

**From:** "David Harpley" <david@canadianzinc.com>  
**Subject:** Fwd: RE: Y14103320-01 Prairie Creek, Clarification for DAR content  
**Sent date:** 05/31/2015 05:21:37 PM  
**To:** "Sachi De Souza" <sdesouza@reviewboard.ca>  
**Cc:** "Alan Taylor" <alan@canadianzinc.com>

FYI

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----- Forwarded message from "Kors-Olthof, Rita" <Rita.Kors-Olthof@tetratech.com> -----

Date: Sun, 31 May 2015 23:23:28 +0000  
From: "Kors-Olthof, Rita" <Rita.Kors-Olthof@tetratech.com>  
Reply-To: "Kors-Olthof, Rita" <Rita.Kors-Olthof@tetratech.com>  
Subject: RE: Y14103320-01 Prairie Creek - RE: Clarification for DAR content  
To: "David Harpley (david@canadianzinc.com)" <david@canadianzinc.com>  
Cc: "Alan Taylor (alan@canadianzinc.com)" <alan@canadianzinc.com>, "Jones, Kevin" <Kevin.Jones@tetratech.com>

Hi David,

As requested, I have checked CZN's DAR and Allnorth's report for consistency with ours, based on a keyword search in the DAR, and a search for items that I discussed with Allnorth for their report. I did not do an exhaustive read-through. I have noted a few differences as listed below, but none of these seem insurmountable.

- CZN's excerpts from our text appear to be almost without exception copy-pasted. On p. 276 of the DAR, there is a short section not copy-pasted but a summary, which I have marked with callouts as to the items referenced.

**CZN's summary in these 3 paragraphs**

geotechnical design parameters in any case, irrespective of the anticipated absence or presence of permafrost. This is likely correct, as long as the reduction in permafrost isn't also associated with too-high moisture contents or ponding water that makes access difficult.

Mitigations and site-specific contingencies are discussed in Tetra Tech EBA's report. Tetra Tech EBA also considered short-term climatic and extreme weather events in a risk analysis. Regarding changes in permafrost and how it will affect the amount the granular material, a reduction in permafrost would only render defined granular sources more viable in terms of suitability for use. That said, Allnorth has defined numerous potential borrow sources, and categorized them into 'intended for use' and 'back-up'. Therefore, no shortage of borrow sources is expected.

The potential for subsidence to affect the road relates primarily to karstification and the Ram Plateau. Tetra Tech EBA covered this item in their report (Appendix 2), and it was considered in Section 10.10 above.

Risks from fires are discussed in Section 13 below.

primarily in discussions re sinkholes for road sections:  
KP024.3 to 28.3,  
KP048.8 to 58.6,  
KP058.6 to 80.3, and  
KP095.7 to 101.7

Not described specifically in those terms, but we did consider all the items MVEIRB wanted reviewed in the risk analysis, e.g. flooding, based on hydrotech findings, contours and likelihood of ice-jamming (where known); overland flow; slope instabilities as related to precipitation or flooding.

In general, CZN's summary is consistent with our observations and recommendations.

Tetra Tech EBA and Allnorth had some detailed discussions about the design and construction implications of permafrost along the route. Allnorth's permafrost summary is therefore generally consistent with our permafrost-related observations and the intent of our recommendations. For one item in this section, on p.47 of their text (p. 56 of Appendix 1A pdf), however, we would be more inclined to emphasize the need for site-specific design, rather than suggesting "typical" cut slopes:

5. The "Northern Land Use Guidebook" suggests steep cut slope on permafrost terrain. The theory behind this approach is to minimize the initial mineral soils exposure and disturbance thereby potentially reducing the short term thawing of permafrost. However, with this approach it is expected there will be additional longer term maintenance of the ditches and cross drainage culverts as the slopes settle to a natural stable state during the thawing process. Generally this report reflects this approach with typical cut slopes at 1:1 or steeper however a final design and approach will also reflect unique site and soil conditions.

Site-specific details on soil types and ice content would be collected prior to detailed design and used to confirm the proposed cut slope angles. The design would also allow for permafrost if present, including mitigation of exposure and thawing which may not stabilize. Allnorth have retained the intent that the configuration will be fine-tuned during detailed design, which is good.

Similar text appears on p. 10 of the Allnorth report (p. 19 of pdf), in the general discussion of road construction techniques, as shown below. Again, they have retained the intent that the configuration can be fine-tuned during detailed design. We have clarified in our own text INAC's specific guidelines and augmented it with TAC 2010 possibilities, along with some cautions regarding site-specific conditions.

To minimize impacts related to permafrost, the standard approach taken regarding the cut slope angle will be 1:1 with some variability depending on soil type and site conditions. This approach is intended to minimize the initial mineral soils exposure and disturbance, thereby potentially reducing the short term thawing of permafrost. It is expected that there will be a need for longer term maintenance of the ditches and cross drainage culverts as the slopes settle to a natural stable state and the thawing of any permafrost stabilizes.

There are occasional references in Allnorth's report, some of which have been transcribed into CZN's report, to fill or corduroy as "insulation," e.g. on p.234 of CZN report. We would like to emphasize that the primary intent of these materials is not as insulation, nor would they necessarily help to prevent or reduce permafrost thaw. We anticipate that appropriate use of fill-only construction and corduroy will be a cost-effective way to help reduce disturbance to or flexing of the subgrade, and mitigate the effects of thaw, including possible differential movements in the road grade or TTF pad. The design of embankment fills, with or without corduroy, would need to be based on site-specific information. We've addressed these ideas in general terms in our mitigations section, which has been imported into the DAR.

For the design of cut slopes and fill slopes, Allnorth refers to the BC Ministry of Forests, Lands and Natural Resources Engineering Handbook, excerpts of which they have inserted in their report. Some of the suggested cut slope and particularly fill slope angles may be somewhat steeper than what we would usually recommend for long-term stability. In our conversation, Allnorth noted that any significant or consistent flattening of proposed slopes may have an effect on the necessary ROW width, thus affecting total disturbed area. We agreed that sliver fills should be avoided, and that there might be sections that could benefit from additional toe support to limit fill extents. Again, the necessary slope configurations are to be determined on a site-specific basis during detailed design.

"Overburden" has been defined in our respective texts as material that is considered to be unsuitable within the road grade, but there is some variation in what should be considered "unsuitable" aside from organics and woody debris. Specific material types constituting "unsuitable" materials would be identified along the route during detailed design, as this will vary somewhat according to location along the road, as well as the use for which they are proposed.

We believe that these and possible other differences in the texts can be addressed by specifying that the Tetra Tech EBA report governs on permafrost-related questions. For other items that do not necessarily correspond exactly between Tetra Tech EBA's report, Allnorth's report and/or the DAR, we anticipate that such items can be easily reconciled during detailed design, for example, such items as fill/cut slope angles, or precise road locations, or what exactly constitutes "overburden" at any particular road section. If there are still questions that cannot be resolved, then the team would be pleased to respond to those questions.

Thanks,  
Rita

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