoring group (GNWT 2017). However, during the 2018 SGP Wildlife Monitoring Workshop, ENR presented information on their caribou behaviour pilot project. The intention was for the government to standardize protocols, share/pool datasets on behaviour, and coordinate field efforts; however, no timelines were provided for the development of guidelines / protocols. In the absence of standardized protocols, we recommend Ekati and Diavik independently move forward on collaboration and coordination of efforts, including both data collection and analysis, on the caribou behaviour monitoring program. In general, it appears there will more consistency between data collected by Ekati and Diavik in the future (14 June 2018 conference call). **This request is satisfied.**
The analysis used by DDMI to test the hypotheses about caribou movement during the northern and southern migrations is potentially flawed. We recommend that DDMI provide more information on the pool of collared caribou used over the course of this study. How many separate caribou were collared? How many times did collaring occur? How many times do the same animals appear in annual counts? We recommend that DDMI utilize statistical techniques that account for the independence (or lack of independence) of samples and interannual variation in migration movements.	No response was provided in the 2017 WMR. We reiterate our recommendation.
Given the delayed southern migration in recent years, please redo the statistical analysis including data up to the end of November or later, if warranted.	DDMI provided an analysis of caribou distribution including data up the end of November in the 2017 WMR. Over the long-term, caribou are following the predicted pattern for the northern migration, but not for the southern migration. **This request is satisfied.**
For the 2016 southern migration (and 2015; and 2014 for female caribou; July to 30 November), collared caribou travelled west around Lac de Gras, which does not support the prediction in the EER. We request that DDMI discuss their adaptive management process and their response action in light of this unanticipated, potential effect of the Project. DDMI should discuss the triggers for adaptive management (e.g., how many consecutive years without support for the prediction are necessary to trigger adaptive	DDMI responded that there is no need for adaptive management because there is no permanent fragmentation effect of the Bathurst caribou herd and, based on Virgl et al. (2017), the herd demonstrates high seasonal range fidelity (Golder 2017a). Monitoring data have demonstrated that for 12 of the 22 years monitored, the prediction for the southern migration was not accurate. The Virgl et al. (2017) research does not consider the presence of the diamond mines in its analyses other than to conclude

management?). If another tool is used to evaluate the importance of deviations from predictions, such as fragmentation of the caribou herd or changes to seasonal range use year to year, please describe how this evaluation is conducted. Please comment on the possibility that the change in the southern migration could be an Ekati effect or a cumulative effect of industrial activities within the Bathurst caribou range.	that the caribou range contraction would result in fewer encounter rates with the mine. Overall, there is uncertainty regarding the primary driver of the observed change in caribou migration – is it a project effect, cumulative effect, or natural phenomenon linked to the population decline? Regardless, uncertainty should not absolve DDMI from implementing a response action to an identified deviation from a prediction. The discussion on adaptive management is still open.
The 2016 WMR mentions that caribou that are most likely from the Beverly/Ahiak herd were present in the study area. Please explain how the presence of caribou from the Beverly/Ahiak herd is managed during the collection and analysis of all caribou data.	DDMI indicated that caribou will be monitored if they fall within the Diavik mine study area regardless of which herd they belong to (Golder 2017a). This includes caribou movement and behaviour monitoring programs. Golder mentioned the presence of caribou from the different herds in the study area in the data collection for the 2017 WMR. It appears as though only Bathurst caribou are analyzed when testing the caribou distribution predictions. **This request is satisfied.**
Grizzly Bear	
We recommend that the hair sampling program be continued, even if other mines do not commit to it.	Sampling first occurred in 2012 and 2013 and occurred again in 2017. Results from the 2017 data collection are expected in mid-2018. Decisions regarding program frequency were anticipated to be determined collaboratively during wildlife monitoring workshops hosted by ENR in 2016; however, decisions have been postponed and will presumably occur once the results of the 2017 data collection are reviewed. We support DDMI's continued involvement in this program.
Please give careful consideration to the possibility that bears may be becoming habituated and their presence on the site may be on the rise. Given the increase in grizzly bear observations near the Mine, DDMI should increase vigilance and future years of data collection should be used to evaluate whether the re-instated deterrent system is effective at reducing grizzly bear presence near the Mine.	Although there appears to be an increasing trend in the number of incidental grizzly bear observations and a corresponding increase in deterrent actions, grizzly bear mortality predictions have not been exceeded and there does not appear to be any population-level effect. In addition, it appears as though a single bear is responsible for the majority of the observations and has a home range that includes the mine. The 2012 and 2013 data analysis indicated a stable or increasing abundance of grizzly bears around the Ekati and Diavik mines. No discussion regarding the effectiveness of the deterrent system was provided. We recommend DDMI investigate if there is something in particular that is attracting grizzly bears to the site that could be determined by evaluating the location and timing of the incidental observations and, in turn, whether some mitigation could be applied to remove any attractants.
Wolverine	
Please give careful consideration to the possibility that wolverine may be becoming habituated and their presence on the site may be on the rise.	The 2017 WCAR (Golder 2017b) presented detailed analyses that found that wolverine occurrence has increased over time. An analysis of data from 2004 –

	2015 from the wolverine hair snagging program was completed in 2018 and found a weak decline in average wolverine density at the Diavik Mine over time. A possible explanation is that that wolverines are attracted to the mine area because of the new more northerly distribution of caribou due to their recent range contraction, or alternatively, the mine may be attracting wolverines. DDMI's ongoing monitoring of wolverine track density and mortality, along with the regional research on the wolverine population, will inform DDMI of whether adaptive management is required to minimize impacts on wolverine. **This request is satisfied.**
Regarding the 2014 WCAR (Golder 2014), it was not clear why caribou herd size was related to wolverine occurrence and how this specifically relates to objective of the WCAR "to examine indirect Mine-related effects". We recommend a brief explanation be provided.	No discussion was provided. We assume DDMI was evaluating whether or not caribou herd size, rather than the Mine itself, might explain the occurrence of wolverine.
The wolverine hair snagging program was not completed in 2015 or 2016. It was last completed in 2014. Last year DDMI anticipated that the next wolverine hair snagging survey would occur in 2017, though the long-term frequency of this program has not been determined. ENR should indicate when they expect to complete the 2014 wolverine hair snagging data analysis. If more data collection and analysis is not anticipated for 2017, DDMI should describe alternative plans for evaluating wolverine abundance in the study area.	An analysis of data from 2004 – 2015 from the wolverine hair snagging program was completed in 2018 (Efford and Boulanger 2018). Decisions regarding program frequency are anticipated to be determined collaboratively once the 2018 report has been reviewed. We support DDMI's continued involvement in this program. **This request is satisfied.**
There may be opportunities for more systematic site surveys/checks for wolverines and waste management to mitigate instances of wolverines in waste bins. For instance, could waste collection bin checks be included in already scheduled waste inspections at the Waste Transfer Area (WTA) and Landfill?	DDMI responded that they currently include waste bin checks as part of waste bin inspections of the WTA and landfill (Golder 2017a). We have no further mitigation recommendations for wolverine at this time. **This request is satisfied**.
The WMP evaluates the prediction that Mine-related mortalities, if they occur, are not expected to alter wolverine population parameters in the Lac de Gras area. We recommend DDMI elaborate on how they are testing this particular prediction given the absence of data on population size.	The 2017 WMR reported zero mortalities for wolverine on-site. Given that there have only been five Mine-related wolverine mortalities reported since 2000, there appears to be support for the prediction that mining related mortalities are not expected to alter wolverine population parameters in the Lac de Gras area. We recommend that DDMI use the new information provided by Efford and Boulanger (2018) to support their conclusion in the 2019 WMP report regarding the alteration of wolverine population parameters.
Waste Monitoring	
While fox observations looked to be steadily increasing in the WTA since 2009, they appear to have levelled off in 2013 (the tabular presentation of data in the 2013 WMR makes it difficult to confirm). We	In 2017, there appeared to be a high number of misdirected food items for the WTA and Landfill Areas relative to the other inspected areas and observations of fox and wolverine were highest for

recommend DDMI evaluate whether this levelling-off of fox observations in the WTA persists in future years.	the WTA. DDMI should explore reasons for the higher levels of misdirected food waste in the WTA in 2017 as this may be contributing to wildlife presence and possible habituation near the Mine site.
DDMI should explore the reasons for the higher levels of misdirected food waste in the A21 Area as this may be contributing to wildlife (particularly wolverine) presence and possible habituation near the Mine site.	DDMI responded that the results are reviewed as part of an adaptive management process and that they will continue employee education programs. This appears to have been effective because fox and wolverine numbers are lower in 2017 compared to 2016 at the A21 Area. **This request is satisfied**.

3.0 Specific Observations

3.1 Vegetation and Wildlife Habitat

There was an increase in the Project footprint in 2017 of 0.47 square kilometres (km^2), resulting in a total footprint area of 11.31 km^2. The additional disturbance occurred at the south end of the project footprint at the South Country Rock Pile. This is anticipated to be the maximum footprint for operations, with the exception of the South Country Rock Pile. The overall disturbance of vegetation types remained at or below predicted levels in 2017, with four individual ELC types, riparian shrub, esker complex, bedrock complex, and boulder complex, at or slightly exceeding the predicted loss.

3.2 Barren-Ground Caribou

3.2.1 Habitat Loss

The 2017 WMR indicates that direct summer caribou habitat loss (2.815 habitat units (HU)) remains at or below predicted levels of 2.965 HUs.

No information is presented in the 2017 WMR regarding indirect caribou habitat loss, but there is also no prediction associated with indirect caribou habitat loss. During the 22 February 2018 conference call, DDMI indicated that the ZOI analysis for caribou captures the effect of indirect habitat loss. According to Boulanger et al. (2012), the ZOI analysis estimates the "average distance from the mine complex where caribou habitat selection was not affected by the mine". If indirect habitat loss (e.g. through dust fall) is occurring, the differential selection of habitat by caribou within and outside of the ZOI would presumably be more pronounced. It appears that indirect habitat loss is implicitly incorporated into the ZOI modelling, but not explicitly measured on the ground. For that reason, no mitigation measure of the indirect habitat loss is discussed, to the best of our knowledge. **DDMI should complete an analysis of the indirect (in addition to the currently presented direct) footprint effect on caribou habitat for understanding the true effects on caribou and for determining future mitigation measures. The recovery of vegetation near the mine should be addressed within the Mine closure plan and proposed reclamation activities, ensuring that forage species palatable to caribou be part of the mix of species (at a natural ratio) in the reclaimed landscape.**

3.2.2 Movement

The aerial survey schedule, three continuous years followed by two years off, was designed to test whether or not caribou occurrence (zone of influence) changes with changes in Mine activity. Boulanger et al. (2012) concluded that there was a zone of influence of 14 km for caribou. A comprehensive analysis of caribou data was completed in 2014 (2014 WCAR - Golder 2014) and DDMI presented results relating to caribou GPS collar data with a focus on movement patterns. Please see Table 1 for some previous recommendations that relate to caribou based on our review of the WCAR[2] (Golder 2014). Ekati and Diavik requested to omit the ZOI requirement for caribou monitoring in 2013. The request was approved by ENR and aerial surveys were last conducted in 2012. No new information is presented in the 2017 WMR on changes to caribou movement and caribou movement was not analyzed in the latest WCAR (Golder 2017b). However, during the 2018 SGP Wildlife Monitoring Workshop, Boulanger presented an approach to ZOI analysis that evaluates ZOI on an annual basis using GPS collar data and reported annual variability in the ZOI. It appeared that this analysis was possible because of the availability of a computer package that can efficiently estimate breakpoints on an annual basis. There could be some potential to use this model to evaluate whether any variables representing mine activity explain changes in ZOI between years. GPS collar data could be used to analyze ZOI for the 2018 season for the Diavik mine.

It appears that DDMI is still waiting for the recommendations and direction from ENR regarding caribou aerial surveys. A ZOI Draft Guidance Document was developed in March 2015 that outlines the conditions under which monitoring ZOI is technically appropriate (Caribou ZOI TTG 2015). ENR is treating this March 2015 guidance document as a "living" document that represents the best current advice of the ZOI Technical Task Group (TTG; GNWT 2017). According to this ZOI Guidance Document, "Project for which ZOI monitoring is deemed appropriate are advised to produce an initial estimate of ZOI during the operations phase of their project. Repeat monitoring should be conducted when the Project is expected to change due to a major shift in the project (e.g. mine phase change, expansion, switch from above to underground mining etc.), change in mitigation practices or other cause." (p.3). We expect that ENR will recommend that in 2019, formal ZOI monitoring will resume given that Diavik will be commencing aboveground mining in the A21 pit in 2018 (GNWT 2017). We also expect that monitoring will occur using geo-fence collar data and not aerial surveys given the small number of caribou that occur within the study area in recent years and the increasing sample size from GPS collars over time (currently 50 collars – 40 female, 10 male) (22 February 2018 conference call). **DDMI should confirm the status and form of caribou ZOI monitoring prior to the 2019 WMP monitoring season.** We suggest that GPS collars may be the better option, as compared to aerial surveys, to ensure timely data collection and analysis of the caribou ZOI. It is our understanding that the approach presented by Boulanger is being considered for publication in a peer-reviewed journal.

Given that Boulanger et al. (2012) concluded a larger than predicted ZOI (14km; predicted 3-7 km ZOI), we expected to see a discussion on how to adaptively manage the unanticipated magnitude of this effect. Despite repeated requests, there has yet to be a fulsome discussion of why there is a larger than predicted ZOI or what is being done to reduce the impact so as to achieve the predicted level of ZOI. Although some discussion occurred during the 2018 SGP Wildlife Monitoring Workshop, no decisions were made, and more discussion regarding potential adaptive management actions was deferred to the future (unspecified timing).

[2] Please see MSES 2014 for a complete review of this material.

- **If ENR recommends the new GPS collar analysis approach to ZOI evaluation (as presented by Boulanger during the 2018 SGP Wildlife Monitoring Workshop), we recommend Diavik consider evaluating covariates in the analysis to reflect changing mine activity over time (i.e., does mine activity influence ZOI between years?).**
- **What plans does DDMI have regarding adaptive management actions relating to the caribou ZOI?**
    - **We recommend ENR evaluate if it is possible to coordinate mitigation measures between mines and use monitoring results from other mines to help in the prioritization of future monitoring efforts?**
    - **Please consider the use of Traditional Knowledge (TK) to help uncover causes for unanticipated impacts on caribou and to develop adaptive mitigation measures.**

3.2.3 Behaviour

The ground-based behavior survey was designed to test changes in caribou behaviour as a function of distance from the Mine. In accordance with recommendations from a workshop in 2009 with ENR and other mines and monitoring boards (Handley 2010), DDMI adapted its monitoring program for caribou in 2010 by coordinating with BHP-Billiton's Ekati mine and implementing ground observations of caribou behaviour for 2010. In 2017, observations were collected on 32 caribou groups from 0 to 2.7 km from the Mine between January 15 and May 13 (winter season). No new analyses are presented in the 2017 WMR on changes in caribou behaviour because there are still insufficient data (# groups) available to detect a 15% change in behaviour. A power analysis to determine the required sample size was provided in Appendix I of the 2017 WMR. It concluded that 55 different caribou groups are required for both near and far from mine categories in order to statistically detect a change in feeding activity. This is based on data reported in DDMI (2011), which would include only summer/autumn observations. Given the shift in caribou encounters with the mine primarily from the summer/autumn to the winter season, a variable for seasonal effects will also have to be included in the analysis. This could reduce the power to statistically detect a change in behaviour. A comprehensive analysis of caribou behaviour data was last completed in 2011 (Golder 2011).

There is now a five-year gap in caribou behavioural data analysis (2012-2017) due to insufficient near-Mine data. We emphasize the importance of these data in understanding the influence of the Mine on caribou.

- **We understand that Ekati prioritized the collection of focal scan information between 2011 and 2013, while Diavik prioritized the collection of group scan information. We also understand that Ekati will be shifting their data collection to include more group scans in future years (14 June 2018 conference call[3]). This will allow for a combined analysis of behavioural data from both the Ekati and Diavik mine in the future. If possible, please confirm that this coordination of survey types will happen for the next reporting period.**

[3] Participants included representatives from Diavik mine, EMAB, MSES, Ekati mine, IEMA, Golder, and ENR.

- **Upon our review of DDMI's Response (14 June 2018) to EMAB's Letter regarding the Establishment of Wildlife Monitoring Program Terms of Reference, we recommend that DDMI provide summaries for activities other than just feeding time, particularly activities with a high energetic cost.**
- **Given that the feeding data presented by DDMI (DDMI's Response on 14 June 2018) do not appear to show the same pattern, we recommend DDMI comment on why there might be a difference in the pattern between 2011 and 2018 and discuss whether they implemented a change to mine protocol that may have minimized the impacts on caribou behaviour.**
- **Given that the two mines have agreed to cooperate, please provide the current sample sizes for behavioural data, perhaps in Table format, including information on:**
    - **Mine operator (Ekati vs Diavik)**
    - **Type of scan (focal vs group)**
    - **Season**
    - **Distance from mine**
    - **Year**
- **Please analyze a DDMI-Ekati combined dataset for the next reporting period, using all behavioural data available to date, to test how caribou behaviour changes as a function of distance from the Mine. This is particularly relevant given the change to above-ground mining at the Diavik mine.**
- **Please describe if and how non-parametric statistics have or could be used in the analysis of the behavioural data.**
- **During the 2018 SGP Wildlife Monitoring Workshop, ENR presented information on their caribou behaviour pilot project. The intention was for the government to standardize protocols, share/pool datasets on behaviour, and coordinate field efforts; however, no timelines were provided for the development of guidelines / protocols. In the absence of standardized protocols, we recommend Ekati and Diavik independently move forward on collaboration and coordination of efforts, including both data collection and analysis, on the caribou behaviour monitoring program. In particular, to avoid bias in behavioural data, please ensure that Ekati and Diavik are coordinating their methods for duration of group scans such that they cover the average caribou activity cycle. In general, it appears there will more consistency between data collected by Ekati and Diavik in the future.**
- **Please consider the use of TK to help uncover causes for unanticipated impacts on caribou behaviour and to develop adaptive mitigation measures.**

Given that analyses of change in behaviour with distance are still planned for the future, we re-state, for the record, that analyses of data should address the following:

- **Clearly state the assumption of no yearly variation in caribou behaviour if the data are insufficient to detect annual variation.**
- **In the event that collaboration on/sharing of behaviour data between operators occurs, please be explicit about all assumptions made in future analyses.**

- **Reconcile behavioural observations with the occurrence of caribou: does behaviour change with distance as occurrence does, i.e. is behaviour "normalized" past the zone of influence of 14 km?**
- **How can the information gained from the various caribou analyses be used to adjust or develop mitigation measures if there is a larger than predicted effect of the Mine on caribou?**

3.2.4 Distribution

To evaluate changes in caribou distribution due to mining activities, DDMI used daily data on the geographic location of collared males and females as provided by ENR. Collars on male caribou were added in 2015; prior to this, only female caribou were collared. Using data collected from 1996-2017, DDMI statistically compared the proportion of caribou that moved west versus east of Lac de Gras; this was done separately for both the northern (28 April through 30 June) and southern (1 July to 30 November) migrations. The methods used for the analysis changed this year, including an extension of the southern migration period from 31 October to 30 November to accommodate the shift in the timing of the southern migration, and the use of north-south and east-west oriented reference lines to assist in classification of collared caribou movements. The use of the reference lines changed some historical collar data classifications for the southern migration in 1996, 1998, and 2007 since previous classifications were only based on visual examination. A north-south oriented reference line across Lac de Gras determined whether movements were east or west, while an east-west oriented reference line across Lac de Gras determined whether movements were north or south.

In 2017, collared caribou distribution followed the predicted pattern for the northern (spring) migration; most caribou deflected west of East Island (31 W vs. 6 E). In 2017, collared caribou distribution also followed the predicted pattern for the southern migration, most caribou deflected east of East Island (5 W vs. 11 E). Across all years, DDMI found that significantly more caribou moved west past Lac de Gras during the northern migration (78%; 249 W vs. 71 E) and during the southern migration (55%; 153 W vs. 126 E). Over the long-term, caribou are following the predicted pattern for the northern migration, but not for the southern migration.

We noted previously that the analysis used by DDMI to test the hypotheses about caribou movement during the northern and southern migrations is potentially flawed. We reiterate them here:

> "1) DDMI used a "two sample test for independent proportions" (Golder 2017b, pg. 9) to test the difference in the movement of collared caribou during their migrations, but it is not clear that they have independent samples, violating one of the assumptions of their chosen statistical test. The methods section notes that "data were obtained from the Wildlife Information Management System (courtesy of ENR), and used to track the locations of 7 to 50 cows during the northern and post-calving migrations from 1996 through 2016" (Golder 2017b, pg.9) However, it is not clear if the same animals were followed every year, or if new caribou were collared each year. This is important because if the same animals were followed from year to year, or for multiple years for a portion of the sampling period, then the samples should not be considered independent.

2) DDMI only analyzed the data once it was summed across all years. This overlooks potentially important interannual variation in migration movement by caribou during both the northern and southern migrations. There are some years when collared caribou movement patterns appear to run counter to DDMIs predictions that caribou would deflect west of East Island during the northern migration, and would move around the east side of Lac de Gras on their southern migration. Some years collared caribou use both sides of the feature, some years no caribou pass by, and some years collared caribou use the opposite side of the feature as predicted.

We recommend that DDMI provide more information on the pool of collared caribou used over the course of this study. How many separate caribou were collared? How many times did collaring occur? How many times do the same animals appear in annual counts?

We recommend that DDMI utilize statistical techniques that account for the issues noted above. Once more information on the sampling methods are provided it may be possible to identify other statistical techniques, such as mixed model approaches, that may be able to address the issues with sampling independence and annual variation noted above. Until then, the statistical results discussed in section 2.1.6 of the WCAR should not be considered conclusive." (MSES 2017)

In previous years, we requested that DDMI discuss potential causes for this departure from predictions and whether or not any response action is warranted for this departure from predictions. In the 2017 WMR, DDMI notes that recent research provides information on trends through time in seasonal range size and location (Virgl et al. 2017). Based on this research, DDMI concludes that caribou are "still able to reach previously used areas despite variation in movements around Lac de Gras." This may be true, but this research does not consider the presence of the diamond mines in its analyses other than to conclude that the caribou range contraction would result in fewer encounter rates with the mine. In the 2017 WMR, DDMI has suggested that there may be a heightened sensitivity of caribou during the post-calving period because calves are maturing and still dependent on their mothers. Therefore, the northern shift during this period may be a result of avoidance of industrial activities. This shift could potentially become more pronounced as above-ground mining activities resume in 2018. Overall, there is uncertainty regarding the primary driver of the observed change in caribou migration – is it a project effect, cumulative effect, or natural phenomenon linked to the population decline? Regardless, uncertainty should not absolve DDMI from implementing a response action to an identified deviation from a prediction.

DDMI did not address the second part of our request regarding response actions. Monitoring data have demonstrated that for 12 of the 22 years monitored, the prediction for the southern migration was not accurate (Section 3.4.2, Table 4). Therefore, one might conclude that the mitigation measures in place to manage impacts on caribou migration are not as effective as anticipated. An adaptive management process would identify and implement new mitigation measures to manage project impacts. As such:

- **We request that DDMI discuss their adaptive management process and their response action in light of this unanticipated, potential effect of the Project.**

- **DDMI should discuss the triggers for adaptive management (e.g., 12 out 22 years without support for a prediction, with more deviations occurring in recent years, has not triggered a response action specific to the southern migration).**
- **Please consider the use of TK to help uncover causes for unanticipated changes to the caribou southern migration and to develop adaptive mitigation measures. Traditional Knowledge may also provide insight into why some caribou routes may have traveled past Lac de Gras, then turned around and traveled back to the opposite side of Lac de Gras.**

3.2.5 Mortality

As far as caribou mortality is concerned, the effect remains at or below predicted levels, which is that Mine-related caribou mortality is expected to be low. The methods applied for this part of monitoring are adequate. Overall, the mean population size of the Bathurst caribou herd has decreased between 1996 (349,000) and 2015 (16,000 to 22,000). A population survey is expected to be completed in 2018 with results available later this year. To support recovery of all barren-ground caribou herds, the 2011 to 2015 NWT Barren-ground Caribou Management Strategy was developed. A new management strategy for 2018 to 2020 is under development.

3.2.6 Advisory

Incidental observation of caribou ranged from 1 to ~2,150 individuals on the East Island in 2017. This results in general caribou traffic advisories being issued, but no deterrent actions were necessary. There were no reported incidents involving caribou in 2017.

The majority (36/38) of the caribou observations occurred between January 4, 2017 and May 13, 2017. The other two observations occurred in September and December. It appears that Diavik took advantage of the incidental observations of caribou near the mine (0 to 2.7 km) to complete 32 behavioural observations between January 15 and May 13, 2018 (outside of the typical summer/autumn season for behavioural observations).

3.3 Grizzly Bears

The 2017 WMR indicates that direct terrestrial grizzly bear habitat loss remains below the predicted level of 8.67 km^2 and mortalities associated with mining activities remain below the predicted range of 0.12 to 0.24 bears per year. The methods applied for this part of monitoring are adequate.

The monitoring objective for grizzly bear presence and distribution was revised from:

> *To determine if Mine-related activities influence the relative abundance and distribution of grizzly bears in the study area over time* (Handley 2010),

to:

To provide estimates of grizzly bear abundance and distribution in the study area over time (GNWT 2013).

A grizzly bear hair snagging program is jointly completed by Ekati, Snap Lake, Gahcho Kue and Diavik mines to address this new objective. Sampling first occurred in 2012 and 2013 and occurred again in 2017. Results from the 2017 data collection are expected in mid-2018. Decisions regarding program frequency were anticipated to be determined collaboratively during wildlife monitoring workshops hosted by ENR in 2016; however, decisions have been postponed and will presumably occur once the results of the 2017 data collection are reviewed. Results of the 2012 and 2013 hair snagging program can be found in ERM Rescan (2014). This report was provided for review in June 2016. The objectives of the DNA program are to:

- "Generate a superpopulation[4] estimate of grizzly bears for the DNA Study Area as baseline data for trend monitoring;
- Describe the spatial and temporal distribution of grizzly bears in the DNA Study Area;
- Identify overlap with grizzly bears that were sampled in areas outside of the DNA Study Area by other surveys; and,
- Provide recommendations regarding a standard grizzly bear monitoring protocol for the NWT." (ERM Rescan 2014).

Essentially, the 2012-2013 hair snagging program is intended to provide a baseline against which future results would be compared. The 2012 and 2013 data analysis indicated a stable or increasing abundance of grizzly bears around the Ekati and Diavik mines, as compared to monitoring information from the late 1990s[5]. It should be noted that the grizzly bear data are sampled from a disturbed landscape and that this may hinder data interpretation if information on the impact of mining activity on grizzly bear abundance and distribution is wanted. **We support DDMI's continued involvement in the grizzly bear hair-snagging program which is designed to address the new, regional scale question about the bear population and distribution and we look forward to seeing the results of 2017 data analyses.**

There appears to be an increasing trend in the number of incidental grizzly bear observations over time, the number of days with bear visitations to East Island over time, and the number of days that deterrent actions were utilized over time (data from Tables 7 & 8 of the WMR 2017). DDMI has indicated that the number of incidental observations of grizzly bears does not appear to be influenced by the number of people on site (WMR, Section 4.3.2). This suggests that bear sightings are simply increasing over time. It appears as though a single bear is responsible for the majority of the observations and has a home range that includes the mine. Unfortunately, incidental information provides little insight into changes in grizzly bear presence, abundance, or distribution because the information is not collected systematically. Given

[4] In the context of mark-recapture DNA studies, the superpopulation is defined as the number of animals that inhabit the sampling grid and surrounding area (as opposed to the grid alone; Boulanger et al. 2004)(ERM Rescan 2014).

[5] "These results suggest a detection frequency of approximately 9-11 grizzly bears/1,000 km^2, higher than density estimates in Nunavut (7 grizzly bears / 1,000 km^2), and possibly indicating a stable or increasing population in the central barrens of the Northwest Territories since estimates for the Slave Geological Province in the late 1990's (3.5 grizzly bears / 1,000 km^2)." (Erm Rescan 2014).

that grizzly bear mortality predictions have not been exceeded and past DNA results suggest a stable or increasing population, project-specific impacts of the mine on grizzly bears are likely minimal.

While the DNA program does not test a project-specific prediction, understanding trends in overall abundance and distribution of grizzly bears over time can help with determining whether increases in incidental grizzly bear observations at the Diavik mine are having population-level consequences for grizzly bears. **In terms of grizzly bear management, we recommend DDMI investigate if there is something in particular that is attracting grizzly bears to the site that could be determined by evaluating the location and timing of the incidental observations and, in turn, whether some mitigation could be applied to remove any attractants.**

3.4 Wolverine

The most recent objective of the WMP related to wolverine is:

> *To provide estimates of wolverine abundance and distribution in the study area over time* (Handley 2010).

Wolverine presence around the Mine is monitored using snow track surveys, hair-snagging, and incidental observations.

Snow track surveys for wolverine were completed in 2017. Since 2015, each winter track transect is surveyed twice instead of only once, as was done in earlier previous years. Data collected in this manner confirmed that snow track detection rates vary through time. Surveys should continue to be completed twice per transect so that the probability of snow track occurrence can be adjusted to reflect temporal variation in weather conditions. No detailed analyses of wolverine track data were completed in the 2017 WMP. The most recent comprehensive analysis (Golder 2017b) reported that the probability of wolverine track occurrence is positively correlated with time and transect length (occurrence of snow tracks increased through time from 2003 to 2016). It also reported that the wolverine track density index decreased as the Bathurst caribou herd size increased and the amount of waste rock hauled increased.

An analysis of data from 2004 – 2015 from the wolverine DNA hair snagging program (mark-recapture sampling) was completed in 2018 (Efford and Boulanger 2018). The previous analysis was completed in 2014. The long-term frequency of this program has not been determined. Decisions regarding program frequency are anticipated to be determined collaboratively once the 2018 report has been reviewed. The DNA hair snagging study found that the average wolverine density at the three northern sites (Daring Lake, Diavik and Ekati) declined over time (2005-2014). The most prominent decline occurred at the Daring Lake site with a weaker decline over time for Diavk study area alone. Efford and Boulanger (2018) made recommendations about future sampling (e.g., grid size, post spacing, sampling frequency, synchronous sampling) in order to maximize power to detect change in wolverine density. A challenge with the program is that the large home range sizes of wolverines and the close proximity of the grids (sharing a border in some cases) makes it difficult or impossible to rigorously separate the population into components associated with each mine grid (or the Daring Lake grid). This makes it difficult to interpret the results in terms of project-specific impacts. However, understanding trends in overall abundance of wolverine can help with the interpretation of project-specific wolverine monitoring results.

The 2017 WMR reported zero mortalities or relocations, and four deterrent actions for wolverine on-site (Table 11). There were 36 days with wolverine visitations on East Island; this is a 51% decrease from 2016. **We commend Diavik for their ongoing efforts to mitigate impacts on wolverine and the reduction in wolverine visitations despite the increase in track occurrence over time.**

The monitoring program has shown that wolverines are interacting with the mine (there have been incidents, mortalities and relocations associated with the mine). However, there is no apparent trend over time in the number of interactions with the mine or the need for deterrent actions. In the most recent comprehensive analysis (Golder 2017b), DDMI reported on a general correspondence between wolverine snow track occurrence with abundance and suggested that the increase in wolverine occurrence was likely associated with an increase in abundance of wolverines in the study area. However, the conclusion that there is a general correspondence (positive correlation) between wolverine snow track occurrence (tracking program) and wolverine abundance (hair snagging program) is based on a visual evaluation of the data and not a statistical relationship. The recent wolverine DNA hair snagging results (Efford and Boulanger 2018) report an overall wolverine population decline for the Daring Lake, Ekati and Diavik area between 2004 and 2015. Given this decreasing wolverine population over time, the increasing wolverine track density (2003-2016; Golder 2017b; Table 4.3-3) is not simply a function of an increasing population. This suggests that the results of the snow track program are not necessarily appropriate for use as an index of broad changes in wolverine abundance as DDMI suggests in the most recent comprehensive analysis (Golder 2017b). Therefore, the DNA program is still necessary to address the objective of wolverine abundance. A possible explanation for an increase in wolverine track occurrence over time despite a decreasing wolverine population could be that wolverines are attracted to the mine area because of the new more northerly distribution of caribou due to their recent range contraction. Alternatively, the mine could be attracting wolverines; however, there are no clear trends over time in days with wolverine visitations, days deterrents were necessary, relocations, or mortalities (Table 11 - Golder 2018).

The DNA program provides information on wolverine abundance and distribution while the tracking program provides information on distribution and directly involves the local community in data collection. The DNA program is conducted less frequently (4 years between reports; 2014, 2018) than the tracking program (annual). **We support DDMI's continued involvement in the wolverine hair-snagging program which is designed to address the new, regional scale question about the wolverine population. We also support DDMI's continued involvement in the wolverine winter tracking program which is designed to evaluate project-specific impacts to wolverine distribution and occurrence.**

The WMP also evaluates the prediction that mine-related mortalities, if they occur, are not expected to alter wolverine population parameters in the Lac de Gras area. Given that there have only been five wolverine mortalities reported since 2000, there appears to be support for the prediction that mining related mortalities are not expected to alter wolverine population parameters in the Lac de Gras area. In addition, the most recent evaluation on the status of wolverine in the NWT concluded that they are Not at Risk (Species at Risk Committee 2014). However, it is not clear precisely how this prediction is being tested as there has been little information provided on wolverine population parameters over time in the WMRs. Although not available in time to be included in this report, we now have information on the wolverine population from Efford and Boulanger (2018). **We recommend DDMI use this new**

information to support their conclusion in future WMRs regarding the alteration of wolverine population parameters.

3.5 Falcons

Monitoring of raptor nest occupancy and success in the study area were removed from the WMP in 2010. However, DDMI contributes nest monitoring data to ENR every five years and last collected these data in 2015; the next survey is scheduled for 2020. DDMI also remains focused on data collection and mitigating effects to raptors nesting in open pits and on Mine infrastructure. Two active peregrine falcon nests were observed. One was located at the Site Services Building and one was located at A154. Both nests have young present.

We concur with DDMI's recommendation to continue Pit Wall/Mine Infrastructure monitoring for nesting raptors. DDMI will discuss options with ENR for future monitoring. The Canadian Peregrine Falcon Survey (CPFS) was discontinued in the NWT in 2015; therefore, DDMI no longer provides nest site occupancy and productivity data to the Canadian Wildlife Service (CWS).

3.6 Waste Management

In 2017, the misdirected attractants (food and food packaging) appear to be higher than 2016 levels on both the Waste Transfer Area (WTA) and the Landfill area compared to 2016 levels. In 2017, misdirected attractants for the A21 Area (new dike) decreased compared to 2016 levels. The underground area is more or less consistent with 2016 levels. In 2017, there appeared to be a high number of misdirected food items for the WTA and Landfill Areas (relative to the other inspected areas) and observations of wildlife (fox and wolverine) were highest for the WTA (WMR, Table 14). While the overall effect of waste management at the A21 Area appears to be positive (fox and wolverine numbers are lower than 2016), the WTA appears to be attracting higher numbers of wolverine and fox compared to 2016. Furthermore, there seems to be an increasing trend in the number of grizzly bear incidental observations and wolverine probability of occurrence over time (See Sections 3.3 and 3.4 of this report). We commend DDMI for its efforts which probably led to the low attraction effect on wildlife in the past and concur with there commitment to continue to carry out employee education programs related to waste handling to decrease misdirected waste. **DDMI should explore the reasons for the higher levels of misdirected food waste in the WTA in 2017 as this may be contributing to wildlife presence and possible habituation near the Mine site.**

3.7 Waterfowl

As expected, no waterfowl information was presented in the 2017 WMR. In past years, DDMI has evaluated predictions relating to waterfowl habitat loss, presence, and habitat utilization. The 2012 WMR recommended a review and evaluation of the current waterfowl program to see if any improvements could be implemented. A meeting was held between DDMI and the Canadian Wildlife Service (CWS) in December 2013 to discuss the waterfowl program. It was agreed that the waterfowl monitoring program

would be discontinued at this time, but CWS did recommend that DDMI re-start the waterbird/shorebird monitoring program at the Mine reclamation stage.

We are in agreement with the recommendation to discontinue the waterbird/shorebird monitoring program and concur with the CWS recommendation regarding reinstating the waterbird/shorebird monitoring program at the Mine reclamation stage.

3.8 Windfarm

As expected, no windfarm associated bird mortality information was presented in the 2017 WMR. Given the low likelihood of avian-turbine strikes, due to location and size of the wind farm, and the absence of bird mortalities in 2013, **we agreed with DDMI's recommendation to discontinue monitoring the wind farm using 2013 methods and to instead monitor for bird mortalities as part of the overall site compliance monitoring program.**

4.0 Closure

The review of the 2017 WMR reported herein presents the conclusions arrived at by MSES. While some recommendations and requests were addressed, we note that several from previous years were not responded to by DDMI (Table 1). The responses to our questions and recommendations are necessary to maintain and improve the understanding of the effects of the Mine on wildlife. Some of our recommendations may be best addressed during detailed data analyses using multiple years of new data. We hope that future communications will lead to further clarification on several details of the 2017 WMR. Our views are submitted to EMAB for its consideration of potential recommendations and actions.

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