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Replies to EA1415-01 Notice of proceeding - risk assessment review and response

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Preamble

These replies to MVEIRB with detailed point-by-point explanations of CNZ comments are in follow-up to the MVEIRB Notice of proceeding -risk assessment review and response, dated December 8th . The document was issued after receiving the Letter CZN to MVEIRB re: Risk Assessment, dated Dec 5 2016.

The notice of proceeding contains the following direction to Oboni Riskope:

The Review Board requests that Oboni Riskope advise whether, in its view:

1. there are any errors of fact identified in CanZinc's letter that would modify or change the risk assessment findings and conclusions, based on the information available at the time of preparation of the Risk Assessment Technical Report (i.e. October 24, when responses to second round information requests were submitted); and
2. consideration of new evidence outlined in CanZinc's letter would change the findings of risk.

The notice also requested a detailed explanation for each response under item 1 and 2, above.

We welcome the opportunity to expand on some points raised by CNZ/Allnorth with the objective to clarify some misunderstanding, correct some statements and finally comfort all the stakeholders in a constructive way.

Through this text, we report point by point first CNZ/Allnorth texts (in Times Roman font, indented paragraphs), followed by our notes/replies in Verdana font, without indent. The titles (Table of Content) of CNZ letter have been maintained to allow easy point-by-point cross-reference. Oboni Riskope Associates Inc. report will be referenced herein as **ORA11-18.**

Letter CZN to MVEIRB re: Risk Assessment point by point replies

CNZ

> We refer to the November 18, 2016 risk assessment (RA) report, and the November 30, 2016 RA 'cover letter', prepared by Oboni Riskope Associates Inc. Canadian Zinc Corporation (CZN) has reviewed these. In our opinion, there is a need to reconsider and adjust the assumptions made in the RA. Following this, an addendum should be prepared with the

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> updated results, which should be presented in a more detailed format to allow further consideration of location-specific concerns and adaptive mitigation requirements, as necessary. CZN will provide more substantive comment on the RA after the addendum. Our main reasons for requesting an addendum are explained below. Detailed comments are provided in an attached table. While we agree with Oboni's conclusion that the all season road poses a lower risk than a winter only road, it would be helpful from an environmental assessment stand-point to separate the assessed risks between summer and winter. Based on Oboni's description, we believe that the assessed risks are greater for winter. Therefore, by combining winter and summer risks, the risks for summer appear greater than they actually are.

The splitting of the results between summer and winter is discussed in detail in point 62 below.

> We have significant concerns regarding the assumptions made in the RA relating to the probability of accidents occurring, and the consequences of those accidents. Before commenting further, we feel it is important to note that, in our opinion, Oboni is at a distinct disadvantage in this regard because the road alignment and terrain were not visited by Oboni in the field, and Oboni is essentially relying on photos and written material.

Yes, there is a distinct information asymmetry, which always exist, anywhere in the world, when we undertake a risk assessment. That's because design teams, operations personnel "know" their system better than a third party independent expert that sees the project for the first time. Generally clients, design teams, operations personnel make distinct efforts before the risk assessment is prepared to provide reliable and complete data. We generally use at least Google Earth (using points generally delivered by clients) before going on site, and in this case oblique photos were provided (Responses to Information Requests Response to Mackenzie Valley Review Board Response to DAR Addendum of Developer's Assessment Report May 10, 2016). Data related to the road project were requested (repeatedly), with limited success as discussed in other points of these replies.
We note however, as confirmed by our road safety experts at http://www.eurosain.org/ (a Riskope division devoted to road safety), that working on plans of a future (not yet existing) road and aero/oblique photos is possible when performing a road safety audit (a procedure somewhat similar to a risk assessment which also has to be performed by an independent team). This is particularly true for a future (nonexistent) road. Furthermore the project is still evolving, as it will be discussed later.

> To be succinct, we do not believe Oboni sufficiently understands site conditions. In our view, this poses a real limitation on the reliability of Oboni's assessment and conclusions. A possible, partial, remedy would be to give Oboni the opportunity to view video of the road, during which we strongly advise that some guidance in terms of road locations and kilometre marks in the video be provided. CZN can provide such an opportunity.

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During prior phases detailed information on the road was requested at least two times and always denied with the explanation that the Stratification drawings were representative of the whole project and any other drawings were unavailable. We have copied below and extract of the transcripts[1] that delivers the rationale followed by CNZ on this subject.

5 MR. DAVID HARPLEY: It's Dave Harpley.
6 So, Cesar, the approach we took is -- is that we were
7 going to provide more detail on certain sections of
8 the road that could then be used as a surrogate for a
9 larger part of the road with similar properties,
10 rather than provide a design for the whole section
11 which is basically going to be the same, and it's just
12 a redundant work at this stage, because it's -- you
13 know, we're at the preliminary design stage. We're
14 not at the detailed design stage.
15 I mean, we've provided the alignment,
16 obviously, and -- and crossing details, but it's not
17 our intent to do a full design of the whole road at
18 this point.

19 MR. CESAR OBONI: Cesar Oboni. So
20 just to make things clearer, so you have calculated
21 volumes and -- without having defined the -- the cross
22 section in longitudinal profiles?

1 MR. DAVID HARPLEY: It's Dave Harpley.
2 So what we did was, you know, in the section that we
3 did the design on and it gives us cross section
4 information, we then extrapolated that over the longer
5 section of the road that it's representative of to
6 derive a volume.
7 So we have generated volumes for the
8 entire road.

If this extrapolation technique was used for excavation and fills volumes (using 19 km drawings to evaluate 184 km of road), hence for borrow-pits preliminary design, sizing and locations, it seems odd that the same technique could not be used for the risk assessment that, as we will see later, was built around a measurable and easy to understand scale of consequences.

Furthermore, video was not mentioned earlier in the public record, as far as we recall?

1 http://reviewboard.ca/upload/project_document/EA1415-01_Technical_session_transcripts_15-Jun-2016.PDF Transcipt June 15th , page 39 40 and 51

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As noted above, the project has evolved (which is normal at this stage) as witnessed for example by the shifting of the road layout towards Sundog Creek bed[2] between km 34.8 and km 39.0. This shifting is included in the reply to Undertaking #19 -*CanZinc will calculate missing curvature data for section KP34-39 and provide this information.*-
In section 2.1.1 of the referenced document we read: *Response: A preliminary design was completed for section km 34+800 to 39+000. As per the request, curvature data is now identified on the plan view and is located in Appendix A* (there is no indication in this reply that the design of the 4km segment has significantly changed with respect to May 10th submission).
When inspecting the referenced Appendix A we notice that the shift has reduced some significant man-made cuts (and downslopes) by pushing the layout out in the direction of the Sundog Creek bed (we are not criticizing this choice or discussing potential environmental/hydraulic consequences, as these are clearly out of our scope, but using this example to reply to CNZ point re: video). We firmly believe that these significant differences can only be grasped (with all their possible hazard/risk implications) by careful examination of drawings and not by merely looking at a video, unless the video has the project "mounted" on it using a 3-D (three dimensional) road design software. Furthermore we wonder which layout the video covers: the original or the alternative(s)?
Knowing out of experience that changes do occur during design (and again, this is normal and expected) we selected an objective scale of consequences that would accommodate them without requiring excessive updates of the risk assessment. That scale of consequences (Consequences Classes) is discussed in many points below.

> Regarding the probability of accidents, Allnorth, the road engineering consulting firm assisting CZN, believes that Oboni needs to revise: the assumptions of driver behaviour and road conditions; the conclusion that the road is too narrow; and, the approach to determining the frequency of road 'excursions' (tolerance).

The essence of ORA-11-18 was precisely to take away "beliefs" and often misleading "logic intuition" and replace them with objective numbers. The world is unfortunately not "perfect" as witnessed by numerous accidents even in highly controlled industries (hydro dams (flood control), nuclear, aerospace, etc.). Until they occur, people generally think the world is perfect. The objective of a risk assessment is to understand what could go wrong, how bad it would be so that the final design is sustainable and safe.

> Allnorth has provided comments on these and other road engineering and operation aspects in the attached letter. In the RA report, there seems to be some confusion as to whether or not man-made slopes pose a significant risk, and whether or not those risks have been included in the RA. Such slopes will be suitably designed with necessary mitigations during detailed design, and therefore there should not be any significant risks to include in the RA.

2 http://www.reviewboard.ca/upload/project_document/EA1415-01_Undertaking_responses_from_tech_session_-__Allnorth_19_23_24_.PDF August 17th

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There have been no man-made slopes related risks included in the risk values delivered by ORA-11-18, simply because their design in unspecified at this date, but we had to mention them for the sake of completeness and ethics (see discussion on ethical duty later on in this text). This point is discussed again below and later to respond to specific comments.

> Similarly, rock fall potential will be mitigated as necessary, and it is not conceivable that such events would cause significant accidents

Although many consider them rare, these type of accidents are well known and recorded in technical highway/road/railroad literature and the media in Canada and elsewhere in the world. Methodologies designed to prioritize rockfalls and landslides from man-made cuts along highways and railroads are indeed abundant, all over the world. They are called RHRAs (Rockfall Hazards Risk Assessment). If interested refer for example to Pritchard, Porter, Savigny, Iain Bruce, Oboni, Keegan, CN Rockfall Hazard Risk Management System: Experience, Enhancements, and Future Direction, 2005 International Conference on Landslide Risk Management 18th Annual Vancouver Geotechnical Society Symposium Vancouver, B.C.

Stating they are not conceivable would be unethical for a risk assessment, so ORA-11-18 flags them as a potential, but does not express any kind of judgment due to lack of mitigation data. In section 7.3.4 ORA-11-18 stated "The care that CNZ will take in designing and performing the cuts, together with possible mitigations will dictate the level of added exposure leading to risk."

We were pleased to see Tetratech[3] writing the following note on October 24th report on terrain stability:

"*There may also be some locations that would benefit from netting that is suspended from higher on the cutslope or above the cutslope, such that the velocity of falling rock is reduced and more likely to fall at the inside edge of the road rather than out on the travelling surface or beyond. Locations where such measures could be successfully implemented will need to be chosen at the time of detailed design, taking into account the likely frequency and anticipated volumes of rock fall at a particular location, as well as the likely success of other measures that could be implemented in addition to or instead of physical solutions. For example, netting may be more useful on blind corners, whereas signage may be more appropriate at locations where sight distances are good in rock fall areas.*

.....

Suitable protection solutions for existing out-dipping rock slopes along the route should be considered at the time of detailed design. As for the above-noted rock fall sections, physical mitigations may be more appropriate on blind corners, whereas signage may be suitable in areas with good sight distances."

3 http://reviewboard.ca/upload/project_document/EA1415-01_TetraTech_report_-_terrain_instability.PDF

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We note that, reassuringly, Tetratech seems to be in agreement with us that small volume-high velocity rockfalls (from man-made cuts and other sources) have to be mitigated.

> We also do not agree with Oboni's assumption that b) and c) type accident scenarios (due to landslides) have a significant probability of occurring. We agree that landslides could potentially affect the road, but we consider it extremely unlikely they will cause accidents.

In Table 24, page 110 of ORA-11-18 we show that b,c, accidents for natural hazards constitute a minuscule part of the overall accident prediction. This is corroborated by the experience on our "example roads". Thus there is nothing to disagree with as the corresponding probability is indeed not significant at all.

> According to the RA report, the assessed consequences of accidents appear to be largely based on Parks Canada's reply to Undertaking #16, although the cover letter implies a slightly greater focus on watercourses. There is no mention of CZN's response to the undertaking, or to CZN's comments on Parks Canada's response.

The Consequence Class Table 14, Section 6.5 which was submitted in the IR#2 questions and even worked on by CNZ (when we asked about accidental tolerance) is quite explicit and clear. There are no "hidden implications" to discuss. As a matter of fact, Section 6.3 states: "Based on the paucity of extant data related to highly sensitive potential spill areas this study assumes that higher consequences will occur as a result of accidents featuring at least one of the following characteristics:
a) relative higher energy (careening over higher/steeper natural or man-made slopes, faster driving, etc. as defined below)
b) potential larger spread of contaminants
c) relative increased difficulties in recovery of pollutants.
The consequences will be cumulative in the sense that a possible spill at a given location where more than one characteristic is present will lead to higher consequences than another location where only one characteristic is present." This choice was made to define Consequences Classes in the most pragmatic and objective possible way and avoid complex toxicological reasoning.

> There is also no mention of the consequence information provided by CZN in the DAR and DAR Addendum. CZN has provided comments on the nonengineering aspects of the RA report and cover letter in an attached table. This includes more detailed comments on consequence assumptions. However, in summary, we do not consider the Parks Canada response to Undertaking #16 to be an accurate reflection of regional environmental sensitivities, or a suitable basis for consequence assessment.

Refer to the prior point which, in our mind, allows an elegant bypass to this discussion while allowing a transparent, pragmatic risk assessment.

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> Oboni has chosen to use the road Stratifications determined by Allnorth as a basis for conducting the RA and to display results. We understand why this approach was taken as this enables assumptions to be based on design elements. However, because many of the Stratifications have considerable length, and also multiple sub-sections, it is very difficult to understand and visualize the results in terms of road location, and the value of the study is also reduced.

This is indeed a painful point. ORA-11-18 would certainly be a better document if there had been firm(er) data to work on, a full road-book, all the cross sections, longitudinal profiles and plan views. Those documents were repeatedly asked, but never provided as discussed earlier, meanwhile it was repeatedly confirmed that the drawings (19km on 180km road) were representative of the whole road.

> This is particularly acute for the grouped 'special sections', which also correspond to most of the higher assessed consequences. We believe a subdivision of the Stratifications is required.

The ORA-11-18 is obviously only a first step, just like the road is in the preliminary design stage (see transcripts at the beginning of this text), in defining the risk landscape of the Prairie Creek project. It is based on documents delivered to date and included in the public record. Drawings exist only for (ORA-11-18, Table 3) 19.92 km on a total of approx. 180 km (~ 11%). Stratification segmentation has been established by the designers without any explanation on criteria or methodology aside statements that the Stratification type drawings were representative of the entire stratification set of segments. Although we are sure the experienced designers of the road put their best effort in these allocations, we recognize how easy it is to fall into oversights in such a project, with documents revised and resubmitted, layout shifts, and partial documentation. That's only a normal human characteristic, which is found again and again in a lot of projects and constitutes in itself a project risk. Thus at this point requiring further subdivision of the Stratifications (without improving/completing data of the road) would be misleading and give an illusion of better understanding of the risks. A reasonable and sustainable risk assessment has to be in harmony with the quality of the available data so that it does not turn into a misleading document.
A complete set of project drawings is required to refine the risk assessment and add details requested by CNZ. A revision at this point would bias the analysis including a false sense of previsions on uncertain data.

> To this end, we have prepared a table (attached) reflecting the subdivisions and assigning unique numbers to them. We propose that the table be used in an updated RA. It may not be necessary to reflect all of the subdivisions in the results, some could be grouped depending on commonality of the results, but the added detail will be needed for others, particularly the special sections.

The table submitted by CNZ on December 5th is copied below. We note this table is different (in the tail end) from the segmentation delivered in Table 7: Road Summary

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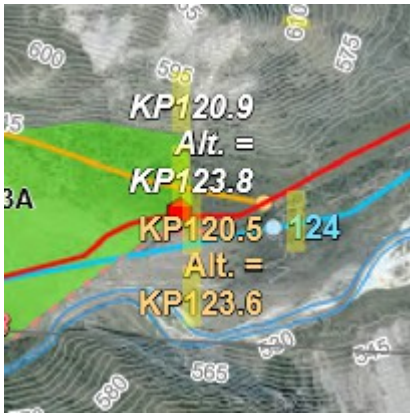
of the document Responses to Information Requests Response to Mackenzie Valley Review Board Response to DAR Addendum of Developer's Assessment Report May 10, 2016. It is unclear to what stage of the project this table refers to, but the gap at km 120.5 and km 123.6 seems to point to a final decision to use the alternate road[4]. This only confirms that in the absence of a complete road-book it is not possible to find comfort that there are no other oddities in the segmentation and more importantly, in the Stratification allotment.



NOTE: from page 39 of ORA11-18 "Allnorth confirmed with reference to their submission "Response to Information Requests" dated May 10, 2016; Appendix E Updated Tables, Table 5 (reproduced below for the original and the alternate alignments, respectively Figure 4,5), the 170 km plus road was segregated into 10 different construction categories plus six to seven unique individual segments (alternate vs original alignment). Preliminary road designs were completed on 1 to 2 km portions of each of the 10 construction categories and provide a comparable representation of what to expect regarding general ground conditions, earthwork calculations, and construction approach. The majority of the road, roughly 165 km, was classified in this manner. The remaining road length was considered unique for a number of reasons including rock excavation (blasting), stream crossing alignment, and close proximity to stream channel (lower Sundog Creek). A preliminary road design was completed for the entire length of any section considered unique and challenging. This included segment 13.0 to 13.76. Therefore, these sections were not classified into the defined 10 road construction categories due to their unique characteristics. As a result, this study bears first on the segments that are best know and gives estimates by analogy to complete the assessment for the rest of the road, using extant documentation, including oblique photos and public records reports."

The table below (submitted Dec. 5th) features 7 special segments (1,2,3,4,5.1,5.2,and 6). Was this table submitted in the public record before October 24th ? If it was, we were not able to locate where/when it was submitted.

4 http://reviewboard.ca/upload/project_document/EA1415-01_Letter_to_INAC_from_CanZinc_re_access_road_land_tenure.PDF last page.

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Stratification	Length (km)	From	To	Description
TYPE I	6.5	0	6.5	Prairie
TYPE II-1	6.5	6.5	13	Funeral
Special 1	0.8	13	13.8	Funeral hairpin
TYPE II-2	9.2	13.8	23	Funeral/Sundog pass
Special 2	0.8	23	23.8	Sundog trib (canyon) crossing
TYPE III-1	1.4	23.8	25.2	Sundog terrace
Special 3	0.4	25.2	25.6	Sundog trib (shoot) crossing
TYPE III-2	2.4	25.6	28	Sundog terrace
Special 4	0.8	28	28.8	Sundog trib & rock cut
TYPE II-3	1	28.8	29.8	Sundog flats, 2 debris fans
TYPE IV-1	3.6	29.8	33.4	Sundog flats
Special 5-1	0.5	33.4	33.9	Sundog flats talus toe
TYPE IV-2	0.7	33.9	34.6	Sundog flats
Special 5-2	4.1	34.6	38.7	Sundog flats talus toe
TYPE IV-3	0.7	38.7	39.4	Sundog flats
TYPE VII-1	1.5	39.4	40.9	Sundog forest
TYPE VI-1	0.9	40.9	41.8	Sundog forest
TYPE VII-2	0.6	41.8	42.4	Sundog forest
TYPE VI-2	2.7	42.4	45.1	Sundog forest
TYPE VII-3	0.9	45.1	46	Polje forest
TYPE VI-3	2.7	46	48.7	Polje forest
TYPE VII-4	2.2	48.7	50.9	Polje forest
TYPE VIII-1	3	50.9	53.9	Polje forest
TYPE VII-5	5.2	53.9	59.1	Ram slope
TYPE VI-4	20.9	59.1	80	Ram
TYPE VII-6	6.3	80	86.3	Ram slope forest
TYPE V	4	86.3	90.3	Tetcela forest
TYPE VII-7	4	90.3	94.3	Tetcela-Fishtrap muskeg
TYPE VIII-2	1	94.3	95.3	Fishtrap
TYPE X	6.2	95.3	101.5	Silent Hills slope forest
TYPE VII-8	9.9	101.5	111.4	Un-named muskeg WP-GG
TYPE VII-9	9.1	111.4	120.5	Grainger forest
TYPE IV-4	0.7	123.6	124.3	Grainger Gap
TYPE VIII-3	2	124.3	126.3	Front Range muskeg
TYPE VII-10	16.8	126.3	143.1	Front Range muskeg
TYPE IX-1	15.8	143.1	158.9	Front Range forest
Special 6	0.6	158.9	159.5	Liard River
TYPE IX-2	13.5	159.5	173	Liard logging road
NB access	10	173	183	Nahanni access road
TOTAL	179.9			

TYPE I	6.5	TYPE VII	56.5
TYPE II	16.7	TYPE VIII	6
TYPE III	3.8	TYPE IX	29.3
TYPE IV	5.7	TYPE X	6.2
TYPE V	4	Specials	8
TYPE VI	27.2		

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> From the above, it is clear that we have significant concerns with the assumptions made in the RA, and these directly relate to all of the conclusions listed by Oboni in their cover letter.

From the above it is clear we have significant concerns with missing information, miscommunication and the spread of information through a myriad of documents, assumptions made by CNZ and the overall "perfect world" described by the various reports which led us to talk about rosy scenarios.

> We ask Oboni to carefully consider the detailed comments provided by Allnorth, and those by CZN in the attached table. We appreciate your consideration of these comments which are intended to be constructive. If you have any questions, please contact us at 604 688 2001.

We will review all the points in detail, in the following pages. Our replies are of course intended to be constructive and help bringing this project to an acceptable level of risk mitigation.
We note that as independent contractor in charge of a risk assessment, we have ethical duties we will refer to as needed later (interested readers can refer to F., Oboni, C., Oboni, Ethics and transparent risk communication start with proper risk assessment methodologies, EGU General Assembly 2014, Vienna, May, 2014, Oboni,C, Oboni. F, Aspects of Risk Tolerability, Manageable vs. Unmanageable Risks in Relation to Governance and Effective Leadership, International Symposium on Business and Management, Nagoya, Aichi-ken, Japan, April 2014;
Oboni, F., Oboni, C., Zabolotniuk, S., Can We Stop Misrepresenting Reality to the Public?, CIM 2013, Toronto).

The first ethical duty was to verify and check that our results would be anchored to reality. We did so by comparing the ORA-11-18 Prairie Creek risk results to three roads we have studied in the past, where management, drivers discipline, vehicles adequacy and maintenance quality would be similar or superior to Canadian standards (at the time of one of these studies a detailed comparison was made between the modern and well maintained fleet under consideration and Canadian comparable and the result was definitely to the advantage of the fleet under consideration). The discussion is located in ORA-11-18, Section 7.2 and Figure 25. It shows that the accident forecast yielded by ORA-11-18 places Prairie Creek in the same class of the Road 3 example (see detailed description in Section 7.2).

Page Comments on Report

> 10 3rd para., ORE (optimum Risk Estimates) – we assume this is a program. Information is required as to what the program is, how it was developed, and how it converts input data into risk estimates.

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Information requirement: ORE is not a program, but a methodology which is custom tailored for each deployment. We teach the ORE approach though three days courses to corporations and universities around the world. Everything required to understand the specific ORE application to Prairie Creek has been summarized in ORA-11-18 in Section 5, 6, 7, 8. Our SoW required us to use plain language and to reply to specific questions, not to produce a course on probabilistic analyses and ORE deployments. The anchoring to reality provided by the comparison with existing roads gives ample comfort that the model, at this stage, reflects "reality" within the margins made possible by the supplied data.
How it was developed: ORE is the result of over two decades of risk assessments performed in Canada and around the world for an array of mining clients, highways, railroads, and even the armed forces and international organizations. ORE has been used in successful competitive bids to support design teams decision making, showing how sensible risk assessments are actually a weapon of choice to increase projects value and ensure sustainability (discrediting common belief that they lead to unsustainable mitigations CAPEX and waste of capital).
How it converts inputs: Interested readers can refer, for example, to:
Oboni, F., Oboni, C., Military Grade Risk Application for Mining Defense, Resilience, and Optimization, Risk and Resilience 2016, Vancouver Canada, November 13-16, 2016
and also to numerous educational posts discussing ORE in our blog at www.riskope.com. Furthermore, as already referred to in the report, Ang, Tang. 1975, 1984, Oboni 2003 are good references for gaining an insight on how to convert input data into probabilities, probabilities calculations and their estimates.

> 51 All concentrate trucks will back-haul supplies, at least diesel, unless diesel demand is significantly reduced by including LNG. CZN is exploring LNG inclusion but cannot confirm this at present.

We have used the values of Figure 10, page 50, section 3.2.2 of ORA-11-18. Unless the situation has significantly gone in the direction of increasing environmentally sensitive cargo loads, then this statement is "neutral". However, we are now concerned by the the beginning of the phrase stating that "all concentrate trucks will back-haul supplies, at least diesel". This would correspond to a significant increase of the values ORA-11-18 referred to in Figure 10, thus an increase of risks. A clarification by CNZ will be necessary.

> 57 Last para., this is a relic from the Phase 1 Project (all season road from Mine to TTF) and is no longer being considered. Delete.

That phrase is irrelevant to the risk assessment results. Once MVEIRB decides the next steps it may be deleted, or simply noted as irrelevant. It does not alter the risk assessment results.

> 61 While "a total of 18 major stream crossings were identified in the original report', there are now only 9 bridge crossings.

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We are in agreement. We referred to older documents to put an emphasis on the project evolution. In ORA-11-18, pages 69-71, Figures 16, 17a, 17b, copied from public record (Table 10: Major Stream Crossing Summary from the Allnorth 10th May report) reports shows 9 bridges and a number of culverts which were integrated in ORA-11-18 risk assessment with their respective Consequence Class.

> 62 Since "a 100% value for the snow/ice conditions accident increase" has been adopted, we assume there is a resulting significant difference between summer and winter risks.

Here we have to go back to basic definitions (Appendix 1, page 140 of ORA-11-18). Risk is, in its simplest form, probability times consequence. Consequence Class does not change between summer and winter, following Table 6, 14 in ORA-11-18. Of course one could additionally argue that in winter concentrate is "more visible" on the snow, but winter comes with its own set of slippery conditions and other difficulties. Thus the only differentiator between summer and winter is the 100% increase in offroad excursions due to slippage and the number of slippery/difficult days in summer (when it rains the most). In Section 4.22 we state 100% increase of accidents due to snow/ice slippery, with a final split is 45/55 dry vs. slippery.

If one goes back to Figure 9 in ORA-11-18, the number of haul days between summer and winter varies between 127-142 and 75-89, as shown in the table below.

	Conservative	Projected
Summer	127	142
Winter	75	89
total	202	231
Summer	62.87%	61.47%
Winter	37.13%	38.53%

The 38%-62% split is a theoretical value as it does not include any "slippery" days consideration. It is our professional judgment that the 45/55 dry vs. slippery is a reasonable value. Should CNZ or MVEIRB be willing to explore the difference between ORA-11-18 split and a theoretical winter/summer split on the final results, it would become apparent that the difference is small and certainly well between the margins of uncertainty of a project with so many unresolved information gaps.

> Accordingly, as CZN is already permitted for winter hauling, it is appropriate to separate and compare the risks relating to summer and winter, as the assessed risks at present represent a combination skewed by greater risks in winter.

As explained in the reply to comment 62 above, the key for performing this split has been transparently given (in compliance to the SoW requesting "how do the risks

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differ between a winter road versus and all-season road"). Given the results of the assessment a party deciding to ignore risks occurring in the already permitted seasons would soon realize that accidental tolerance is exceeded anyways in some cases. Ethic reasoning dictated us to present the results as described above to avoid misleading any involved party through "administrative censure" potentially generating "risk blind spots."

> 66 As "Riskope's SoW specifically requires to only evaluate risks in areas where the all season road differs from the winter road", the avalanche paths 16, 20, 33-35 noted in Table 9 are out of scope as they relate to road sections that do not differ from the winter road. Paths 25-28.5 are on the north side of Sundog Creek and will not influence the all season road which was realigned to the south side from the winter location. Hence, any influences assumed from avalanches in the assessment should be removed.

We are aware that Alpine's report deals with the Winter Road only and so there may be avalanche paths in the area where the road was realigned to the south side, thus making its blind use questionable (this is not a criticism to Alpine's report but to the use that can be made of it). Furthermore note 52, related to path 20 and the NB at the top of page 67 give further details on ORA-11-18 line of thinking. Finally we invite the reader to consider the numerous caveats raised by Alpine in their Winter Road Avalanche report. As a final note, from ORA-11-18, Table 24 it appears that the accidents generated by avalanches are an insignificant part of the overall accident forecast. The earlier note on ethics also remains valid for avalanches.

> 79 Last para., regarding accidents caused by hazards (b, c), we consider this extremely unlikely (beyond present credibility)

Table 24 of ORA-11-18 shows these accidents are insignificant compared to the accident forecast. This is corroborated by the experience on our "example roads" and apparently your experience as well. Please note that, in technical language, credibility is generally agreed to be one in a million, up to one in hundred thousand. Anyone with a minimal experience in slopes stability, rockfalls will state that beyond credibility is too strong a statement in any such environment.

> Hazards of significance (landslides, major rockfall) occur very infrequently, measures in ten's or hundred's of years

We have accepted the geohazard study as is, in compliance with our SoW, but we do not agree with these statements (refer also to October 24th Tetratech report referenced earlier). Having worked on rockfalls and landslides all over the world, we are of the opinion that statement is misleading. Interested readers can gain some additional information in the following publications:
Oboni, F., Bourdeau, P.L. & Bonnard, Ch. (1984) - Probabilistic Analysis of Swiss Landslides - Proc. IVth Int. Symp. on Landslides, Vol. 2, ISL, Toronto, 1984, pp 473-478;

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Oboni, F. (1988) - General Report: Analysis Methods and Forecasting of Behaviour - Proc. Vth Int. Symp. on Landslides, Lausanne. Vol.1, pp 491-499;
Oboni, F. & Angelillo, V.T.G (1993) - Risk Maps for Rockfall Prone Areas: Environmental/ human aspects - Proc. Int. Conf. on Environmental Management. Geo-Water and Engineering Aspects, Wollongong, Australia, pp 715-720;
Oboni, F., Hlobil, Z. & Angelillo, V. (1994) - Risk Maps for Rockfall Prone Areas: A Methodological Approach - Proc. IVth Geoengineering Int. Congress on Soil and Groundwater Protection, Torino, pp 215-217;
Oboni, F., Oldendorff, G. (1997) - Integrating Risk and Crisis Management: Meeting the Needs of a Sophisticated Society - IUGS Working Group on Landslides Committee on Risk Assessment, Honolulu, 1997. **NB:** at this conference we co-fathered with a number of other international experts the first ever published glossary of risks specifically related to geohazards.
Oboni, F., Oboni, C., The Long Shadow of Human-Generated Geohazards: Risks and Crises, Geohazards Caused by Human Activity, Prof. Arvin Farid (Ed.), InTech, ISBN 978-953-51-2802-1, Print ISBN 978-953-51-2801-4, November 30, 2016.

> The chance of one occurring just as a truck is passing is considered extremely low.

Yes, absolutely and that's why the accidents generated by geohazards type b,c are almost insignificant on the overall risk profile, at this stage of the study.

> Such events are more likely in spring during thaw, or after summer intense rainfall. There will not be traffic in spring because of the inability to cross the Liard River, followed by load restrictions on the Liard Highway.

This "administrative view" on hazards is the recipe for disaster. Unfortunately nature, rockfalls do not respect human timetables.

> Intense rainfall would likely cause suspension of trucking, followed by inspections before trucking resumes.

Inspection from the road will not ensure there are no incipient failures. It certainly goes in the good direction, though, as common practice. Best practices can be discussed if and when required.

> Further, maintenance crews and monitors will inspect the road first each day, confirming road clearance before truck arrival.

The model includes this idea and considers that only one truck (because the real world is not perfect and we do not know how long before the transit the inspection will take place) might encounter an obstacle out of the total number of outbound and inbound transits. Again, the results of the accident forecast from geohazards is such that we do not even understand why we are discussing this (at this point of the study, without man-made cuts included).

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> There is a possibility of minor rockfall at any time, however this is unlikely to cause an off-road excursion. Therefore, we believe 'b' and 'c' accidents should be removed from accident assessment.

Ethics forbids us to censor the study, and that would contravene our SoW, but again, the forecast is so low, we do not understand why Canzinc are so adamant in lowering the quality of the Risk Assessment.

> 82 2nd para., with cold temperatures, we agree materials are generally stiffer and more brittle. However, concentrate will also freeze, making a spill less likely and recovery easier if a spill occurs.

Having three tons ice-balls "flying around" in the box or out of the box is an interesting scenario. How long will it take, after departure from the mine, to freeze bags with concentrate containing, reportedly, only 8% moisture?

> 83 2nd para., no justification is provided regarding the assumption that CZN's spill estimates are a 'lower bound', other than to consider them 'rosy' estimates. Please explain why the estimates are not realistic, or assume to be so. Was a higher bound for spill estimates assumed, and if so, what was it?

Lower bound: There have been spills of 40 tonnes reported by the media along the Red Dog access road, from trucks with reinforced cover. Red Dog truck reportedly transport concentrate in bulk and not in bags, so that value cannot be taken as a high bound as such. We note however there are locations where 4m high fills, bridge approaches and bridges exist along the Prairie Creek road. The mass of the concentrate vehicles will impart high kinetic energy to the truck and its load in those locations, even if the off-road excursion occurs at low initial speed. Thus we consider the CNZ small volumes forecast as a lower bound.
Upper bound: a upper bound was not assumed, in order to avoid tedious discussions, based on opinions. The solution to allow a reasonable risk assessment and avoid endless discussions was to define the failure criteria and the Consequences Classes as described in ORA-11-18, Section 2.3.1 and Table 14.

> 85 Environmental consequences appear to have been largely based on Parks Canada's reply to Undertaking #16. Oboni requested details of locations of sensitive wildlife and vegetation, however it was not clear at the time that the intention was to primarily use that information to determine spill consequences. Wildlife are only at risk if they drink contaminated water or eat contaminated vegetation. With spill response, the latter is unlikely. Impacts to vegetation are unlikely to be significant given a probable localized spill area compared to a much larger area of similar vegetation. Therefore, the consequence focus is incorrect.

Of course we asked details, like we asked to have more data on the road design. ORA-11-18, Table 14, Section 6.5 delivers the Consequence Class we developed to avoid

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endless discussions on toxicological impacts and deliver reasonable results. It is pragmatic and based on data everyone can see, no hidden agendas or tricks to be discussed. Spill response can and has potential to be delayed by many factors in the "real world" (See Red Dog discussion later).

> We believe the focus should be water quality and fish. In addition, we do not believe Parks Canada's response is correctly representative of regional sensitivities. It appears the comments made by CZN on this matter (PR#282) were either not seen or ignored. To reiterate, there is no evidence that a mountain caribou 'population' exists downstream of Sundog Creek. There is evidence that a few caribou occasionally stray from their range to the north and can be seen anywhere between the Mine and the Ram Plateau. Similarly, there is no evidence of a grayling 'population' present in upper Sundog that survives the winter. More likely, a limited number of grayling migrate up to Km 25 in spring, and those that don't retreat don't survive the winter. Parks Canada is asked to provide any data they may have to the contrary.

ORA-11-18 Table 14, Section 6.5 show that the "worsening" of Consequence Class due to the proximity of environmentally sensitive targets is limited. When more evidence will be presented (one way or another) risks could be easily altered by moving up or down the consequence class scale, if the various parties reach an agreement.

> We agree there is some sensitivity regarding fish presence, but the appropriate context needs to be assumed.

See above

> Regarding karst terrain and underground drainage, the reality is the karst rock has a soil cap that would have to be penetrated by a spill before it would enter any underground drainage. As part of EA 0809-002 studies, SNC Lavalin advanced some shallow boreholes on the Ram Plateau near Km 57 using a hammer drill that drove sampling tubes to the point of bedrock refusal, or shallower. A figure showing locations and the borehole logs are attached. These show that there is a 2-4 m soil cover in the area, and that this includes clay and frozen layers

In our experience there is nothing more insidious than karst and those boreholes are not sufficient to ensure the cover continuity, especially since we do not know the position of the road relative to topography.

> This data is likely typical of the western Ram, although judging by the thicker vegetation, the soil cover is progressively thicker on the eastern Ram. Further, karst is prone to dissolution along joints and faults at a very slow rate. Such dissolution results in pathways between massive, largely nonpermeable dolomite. Areas of dissolution are characterized by dissolution features (poljes, sinkholes) and depressed relief. The road specifically avoids these areas, traversing underlying massive dolomite. Hence, karst sensitivity to spills has been greatly over-stated. Most certainly, clean-up difficulty for water and karst cannot be

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> assumed to be equal. The Tetcela and Fishtrap drainages are not 'sensitive due to easy transport of any spill'. They are flat, lowlying, densely vegetated areas in terms of ground cover. Any spill would not migrate rapidly, and would readily be recovered. A spill in or near the crossings would be a concern, but this is highly unlikely. Tetcela is a flowing river, but Fishtrap is a slow-flowing wetland in the upper reaches proximal to the road and these are not considered to host fish. The area is bird habitat, but the area is very large and the effects from a localized spill would not be significant in this context. Swans are regularly seen in the Fishtrap area (not Tetcela), but not proximal to the road. Yellow Rail may or may not be present, but as noted, their habitat is not limited. Therefore, Parks Canada's response to Undertaking #16 is not considered to be a suitable basis for spill consequence determination. We submit that a better basis for consequence determination can be found in Sections 9.4 and 9.5 of the DAR (PR#55), and Section 7 of the DAR Addendum (PR#100), which focus primarily, but not only, on water quality and fish. In addition, we don't think Oboni has considered the actual severity of potential spills, as called for in their scope of work. In our opinion, potential severity is fundamental to a correct understanding of consequence, and therefore an appropriate focus on those sections of the road where accidents may be more severe.

Already discussed in various points above, no need to reiterate.

> 87 3rd para., CZN acknowledges there are locations with 'difficult cross sections' and not readily accessible in the event of a spill. However, we compensated for this by defining a number of control points in these locations where equipment and supplies will be left for the use of responders arriving on foot. Refer to the DAR, Section 9.5.2. We see no account for this in the assessment.

Discussed above. Again, in order to avoid endless discussions based on the real time for rescue and containment (in all seasons and conditions), Section 6.5, Table 14 has defined a Consequence Scale that does not include "time to containment". Instead it includes topographic/environmental parameters that everyone can "see".

> 87 2nd last para., to be clear, CZN is not proposing bulk transport with a tarp for cover. Such transport would use the Convey Ore system using solid, lockable lids. Similarly, if concentrate is transported in bags, the bags will be tied-down in a truck box with a solid, lockable lid.

So, if we understand correctly there are still two options open: a) bulk with lockable lid (like recent Red Dog 40 tonnes spill), or b) bags tied-down. Our Table 14 was conceived to be a "general purpose" Consequence Scale and thus applies to case a,b. The various stakeholders will appreciate the differences during later discussions. The kinetic energy developed during any accident scenario of the higher classes will be significant.

> 89 The rationale for Classes 7-9, and their assumed severity, is unclear. Major watercourse

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> crossings will be locations where the lowest speed limits, highest required vigilance and crossing guides will be required. As a result, these locations are likely to be associated with the lowest probability of accidents occurring.

Risk is probability times consequence. Mixing the two is a classic mistake that only generates confusion. The rationale for Classes 7-9 is looking at consequences, not at the probability. The Table of contents of ORA-11-18 is organized in such a way to keep probabilities and consequences separated until risks are estimated. This is to avoid the well known "jumping to conclusions" cognitive distortion which is again a common mistake people make when engaging in non rigorous risk framework discussions.

> 90 Table 15. Regarding road sections 13-13.76 and 23-23.7, consequence class selection should reflect that there are no fish at these locations and that accessible control points are located downstream. For section 52-53, this is not karst terrain.

We don't see any mention of fish in the table at 13-13.76; presence of water courses nearby has been considered a consequence class differential as concentrate spills would disturb local environment and generate increased need for restoration (refer to the Red Dog discussion later on, where post-spill restoration program is mentioned). ORA-11-18 does not state km 52-53 had karst terrain. It states that the stratification VIII which was supposed to be representative does contain karst.

> 91 Table 16. Stratifications 2 and 3 do not have bridges. Bridges are included in the special sections in between. Stratification 8 is not on karst.

Bridges: In the 5th December CNZ letter Stratification II is shown to develop between km 13.8 and km 23, which correspond to Table 7 road summary from May 10th. In the same May 10th report, Table 10: Major Stream Crossing Summary, we have Multiple Large Culverts at km 20.5. From ORA-11-18, based on the Consequence Scale adopted through, there is not a significant difference between large culverts and bridge.
The 10th May report also provides us with the longitudinal profile for km 25+000 to km 26+000 labelled as Stratification type III. However Table 7 road summary identifies the Stratification type III from km 23.8 to 25.2 and km 25.6 to 28, with a special section from km 25.2 to 25.6. We are again in a situation where updated documents in the form of a complete roadbook would eliminate uncertainties and asymmetric information.
We note, however, that these specific adjustments would not change the global results, i.e. the risk profile depicted by ORA-11-18.
Karst: Karst was identified by extant reports from km 53-64. Hence Stratification VIII seems to marginally contain karst as we stated. To be precise, the new Stratification delivered by CNZ, copied earlier in this report, shows that segment VIII-1 covers km 50.9 to 53.9, VII-5 goes from km 53.9 to 59.1 and VI-4 covers km 59.1 to km 80. The appropriate lengths of exposed segments have been estimated and included in ORA-11-18 risk assessment.

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> 101 As 'avalanches would typically only be expected in the spring', they would be occurring at a time when trucking will be suspended (April to mid-June) due to absence of a Liard River crossing and highway weight restrictions.

This is a "administrative view" of risks that we cannot share. Anyways, as stated earlier, the contribution of avalanches is insignificant, so it does not substantiate that the RA require an update or there was a mistake.

> 111 Re man-made cuts, an all season road already exists through the mountainous section, and few cuts will be required for the remainder which will be properly designed. No significant risks are expected.

This point has been discussed and dismissed earlier.

> 115 2nd para., we agree that higher consequences will occur as a result of the noted characteristics, however, we do not agree that there is a paucity of data related to sensitive potential spill areas (see our reply re page 85) or that there is an absence of baseline information considering the data available and stage of the project.

Discussed above.

> 116 Fig 26. The high number of predicted excursions for Stratification 5 (km 86.3-90.3) is not credible considering the gentle sloping to flat, lowland terrain, and controls associated with the 2 bridge crossings.

The figure shows off-road excursions per Stratification and per Classes 6 or higher. The presence of creeks and drainages bumps up the Consequence Class in compliance with the Consequence Class Table 14.

> Sub-division of the special sections is required to understand where the predicted excursions are on the road.

Discussed earlier when talking about the lack of a complete roadbook.

> 119 Fig 28A. As Oboni notes, the predicted number of excursions is distorted by Stratification length. Stratification 7 is highest because it is 56.5 km long. The only section with a degree of difficult is km 53.9-59.1. Fig 28A would be more meaningful if the Stratifications were subdivided.

Indeed, some distortion was noted in ORA-11-18. However, Stratification 7 is known only thanks to drawings covering (Table 3 ORA-11-18) 2.5 km on a total of 56.5 km. The statement that only 53.9 to 59.1 is difficult cannot be proven unless more data in provided. As stated above, if data had been delivered, also Fig. 28A would be more meaningful.

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> 119 The value of Figs 28B and 28C is diminished by a lack of subdivision of the Stratifications, especially the special sections, and low resolution of the more important consequence classes 5-9. In Fig 28C, for the higher consequence classes, Stratifications 8 (class 5) and 5 (class 7) are noted as having higher excursions, yet the road sections they relate to are in relatively flat terrain with an absence of hazards. This indicates issues with the assumptions regarding accident probability and consequences.

There is a logic in the results, based on transparently sets of "rules" stated all over ORA-11-18. Risk is made out of probability and consequence. Consequences are clearly split in Classes in Table 14. Let's try to explain this a bit further.
If two identical section a,b of road are respectively running along: a) a steep ravine, ending in an environmental target (water course, fauna, flora, residences, etc.), b) a flat terrain with a bare field environment, risks generated by -a- will be larger than those of -b-, for any probability of an accident.

> 120 1st para., mitigations will be considered during detailed design. We have anecdotal evidence regarding rockfalls that they aren't significant. However, some sections (e.g. 14.8-15.5) may need protection.

Irrelevant at this point and does not justify that the RA requiring an update.

> 125 3rd para., see the reply to page 87 re control points.

Discussed above.

> 126 2nd para., note that trucks will drive in convoy most of the time, will be monitored all of the time, and travel times will be reviewed. 'Bravado' will thus be unlikely, and would be spotted quickly. The transport supervisor will determine daily driving requirements, including chainup.

This refers to Section 10, mitigations, where ORA-11-18 states: " JMS is not immune to human error and does not entirely preclude drivers bravado." The rules described in the replies certainly correspond to good practices, which are applied by most of our clients, but are subject to human error, mistakes, stress and pressure. In a perfect world, they would give 100% insurance of no accident. In the real world, well, it's different as shown by the number of accidents recorded in mining access roads.

> 126 Last para., what is meant by "review the cargo safety rules"? CZN has and will continue to endeavour to make cargos as safe as possible.

It means that, up to date, we do not recall having seen how the concentrate bags will be attached, for example. Same for all other loads. Many accidents involving trucks occur because of cargo movements (all over the world). Many accidents become catastrophic, as you certainly also know, because of cargo movement.

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> 132 5th para., there is no km 122.7-123.4 special section on the final alignment. That was on an alignment replaced by an alternate.

Thank you. See discussions related to the changes of the project, asymmetry in information, absence of a roadbook. This is again a minor change in the assessment results.

> 133 Last para., the main deviations from tolerance are due to an incorrect assumption of environmental sensitivity.

An opinion which is definitely different from ours.

> 152 Assumption 15, "crossings and junctions are not considered to represent a noteworthy hazard". What, then, is the basis for consequence classes 7-9?

Again, Table 14, Section 6.5 defines Consequence Classes.

Page Comments on Cover Letter

> 4 1st . para., Oboni notes that the real life accidents in their examples were driver-related, and not due to hazards. They also state that they "found a similar result in this study". This conflicts with their comments elsewhere regarding landslides and rock falls, in which they say these can cause accidents, e.g. 2nd. last para., "high velocity, small volume events can generate high risks". It is again worth noting that the evidence indicates that these events are not currently thought to be significant, but if they are found to be, upslope protection would be implemented.

There is no conflict. Although there were no geo-hazard related accidents in the road examples, that does not mean such an accident in "impossible". Also, high velocity, small volume can generate high risks if the product of their probability and consequences is high.

> 4 2nd last para., stating that "man-made slopes generate frequent and damaging slides and rock falls which have not been evaluated to date due to lack of information" implies that there is significant risk attached to these. We do not expect this, hence the absence of detailed evaluation to date. These slopes will be subject to evaluation and appropriate mitigation during detailed design. That is an assumption Oboni can and should make, rather than implying risk.

As stated earlier, there is a significant volume of technical literature on rockfall hazard along highways (world-wide) to lead us to believe that your "expectation" may be excessively optimistic.

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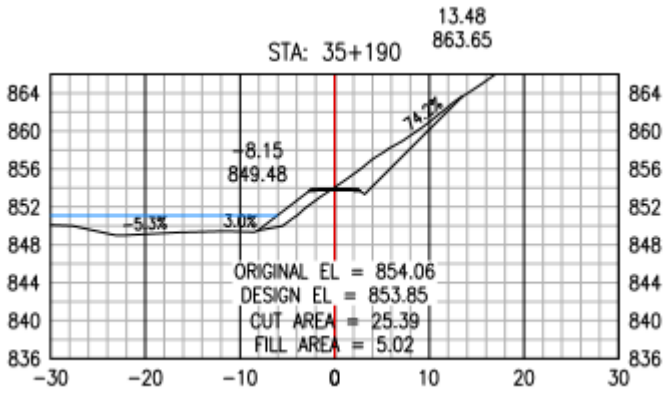
> 5 2nd para., while km 6.5-13 would be a high consequence location, accident probability is very low due to the gentle grade and generally small grade separation difference between the road and stream. For km 23.8-39.4, for the most part, either the accident probability is low or the consequence is low. Sundog Creek is not potentially fish-bearing until km 25. From 23.8-28, the road will be on a relatively flat bench, apart from a tributary crossing. From km 28.8-39.4, the road is mostly on old floodplain and distant from the creek with very little grade separation, although some portions are adjacent to the creek.

We assume this refers to the Aug. 17th Undertaking #19 reply which still shows, for example at km 35.19, 4m high embankment on the down slope, and a 10m cut upslope.



> Oboni's comments indicate an insufficient understanding of site conditions, which we believe is understandable given they have not made a site inspection.

Thank you for the understanding. The situation is due to informational gaps discussed above. However, as explained through these replies, we have bypassed these difficulties, for example, by selecting an appropriate Consequence Class scale and parameters, extending the results of the sample segments for each Stratification type to the entire Stratification while length-adjusting the exposure to various aspects of hazards and the environment. Finally the results have been bench-marked to ensure they were anchored to reality.

> 5 2nd para., we appreciate Oboni's attempt to provide more detail in terms of the locations of 'risky' areas, however, we need to see that and more detail in the results for subdivided Stratifications in order to better understand the assumptions leading to the determination of excursion probability and consequences, and to respond to those in terms of review and adaptive design, as necessary.

This has been discussed at length in the first part of this text.

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5 Last para., Oboni is asked to review his conclusion that the mitigations proposed to date are not sufficient to bring the risks within the accidental tolerance based on: a more broader and appropriate consideration of the environmentally sensitive context of the project; a better understanding of the local topography (see Allnorth letter); reconsideration of road width issues (see Allnorth letter); and, an assumption that man-made slope and rock fall risks will be mitigated appropriately during detailed design.

We will review below.

Allnorth

We have completed a review of the recently released Risk Assessment completed by Oboni Riskope Associates based in Vancouver, B.C. On a project such as this, it is always useful to receive 3rd party review to identify possible overlooked aspects of the project.

Agreed

Though this process, objectives can be clarified and enhanced to improve the overall safety and efficiency of the project.

Agreed

In advising Canadian Zinc (CZN) through the advancement of their project, we have drawn from our past engineering and operational experience working throughout North America on similar resource projects. Specific experience of our team members includes the operation and growth of a resource transport company which operated in Western North America. This includes the management of 150 on and off highway commercial transport trucks, road construction and maintenance activities, as well as compliance with regulations on a provincial and federal level.

Received

The engineering members of our team have significant experience in the location, design and construction of resource extraction roads throughout North and Central America. This included roads in similar conditions to those that would be experienced on the Prairie Creek Mine Road. In total, Allnorth and their people have completed thousands of kilometres of resource roads for various resource activities including mining, industrial construction and forestry.

Oboni Riskope Associates Inc. Has gathered significant experience in quantitative risk assessment for linear facilities, in particular roads, highways and railroads, world-wide. Teck properties (confidential locations in US, Canada, Peru, Chile including various access roads), Antamina access road, Canadian National, Canadian Pacific,

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Union Pacific, Halsema Road (Philippines), Algerian railroads, Transgabonese railroad, Madagascar highway, Italian mountainous road network, and several stretches of highways, rockfalls along road networks in Switzerland, access road to the Cassass drainage tunnel in Italy, Balangero mine access roads (Italy), just to quote a few.

> The design specifications that have been developed and used for the Prairie Creek Mine Road are based on this cumulative knowledge and experience.

Oboni Riskope cumulative knowledge and experience shows that the past rarely equates the future, accidents are oftentimes considered impossible until they occur, especially when designers express judgments on their own designs.

> After reviewing the report, we believe there are many incorrect assumptions used to assess the risk or probability of accidents, and in respect of the severity of risks associated with construction and operation of the road system. As a result, the assessment does not properly reflect the situation related to the proposed haul road. The mistaken assumptions translate to a higher risk probability related to the hauling operation, and this is not realistic.

After reviewing all the comments above we have shown and proven that the criticisms are unfounded (there are no "mistakes or misconceptions", but margins that are absolutely compatible with the stage of design the project was on October 24th). Many criticisms tend to introduce biases and censure and finally ask for details on risks incompatible with the extant state of data. Incomplete data have been declared by CNZ to be sufficient for other important preliminary stage purposes like, for example, evaluating excavation and fill volumes and hence determining borrow-pits location and volumes. ORA-11-18 has used the same "extrapolation technique" CNZ has used so far. Thus, in compliance with the Notice of proceeding we carefully considered each single comment, and can now state that, to the best of our knowledge, none generated the need for any significant alteration of ORA-11-18 at this stage.

> Examples of mistaken assumptions include those relating to road width, discounting the applicability of forest engineering standards to concentrate hauls, and an emphasis on international accident examples (Switzerland, the Americas) that are unlikely to be suitable for comparison while discrediting local examples (Wolverine and Red Dog mine) which are suitable.

We are happy to receive opinions, and we welcome the discussion in a constructive way, but repeatedly using terms such as "mistakes", "misconceptions" and calling these "mistaken assumptions" goes a tad too far and does not correspond to a courteous professional behaviour. Calling Red Dog a comparable road to the 5m Prairie Creek road really requires a stretch of imagination (see Figure 15 of ORA-11-18, displaying a Red Dog concentrate truck on the Red Dog access road. By the way, it would be highly desirable that Prairie Creek access road will not generate the same accidents and difficulties reported by public sources for the Red Dog access -a review is offered later in this text). Wolverine has been included in ORA-11-18: The term "fell

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off the road" does not allow any precise understanding of the dynamic of the accidents or the resting position of the vehicle, no details were given on the state of the bags or their retrieval. We do not know anything about the topography at the accident scene, or the causes of these accidents that occurred mid May and mid October. The same applies to the phrase "Zn concentrate went tipped over on side".
These accidents seem however to correspond to CNZ ideas of what typical accidents would be along the road (See Section 6.1). If two occurrences of this type would occur on average (there is no way to state with any certainty that this would be the case) then Prairie Creek road could see 32 such accidents over its the service life. These accidents were certainly not the worst case scenario, and, at the other end of the spectrum, it is reasonable to believe that many more accidents occurred of lesser consequence (non reportable accidents in the Yukon). So it was not discredited.
The opinion related to examples unlikely to be suitable is void. Interested readers can refer to ORA-11-18, section 7.2, Tables 17,18 to see how they relate to Prairie Creek.

> In addition, there appears to be misconceptions regarding road design and built-in mitigations for difficult road sections, which indicates an unfamiliarity with road engineering for resource roads. We provide a description of these items below, followed by more detailed comments according to page number.

If we had not worked on numerous resource roads risk assessments we would accept your comment. Our participation in post-accidental investigations (spills, rockfall, avalanches, slides, floods) as technical experts and/or expert witnesses in civil and criminal courts (Canada, US, Chile, Italy, Peru) has certainly added to our familiarity on what happens in the real, "imperfect" world of access roads and other projects.

Probability of Accidents

> Oboni's assumptions of the probability of incidents along the haul route were based on examples of operations which are significantly different from the operation proposed by CZN. We strongly believe that the statistics from operations which exhibit similar climatic and regulatory conditions, including driver requirements, licensing and training, would better reflect an incident rate and severity which may be realized on the Prairie Creek road.

Again an opinion. We interviewed a highly skilled and respected transportation master (Northern BC, Alberta experience), drivers accustomed to driving in Forest road environments (all seasons) in addition to our own past experience. Our data support the risk assessment.

> It is referenced in Oboni's report that driver qualifications and experience are leading factors in the probability of an accident and incident. We agree with this. The regulation and training of commercial transport drivers in Canada and the United States is some of the most onerous in the world. It could be easily envisaged that the number and severity of accidents

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> in the 'Americas' (assumed to mean Latin America) are correlated with lower levels of training and controls (e.g. speed) and not comparable types of haul.

This statement shows a clear misconception on how big international mining companies operate. Some of those roads are owned, managed and regulated by a major Canadian Mining company or Canadian Joint Venture. The level of discipline and enforcement is extremely high (including substances/alcohol abuse control, speed limits enforced with radar, GPS located vehicles, engine parameters real time broadcast, etc.). Again refer to ORA-11-18 to gain some understanding related to how comparable the examples are to Prairie Creek. We are unfortunately bound by client confidentiality, so we cannot give you access to our files.

> It is unclear to us why the Wolverine (Yukon Zinc) and Red Dog examples were excluded.

Discussed above. For Red Dog, we are again bound by client confidentiality, so we cannot comment on the accidents that have occurred/occur on that road. Remember that risk is probability and consequences, so topography and all related data are important. That being said, since you asked, we have performed a quick Google search on publicly known Red Dog accidents and found the following:

http://arcticcircle.uconn.edu/SEEJ/RedDog/alaska_dec/tables.pdf reports among many other interesting facts that in 1998–1999 Red Dog switched to reinforced covers on concentrate trailers (for improved spill control).
The 40 tonnes concentrate spill related in the second link (below) occurred after this mitigation was in place. Please note also that weather conditions made it very difficult to reload the spill and the retrieval time expanded considerably.

http://peninsulaclarion.com/stories/072201/ala_072201ala0120001.shtml#.WEtFA_ArKUk
http://peninsulaclarion.com/stories/123100/ala_123100ala0080001.shtml#.WEtFTPArKUk
http://dec.alaska.gov/spar/csp/sites/reddog.htm
Truck spill sites: Since the start of the Red Dog operation, a number of truck spills have occurred. While most of the spilled concentrate and fuel was recovered at the time of the incident, data to document recovery efforts on older spills was sparse. A study characterizing these sites was completed during 2003. The operation has been implementing a program to recover, recycle, and restore/revegetate the former spill sites.

These documents clarify ORA-11-18 position on many points.

> In our opinion, these examples are more directly relevant than the examples selected. We have knowledge that the accidents reported for the Wolverine Mine road are accurate in terms of the number of accidents that occurred.

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We never said they were not accurate in terms of the number of accidents.

> We believe Red Dog is a suitable example despite the fact that it may be "flatter, less turns, wider" because the traffic is likely faster and drivers are as prone to distraction and fatigue as they would be on other roads.

That is an opinion. We have a different one and, again, those data are confidential.

> Further attributes of the Red Dog haul include the fact that the gross vehicle weights (GVW) are three to four times higher than those proposed for the Prairie Creek haul, thus increasing the difficulty of the haul from an operational perspective and discrediting the belief that it is easier due to the gentle topography and wide grade.

So, it does not make sense to use Red Dog as we would have an additional difficulty to reconcile with Prairie Creek risk assessment.

> It should also be noted that the equipment being used (e.g. those in Fig 20 and 21 and those in the 'Americas' examples) are significantly different in design and function from those proposed in the Prairie Creek Mine Haul.

Yes, they are lighter and more manoeuvrable, running on wider roads.

> The units are not designed to meet the requirements of Canadian Motor Vehicle Safety Standard and are likely not maintained to the same standard as is required by the Commercial Motor Vehicle regulations in Canada and the US.

One would be surprised. We discussed earlier the comparison we made on that fleet and Canadian equivalents.

> Therefore, based on both the technical equipment details and, more importantly, the driver training and speed controls, we would correlate the Prairie Creek Haul with the Red Dog and Yukon Zinc hauls and accident rates, and not those of operations which do not have climate, topography, culture and regulatory similarities.

And we did not because there are many other parameters we had to include in the comparison.

Road Width

> The report contains eleven (11) references to narrow or sub-standard road width. The road design specifications reflect the terrain considerations, road footprint, and traffic volume while balancing safe and efficient transportation of materials.

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That is an opinion and does not justify that the RA requiring an update.

> The standards which will be utilized in the final detailed design will conform to B.C.MFLNR standards which have been well established and proven.

Standards do not constitute an insurance that risks are under control (this is not an opinion, it is a fact reported by many sources around the world). Recently well established common practices and proven standards have brought to Mount Polley dam failure in BC, for example, as shown by the Independent Panel of Experts appointed by the B.C. MoM and reinforced by the B.C. Auditor General report.

> The proposed 5 metre width of the haul road, with some special 4 metre sections and widening out in corners to over 6 metres, is wider than a standard provincial highway lane in northern BC.

Absolutely right! But a lane is only one half or less than the whole road width and the selected code notes that 5m width does not allow for any slippage. In other words, there is no margin for anything out of "perfect" conditions.

> A typical highway lane in northern BC measures 3.6 metres from the centreline to the fog line plus an additional 0.5 metre shoulder for a total, safe operating width of 4.1 metres which provides a typical safe operating speed of 90 to 100 km/hr under appropriate alignment conditions. On a typical highway lane, the areas beyond the surface shoulder and the area to the left of the road centreline are generally not used due to the potential consequence, effectively limiting the total area of use to 4.1 metres. For the proposed Canadian Zinc Road, the width of 5 metres is well beyond the standard provincial lane width including a paved shoulder and will be operated at a speed that is approximately 1/3 the designated highway speeds. It is also important to understand that sections of the road that may be built to a 4 metre width (less than 1.1%) will have the following attributes: Widened where required (horizontal curves) to accommodate the flow of traffic and vehicle tracking. Full stabilized grade (the entire 4 m). Within these sections, blasted rock will primarily be the road base material providing a solid, compacted, and stabilized operating surface with excellent traction qualities. Incorporate further speed reduction zones to less than 1/3 of the speed which would be driven on a standard highway. Our approach is to operate at low speeds through sensitive or difficult terrain, implementing a comprehensive road maintenance program, and establishing and enforcing thorough operating procedures and controls to minimize the risk to property, environment, and life. It is not uncommon to see highways in northern B.C. with no shoulder, Highway 37 and Highway 77 for example with little to no reduction in general operating speeds. Therefore, we do not agree that the proposed Prairie Creek road normal width of 5 m is narrow or substandard.

We appreciate all this, but the point is that the 5m width (we will not even talk about the 4m wide sections) is defined by the selected standard (ORA-11-18, Figure 3) as not allowing any slippage of the vehicles.

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Road Standards and Speeds

> Oboni noted that "Slippery Condition" and "Road Speeds" are contributing factors in the occurrence of off road excursions. This relates to the probability and the severity of such incidents, as mentioned in Oboni's cover letter. The design of the road and the operation is based on implementing standard controls to reduce either the severity of the incident if it is to occur, or preferably the probability that it will occur, to an acceptable level.

ORA-11-18 bears precisely on the risk evaluation (probability, consequences) and how it compares to the accidental tolerance defined in IR#2 Question 8 reply.

> Allnorth anticipates the use of both engineering and administrative controls which will reduce the frequency and severity of accidents, providing for a lower overall number of accidents and risk. Many of these controls have been indicated in our submissions and many are standards within the industry, and/or minimum regulatory requirements. Oboni refers to excessive speed or 'bravado' as a significant factor in road accidents. This occurrence is very unlikely on the Prairie Creek road for a number of reasons, primarily of which is GPS tracking and the recording and review of time cards. Also, there will be road monitors and supervisors spot checking speeds. For the most part, trucks will travel in convoy and speed differential will not be possible. As such, there will be no incentive to speed, on the contrary, there will be administrative penalty if it occurs.

All this is very good and it is standard on the roads and for the specific class of traffic we have used as examples.

Administrative Controls

> Administrative controls will be implemented focussing on drivers, with the proven expectation that these will reduce the probability of a negative occurrence. Specific controls that will be in place include; Driver Training – All drivers on the haul will complete on-site training, including the identification of hazards at specific areas along the road. Seasonal two-way signage - Utilized to accentuate areas of specific risk or hazard. Standard Operating Procedures e.g. travelling in convoys, two way radio use, mandatory chain up based on road conditions, speed zones, no stopping areas and stipulated separation distances.

All this is very good and it is standard on the roads and for the specific class of traffic we have used as examples. We are very proud of having fathered a number or Risk Based Standard Operating Procedures for mining access roads that have become "common practice" in the industry in Andean countries (developed and applied for/by major Canadian mining companies).

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Engineering Controls

> There are two important misconceptions in Oboni's report that directly relate to the probability of excursions. The first has to do with the road surface. Oboni refers to slippage or loss of traction on wet, muddy roads. It is important to note that the Prairie Creek road will have a gravel surface.

Maybe a gravel surface on the first year, but in our experience gravel gets contaminated by all sorts of factors during the life of such a road. Again a "perfect world" conception.

> The entire road surface will be finished with a crushed rock road surface which will provide significant traction in dry and wet conditions. In winter, this will be further supported through the use of a crushed rock gravel/ sand material to provide additional traction, with the use of tire chains as necessary.

See above

> The second misconception is that trucks could 'slide-off' the road surface and roll down an embankment. The road surface will be suitably sloped inwards so that any loss of traction will result in arrest in a perimeter ditch or against the inner slope.

"Perfect world" conception again. This type of accident is typically included in Consequence Class 1. There are numerous cross sections in the public record that do not show any ditch.

> In terms of the 4 metre road width, 4 sections amount to 2.1 kilometres of the proposed 180 kilometre road (1.1 %). Road designs were completed on all identified critical/unique terrain areas, so no additional 4 metre prescriptions are expected.

Thank you for this clarification.

> There will be an opportunity to reduce the total 2.1 kilometre length significantly during the detailed design stage. Also, the length could be reduced further by incrementally widening any curvature with a radius less than 180 metres to allow for proper tracking of longer truck configurations. The net result of these refinements could reasonably reduce the total 4 metre wide prescription to 1 kilometre or less.

Thank you for this clarification.

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Application of Forest Engineering standards to concentrate haul.

> The Oboni report questions the applicability of Forest Engineering standards to this type of concentrate haul. Many truck configurations used in forestry, particularly the BCL-625, are based on the Super B style configuration and maximize operating weights at 63,500 kg as per MOT standards (CL-625). It should also be noted that logging trucks have a considerably higher centre of gravity compared to concentrate trucks, and travel at considerably higher speeds. Further, the traffic volume experienced on a standard forestry operation would be similar or greater than the proposed volume on the Prairie Creek haul plus greater component of public and other industrial road users. Also, many forest operations experience high intensity traffic for a shorter duration of time. The intensity of use could be up to ten times that of the prescribed Prairie Creek operation. Therefore, not only do we believe that the forest engineering standards are suitable for the concentrate haul, we consider them to be very conservative and carry an expectation of greater safety and a lower probability of accidents on the Prairie Creek road.

Once more: risk is probability times consequences. The reasoning above is an opinion on probability, but spilling concentrates instead of scattering logs is a rather different story. As publicly reported, Red Dog has a program for restoring the environment at road accident spill sites.

Man-Made Cuts

> Oboni makes frequent reference to man-made cuts in their report, and imply potential for risk. The comments also suggest that there will be a propensity of large cuts. In actuality, a total of 18 cuts are planned of various lengths and sizes (see the attached table and cross-sections). It is our expectation that CZN's geotechnical engineers will have input into cut slope design and any associated control requirements such that risks will be minimized.

Understood and appreciated. We have copied below the Table of Appendix A (Dec 5th) and a particular cross section.

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Appendix A

Proposed Cuts - Prairie Creek Mine Access Road

Section	Length (m)	Road Width (m)	Construct. Type	Cuts (m)			Cut Slope Angle run:rise	Comments
				Min.	Max.	Avg.		
5.71 to 5.78	70	5	I	1	4	2.5	1:1	Minor cut prescibed on upslope side of road. Expect gravels/fragmented rock. Gabien baskets may be utilized. .
13.07 to 13.35	280	5	N/A	2	16	8	1:1	Cut through expecting gravels/fragmented rock. Gabien baskets may be utilized.
13.41 to 13.6	190	5	N/A	2	8	5	1:1	Cut prescibed on upslope side of road. Expect gravels/fragmented rock. Gabien baskets may be utilized.
23.36 to 23.44	80	4	N/A	2	5	3.5	0.25:1	Through cut prescibed. Expect fragmented/solid rock cut.
23.53 to 23.61	85	4	N/A	2	12	9	0.25:1	Through cut prescibed. Expect fragmented/solid rock cut.
25.21 to 25.33	120	4	III	1	7	5	0.25:1	Through cut prescibed. Expect fragmented/solid rock cut.
25.42 to 25.5	80	4	III	2	9	6	0.25:1	Through cut prescibed. Expect fragmented/solid rock cut.
30.0 to 30.02	20	5	IV	0	6	3	1:1	Minor cut prescibed on upslope side of road. Expect gravels/fragmented rock. Gabien baskets may be utilized.
35.17 to 35.22	50	5	N/A	0	10	4	1:1	Cut prescibed on upslope side of road. Expect gravels/fragmented rock. Gabien baskets may be utilized.
35.64 to 35.75	110	5	N/A	0	10	6	1:1	Cut through expecting gravels/fragmented rock. Gabien baskets may be utilized.
36.51 to 36.58	70	5	N/A	0	10	6	1:1	Through cut prescibed. Expect fragmented/solid rock cut.
36.66 to 36.76	100	5	N/A	0	10	6	0.25:1	Through cut prescibed. Expect fragmented/solid rock cut.
36.9 to 37.1	200	5	N/A	1	10	7	0.25:1	Through cut prescibed. Expect fragmented/solid rock cut.
37.1 to 37.26	160	5	N/A	0	12	6	1:01	Cut prescibed on upslope side of road. Expect gravels/fragmented rock. Gabien baskets may be utilized.
49.91 to 49.93	20	5	VII	1	5	2.5	1.5:1	Minor cut prescibed on upslope side of road. Expect sand load type material. Gabien baskets may be utilized.
50.0 to 50.06	60	5	VII	2	5	3	1.5:1	Minor cut prescibed on upslope side of road. Expect sand load type material. Gabien baskets may be utilized.
80.3 to 80.41	110	5	V	2	4	3	1.5:1	Minor cut prescibed on upslope side of road. Expect sand load type material.
98.8 to 98.9	100	5	X	2	7	4	1.5:1	Cut prescibed on upslope side of road. Expect sand load type material.

The minor cut described at km 80.3 to 80.41 is declared to be in Stratification V, documented to date, as far as we have understood, by a segment Stratification V, km 88-89 from the Allnorth May 10th report, which was supposed to be representative of the whole segment.
We note however that Dec 5th letter and May 10th report seems to contain Stratification V limits (km 86.3 to km 90.3) which are in conflict with the table above.

We would welcome a clarification related to the existence of the cross section below, copied from the Dec 5th letter and in particular the double labelling of the location (80.3-80.41, compatible with the table above) and the Sta 88+340 appearing on top of the cross section (which would be compatible with May 10th Stratification V).

We note that this new information does not substantiate that the RA requiring an update since the cross sections are indeed necessary to determine the Consequence Class, but the likelihood of off-road excursion is evaluated using the longitudinal profiles and plan views.

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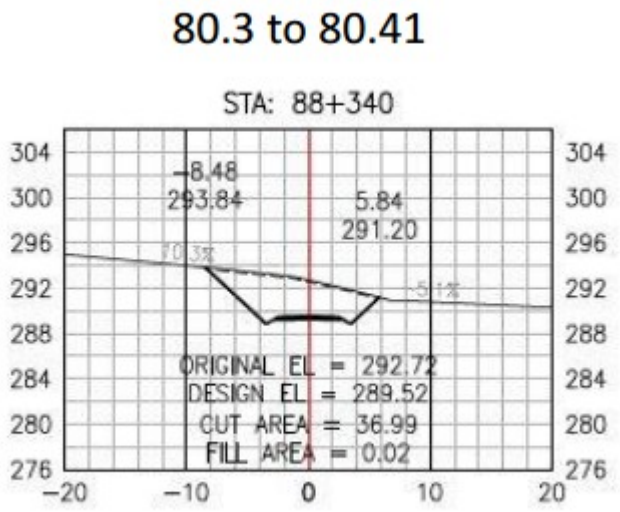

Additional Comments Regarding Cover Letter dated November 30, 2016.

> Page 2, Last paragraph. Page 3, 3 rd and 4th paragraph. Reference to narrow road base that cannot accommodate barriers, if required. Our submissions stated that, at this stage of planning, the use of barriers is not foreseen, however they could be considered during the detailed design stage if it is determined to be beneficial. If barriers are required, then one option is to expand the road width to accommodate them. A standard jersey barrier is 0.61 m wide. This approach is consistent with standard resource operating rules and guidelines.

Again, as stated earlier, hiding behind "business as usual" and codes is not a good medicine for risk management, when dealing with hauling concentrate along water courses. Hundred years ago the mining industry used to dump tailings in the rivers. We do not do that (voluntarily) anymore. Our road safety experts at http://www.eurosain.org/ (a Riskope division devoted to road safety) are unanimous in stating that Jersey barriers (even with proper foundation and continuity cable) would be inefficient in avoiding an off-road excursion of the concentrate vehicles. Thus other solutions (berms?) should be envisioned. Along some creeks and watercourses the increase of width would generate other problems and would not solve (unless specific measures are taken) the foundation problem of the barrier.

> Other, narrower, options include steel or cable barriers. Therefore, it is not accurate to say that barriers are not feasible.

See above.

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> Page 2, Cross section example. The summary utilizes one cross section located at 36+900, and, by this single example, could leave the reader to believe that this is common place or a normal representation of the road. However, this cross section represents a "worst case" scenario and very small component of the road. This particular cross section was extracted from an earlier submission and does not reflect the latest, updated preliminary design. Note also that the vertical scale is exaggerated. Refer to the expected cut cross sections which accompany the attached table in Appendix A.

Yes, right. Indeed we extracted that figure from May 10th submission, replaced by Aug. 17th one in that segment. We would be delighted if you provided the public record with the latest version of each Stratification (drawings showing plan view, longitudinal profile and cross sections, topography, watercourses, etc. and related date), and a list of submission documents references that include those latest version of each stratification. That would allow to perform a check to ensure that there has been no significant version mismatch.

> Page 3, 4th paragraph, Page 5, 3rd paragraph 3rd bullet. References such as "no U turn design", "so called Special Sections" and "lack of cross sections", implies uncertainty in designs. We provided preliminary road designs for representative portions of terrain and construction situations within the whole road length. These sections were identified by field investigation completed by 3 senior road location/construction specialists over a combined period of one month, summer and fall seasons, both on the ground and using intense low elevation helicopter reconnaissance. Within our responses to Information Requests, we identified the sections which are considered greater risk due to terrain considerations, road grades, and design. There are no additional sections providing a level of uncertainty not represented by the provided road designs. It appears to us that, since Oboni did not visit the site, they are finding it difficult to cross reference the provided road designs with the available LiDAR contour data and orthophoto imagery, and thus derive satisfaction that the difficult road sections have been designed accordingly with appropriate mitigation. It would likely be of assistance to Oboni if Allnorth provided additional drawings showing imagery for the difficult mountain section between km 6.5 and 28.8 with cross references to the designs. This could be provided in approximately 1 week. "U" turns, to be located at approximately 10 km intervals along the route, are considered to be a minor issue. These are typically adopted as the road design process progresses, and existing disturbed areas such as borrow pit access roads would be utilized.

It is difficult to understand why this proposal to deliver more information comes only after the RA was completed, as there were ample opportunities to deliver more material earlier based on our repeated requests.

> Page 4, 2nd paragraph. "Minor (of little concern, but may be the "seed" for more critical accidents as getting used to small recurring events, not adjusting to act on them, will lead to catastrophic events)". Again, this implies a lack of understanding of modern transport management systems. Such systems include review and adjustment for any type of concern,

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> no matter how little, such that the idea of accepting such a situation without adjustment is incomprehensible.

The statement corresponds to reinventing the whole accidental event theory in one statement. Most accidents do occur because of normalization of deviance, even in highly controlled and scrutinized situations. The problem is that, may be, we understand very well what happens in the real world after more than two decades of risks assessments in all industries, from mining to (mining) transportation, supplying, machinery, construction and even chocolate makers (see references earlier).

> Page 4, Last paragraph. With reference to "Residual risks could be brought to accidental tolerance level if detailed analyses of mitigations is carried out and mitigations are then implemented and monitored", in the first instance, as explained above, the presumption that residual risks exist is a function of incorrect assumptions. In the second instance, the described process is a standard element of the detailed design process.

First instance: Residual risks are by definition the risks that are still present after mitigation to a certain level (defined by the tolerance threshold). The presumption they do not exist, i.e talking about zero risk, a notion that is purely theoretical is delusional in the real world.
Second instance: absolutely right, but experience shows that, again, flaws are introduced at inception of many projects.

Additional Comments Regarding Report dated November 18, 2016

> Page 22, 23, 135: "The priority risks to consider/manage are those deriving from the systemic mechanisms described in the prior point. The audacious interpretation of codes developed for other traffic (forestry vs. Concentrate cargo) has lead to select a unforgiving road base width which generates risks that should be considered and managed as a priority, at least in environmentally sensitive areas".

Yes, we wrote that and we stand by that statement.

> Page 36: "specifications of Table 2 constitute a selection of the flexible rules defined by B.C. Ministry of Forests, Lands and Natural Resources Operations Engineering Manual for average conditions on forest roads where vehicles are generally lighter, not as complex (Super B double trailers, as discussed in Section 1.2.2) and cargo is wood (not concentrate or hazmat) as considered in this project". There is a misconception that road design standards developed primarily for "forestry" operations are not necessarily applicable to concentrate hauling.

Yes, we have noted there is disagreement on this. The point is that from a consequence point of view wood does not equate concentrate.

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> During the last two decades, the majority of Highway log hauling truck configurations (BCL-625) are comparable to the "Super B" style trailer configurations. This was a result of most modern sawmills preferring shorter logs and the efficiency of super B style trailers. The majority of delivered loads in forestry operations do operate at maximum legal axle loading (to maximize efficiency). In the case where "off highway" forestry operations exist, operating loads are much higher (90,680kg to 149,700kg) than the 63,500 kg limits imposed by MOT. Another consideration is the operating height of the vehicles. The typical log hauling configuration operates at a maximum allowable height of 13'6", whereas the proposed concentrate trailer height is slightly greater than 10'. Consequently, the load "centre of gravity" is much lower for concentrate. Also, shorter double trailers navigate bends more easily and safely than a larger single trailer. Therefore, we believe the road design standards within the BCFLNR are applicable and are conservative for mine haul roads.

But the point remains that the code was designed for a load that, when spilled, would have different consequences.

> Page 23, 135: "Climate change is certainly a major one which could alter the number of "slippery road" days, avalanche patterns and drainage, flooding, etc. Given the statements related to JMS, and preventative road closure approach, climate change could, in the negative effect side, cause more closures. The obvious reaction would be to increase traffic to "make-up the missed days" as soon as the conditions allow. There would then be an increase of rotations, but not an increase of the total number of loads. During that period the "one way haul" concept may not work, and colliding trucks accidents, not considered in the study, could occur, on top of low speed off-the-road excursions, if pullouts are not exclusively used. It is hard to see that such conditions would alter in a significant way the results of the study, but should conditions significantly deviate, a reassessment should be performed." Given the length of the road and the proposed traffic volume, if it became necessary to increase the total number of trucks temporarily, the road operations would still be well within the operating capacity of the road. It is our opinion that potential incidents would not increase as a result of an additional number of trucks.

An opinion again, but usually additional traffic per day on a road increases the likelihood of a mishaps.

> Page 31, 58: For locations with high consequence event potential, the approach taken is that operating speeds will be set accordingly, greatly reducing the probability of a "high consequence" event. This approach is applicable to 4 metre wide sections, horizontal or vertical alignment restrictions, bridge crossings and environmentally sensitive areas. The language used may lead the reader to believe a "high consequence" event will occur at a greater probability than what is likely. The approach of reducing speeds in these areas will actually significantly reduce the probability of these occurring, and the severity of the potential incident.

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We have already discussed this.

> Page 33: For 4 metre wide sections and bridge crossings, the design standards applied conform with the BCMFLNR Engineering Guidebook and within the parameters defined in the "Single Lane" category identified in "Oboni's Table 1".

The correct row to look at in ORA-11-18 is Table 1 is the second, for combination vehicles (look at note 10, for a definition).

> Also, in our extensive operating experience, we cannot recall any significant accident occurring at a crossing.

Irrelevant in the Risk Assessment as discussed in ORA-11-18, under the assumptions and conditions.

> Page 34: "We note that 5m or 4m wide running surface with no shoulders correspond to a narrower effective road, in particular with respect to the selected slopes of the fills." See our previous comments re road width and reduction of 4 m wide sections. Regarding close proximity (tight) or parallel to streams, only one section (KP 5.36 to 5.48) has a 4 m wide running surface. This section is located within a 65 m radius curve. In this situation, the final design would incorporate a 5.8 m wide surface to accommodate trailer off-tracking.

OK, thanks for the added details.

> Page 52: "for the sake of this study we will consider the following "general" speeds: 30km/h on average with typical speed of 40~50 km/h and max of 60km/h in some sections for the concentrate and other heavy traffic." Based on detailed calculations completed in Allnorth's Transportation Study, the following is considered more definitive: Average speed loaded 34 km/hr summer, and 31 km/hr winter Top speed loaded 40km/hr Top speed empty 50km/hr In prescribed (difficult/sensitive) sections, top speed loaded 20 to 35 km/hr.

OK, thanks for the update.

> Page 61: "In the Alps accidents have occurred due to climate change where bridges have been blown away during flash floods" Hauling operations will not be conducted during major weather events, and inspections would be undertaken prior to operations continuing. Again, the language suggests a "high consequence" event will occur, which is unnecessarily alarmist and unlikely.

Sorry the end of the statement was not read. It states: " As it has been specified that traffic would not be running during severe weather, hence flooding events, it is considered that bridges will be present at all time vehicles have to cross them. Business interruption is not part of the scope of this study." So there is nothing to be

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alarmed with, but that type of accident would occur if traffic was not stopped for any reason (judgment, error, stress, pressure, etc.).

> Page 62: "dust represents a major safety hazard to the vehicle operator in that it can become so dense that visibility is severely reduced. When subjected to heavy wetting, non stabilized earthen roads become extremely slick and may be severely defaced by erosion. Thus, reduced vehicular controllability from a slippery surface creates a safety hazard" Dust is a controllable hazard during the limited dry periods in summer. Operationally, trucks will be spaced out accordingly to minimize visibility issues. Dust suppression would only be sufficient to wet the surface. The all season road will be surfaced with an appropriate quality and quantity of gravel material. Non-stabilized earth roads will not be used.

Thank you for this clarification and the explanation related to spacing the convoy. What will be the distance you consider reasonable to avoid visibility problems?

> Page 83: "If two occurrences of this type would occur on average (there is no way to state with any certainty that this would be the case) then Prairie Creek road could see 32 such accidents over its service life. These accidents were certainly not the worst case scenario, and, at the other end of the spectrum, it is reasonable to believe that many more accidents occurred of lesser consequence (non reportable accidents in the Yukon)." This statement is un-verified supposition and should be deleted. As noted, our direct knowledge is that the two occurrences were all that occurred on the Wolverine access road, and they were not high consequence events. JMS procedures for Canadian mines require all incidents to be reported.

In order to be constructive one should support this criticism with the full record of losses of the Woverine road, full road design and topography, traffic description and trucks descriptions. Then a comparative study would be made and then we could decide whether Wolverine history is indeed "comparable" to Prairie Creek future. Certainly a useful exercise. That's exactly what we did when selecting the Road 1,2,3 examples to benchmark ORA-11-18 risk assessment results.

> Page 87: "skilled truck drivers interviewed during the development of this study have confirmed it is rare to see a truck accident where the truck does not turn on its side or capsize". The report identified a 1:3 probability of a roll over or capsize. Literature provided by the BC Safety Authority confirms that statistic ("Overview of Forestry Truck Crashes in BC" BC Forest Safety Council, October 20, 2005). Oboni should use reliable statistics and avoid "hearsay".

Roll-over or capsizing: Thank you for confirming that through a independent source. We really appreciate this cooperating attitude.
"Hearsay": In our professional practice we always include witnesses, reputable professional point of view and integrate those "voices" with literature and/or mathematical model in compliance with the ORE methodology flowchart (refer to ORE

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reference earlier in this text for the flowchart). In many cases oral tradition by inhabitants, ancient sayings and wise local individuals have contributed to understanding situations that were not easy to grasp (Canada, Switzerland, Italy, Bolivia, Laos, for example).

> Page 96: "Let's also note that reportedly the Red Dog mine access road does not have any comparable feature to Prairie Creek access road (flatter, less turns, wider) and could not be used as a comparison." Statistics from mines operating in the Americas are not considered to be suitable for comparison because they operate under different regulatory rules (reduced operating standards) and geographic conditions.... followed on page 10 by ...We believe the Red Dog and Wolverine mine operations provide a better representation of the Prairie Creek mine operation.

Now we are confused. Earlier it was stated that Red Dog should be used as an example, now it is stated it is not suitable for comparison, but then it is. Could we get a clarification?

> Page 10 In summary, the Oboni report contains many incorrect assumptions and therefore the risk or probability of accidents is over-estimated. As a result, the assessment does not properly reflect the situation related to the proposed Prairie Creek haul road, and is not realistic.

Well, we have demonstrated by replying point by point as requested by MVEIRB that ORA-11-18 used defensible and reasonable assumptions applied to the existing pertinent data on the public record.
The results are anchored to reality using a bench-marking process and therefore cannot be considered over-estimated. Thus, at the present stage of development and available information, the risk assessment does reflect the situation of the project in a realistic way with reasonable margins and uncertainties.

Conclusions

Our reply to MVEIRB Notice of Proceeding is therefore as follows:

1. There are no errors of fact identified in CanZinc's letter that would modify or change the risk assessment findings and conclusions, based on the information available at the time of preparation of the Risk Assessment Technical Report (i.e. October 24, when responses to second round information requests were submitted);

2. The consideration of new evidence outlined in CanZinc's letter does not change the findings of risk.

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As described in the text above, should a consensus be reached that environmental sensitivities or any other key parameter are significantly different than those stated in ORA-11-18, then it will be time for an update that will then be, again, unbiased, uncensored, consensus driven and ethically correct.