Parks Canada Parcs Canada

June 30, 2010

Chuck Hubert & Paul Mercredi
Environmental Assessment Officers
Mackenzie Valley Environmental Impact Review Board
#200 Scotia Centre
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Via email: *chubert@reviewboard.ca*
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Re: EA0809-002, Prairie Creek Mine, Canadian Zinc Corporation: Information Requests

Parks Canada is pleased to provide the Mackenzie Valley Environmental Impact Review Board (the Board) with information requests in response to the Developer's Assessment Report submitted by Canadian Zinc Corporation (CZN) to the Board. Our information requests arise from our review of the following documents submitted by the consultant to the Board:

- Developer's Assessment Report (March 2010) and Appendices,
- Developer's Assessment Report Addendum (May 2010), and
- Aquatic Effects Monitoring Plan (June 2010).

Our interests in the review relate to the identification and evaluation of the effects of the project on Nahanni National Park Reserve of Canada (NNPR).

Please note that when possible we have referred to information requests from other parties, where their requests reinforce or complement ours. We hope this will assist the Board in reviewing our requests.

Canada

We look forward to receiving CZN's responses to the requests as part of the ongoing review of this project. If you have any questions, please feel free to contact Wendy Botkin at (204) 984-1152 or Katherine Cumming at (204) 984 -1929.

Sincerely,

Chuck Blyth
Superintendent Nahanni National Park
Parks Canada

Cc Alan Fehr, Parks Canada
Rob Kent, Superintendent, NNPR, Parks Canada

Information Requests related to Vegetation and Wildlife

IR Number: Parks_Canada_1
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Vegetation reclamation and invasive species assessment
References: Appendix 17
Terms of Reference Section: 3.2.4, 3.3.3 (4)

Preamble:
As suggested by Section 3.2.4 of the Terms of Reference, the DAR briefly considers what the existing (baseline) vegetation is relative to pre-development. In particular, a number of contentions about vegetation are made that are testable:

(1) 63 km of old access road has re-vegetated naturally since the 1980s (Appendix 17, page 42);
(2) Invasive alien plant species are not thought to be an issue (Appendix 17, page 44).

Unfortunately, no evidence is provided to substantiate these claims. The current status of the road as "naturally reclaimed", having not been used by heavy traffic in over 25 years allows for an assessment of reclamation rates in various vegetation types. This information is important to help us assess the potential significance of impacts of the road on vegetation and wildlife habitat after reclamation. If invasive alien species are present on the road from previous use, there is a potential for significant effects if the species is further spread through the proposed development. This information also provides evidence as to the potential risk of introducing alien plant species through the new use of the road and could indicate a need for stronger mitigation measures and a more hands on approach to reclamation.

Request:
1. To assess reclamation potential, describe a study design and when Canadian Zinc Corporation will collect information on the status of re-vegetation of the former access road within NNPR to natural species; particular attention should be given to Riparian Alluvial, Black Spruce Muskeg, and Aspen Liard Floodplain communities (as described in Section 3.1.5 of Appendix 17) – owing to concerns about the effects of altered drainage on these particular vegetation communities.
2. To assess the potential for invasive plant species, describe a study design and when previously disturbed sites within will be sampled for invasive plant species.
3. Assess the costs and benefits of mitigation measures to prevent introduction of viable propagules of invasive species from trucks and road equipment (e.g., vehicle cleaning station – see wheel wash description in Section 4.3.1.3.4).
4. Describe natural reclamation relative to various vegetation communities and discuss which types may require additional reclamation efforts. Outline the benefits and detrimental effects of active reclamation in these vegetation types.

IR Number: Parks_Canada_2
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Road routing impacts on vegetation
References: DAR 4.8, 4.9, 9.4, Appendix 17
Terms of Reference Section: 3.2.4 (8 & 9), 3.3.3 (4b), 3.3.6 (1a & 1b)

Preamble:
The DAR's information on vegetation has deficiencies. Vegetation work from the early 1980's is relied upon extensively for this report. Surveys are limited and out of date. Vegetation mapping completed in the early 1980's concluded that 12 vegetation communities are encountered along the access road, yet this was based on a total sample of 14 transects. This is nearly 1 transect per community which is clearly insufficient; more sampling would have likely yielded more and may have better defined rare or important vegetation community types. Additionally, since the original surveys natural variability (e.g. fires) have significantly altered many vegetation communities. Unfortunately, recent (EBA 2009) vegetation work only focused on detecting of rare species on the existing roadway, not providing an update to the dated mapping nor assessing communities that may be encountered along routing alternatives.

Although there may be some actions that can mitigate impacts to vegetation, potentially significant effects are best mitigated through proper routing of the access road at the environmental assessment stage. There was no consideration of unique or important vegetation (vascular and non-vascular) communities that may be encountered on the proposed alternate routes. Furthermore, there was no evidence to demonstrate that the current route was better or worse than other routes for mitigating potentially significant effects on rare vegetation communities or species.

Request:

Describe and compare the potential impacts on vegetation of the proposed route with other potential routes.

IR Number: Parks_Canada_3
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Road routing impacts on wildlife
References: DAR 4.8, 4.9, 9.4, Appendix 17
Terms of Reference Section: 3.2.4 (8 & 9), 3.3.3 (4b), 3.3.6 (1a & 1b)

Preamble:
Woodland caribou (Boreal and Northern Mountain ecotypes) have been indicated as a species listed under Schedule 1 of the Species at Risk Act (SARA) that uses habitat within the EA Study Area. Additionally, wolverine and grizzly bear occur throughout the EA Study Area and are considered wildlife-at-risk. Finally, moose, Dall's sheep, and beaver have been indicated as key harvested species by the Terms of Reference that should be given special consideration.

The DAR's information on wildlife has significant deficiencies. Wildlife work from the early 1980's is relied upon extensively for this report. Surveys are limited and out of date. Wildlife communities, populations, and behaviour are more susceptible to change than vegetation communities and vary within and among years. Consequently, the baseline data from 1980 and 1981 are of limited use except as a historic point of comparison for current and future conditions. A 1994 RES report is cited but little information is provided on the nature of the survey. Within the past 15 years the wildlife survey work in the area has consisted of a one day road survey in June 2006; a one day aerial reconnaissance in April 2007; and a two day survey in 2009 during which the mine site and access road vegetation and wildlife were evaluated from either helicopter or all-terrain vehicle. As such, only one survey (April 2007) captures the winter period when road use will occur, and the consultant's report suggests results from that survey only captured tracks made between April 3-7 due to wind conditions and snow drift. The survey conducted in June occurred at the peak of calving and lambing for most ungulate species and coincides with the hiding phase for most species, thus making observations difficult. The last survey described in Appendix 13 (July 2009) was not designed to detect wildlife species and can be best described as incidental observations of wildlife sign (e.g. vegetation browse, feces, or tracks) encountered at several vegetation plots and transects. In the EA Study Area, Woodland caribou, wolverine and grizzly bear are considered wildlife-at-risk, while moose, Dall's sheep, and beaver have been indicated as key harvested species by the Terms of Reference. Clear, adequate, defensible, and current information is needed for these species to inform decisions on potential significant effects.

Although there may be some actions that can mitigate impacts to wildlife, potentially significant effects are best mitigated through proper routing of the access road. For example, the frequency of truck travel along the winter road will be high and if there is wildlife habitat of value adjacent to or intersecting the road, there could be significant negative effects on wildlife. There was no evaluation of the varying degree of effects expected to occur on wildlife from the proposed alternate routes relative to the existing route. Furthermore, there was no evidence to demonstrate that the current route was better or worse than other routes for mitigating potentially significant effects on wildlife.

Of particular importance, the impact of the proposed alternative and existing routes on at-risk or key harvested species has not been considered. Specifically, Woodland Caribou (Boreal and Northern Mountain ecotypes) are a species listed under Schedule 1 of the SARA that use habitat within the EA Study Area. As stipulated in 3.3.6 of the Terms of Reference, any species listed under Schedule 1 of the SARA must be identified and any adverse impacts of the development on them thoroughly assessed and mitigated, regardless of whether the impact(s) are deemed "significant". This stipulation is to meet legislated requirements and to ensure that the species is minimally impacted. In particular, SARA requires that an assessment:

a) identify the adverse effects of the project on the listed wildlife species and its critical habitat and,
b) if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them.
c) The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans.

Request:

1. Describe and compare the potential impacts on all wildlife of the proposed Polje By-Pass and Silent Hills Alternative relative to the original route.
2. Describe and compare the potential adverse effects of the existing route and proposed alterations on caribou populations, and calving and wintering range relative to other potential routes.

IR Number: Parks_Canada_4
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Mitigating wildlife effects
References: DAR 4.8, 4.9, 9.4, Appendix 17
Terms of Reference Section: 3.2.4 (8 & 9), 3.3.3 (4b), 3.3.6 (1a & 1b)

Preamble:
The DAR does not identify project details that may have significant effects on wildlife. For example, aircraft overflights can have significant effects on calving/fawning animals; improperly stored waste can attract wildlife and lead to an increase in defense kills; speeds of vehicles can influence the frequency and therefore the significance of wildlife mortality on the road; and road construction could alter drainage and therefore vegetation and wildlife habitat. The DAR also does not identify mitigation for some potentially significant impacts on wildlife. For example, potential impacts and mitigation are not identified for the initial road construction period which will be during spring, summer and/or fall and could have different significant impacts on wildlife than annual winter road construction and operation.

Request:
1. Demonstrate that the Solid Waste Facility identified in Figure 6-13 and 6-16 will keep wildlife away from attractants by providing a detailed drawing with particular reference to fence height, type, depth, whether the fence is electrified or entirely enclosed, and the surface area encompassed and depth of each area (page 197 and 209 of the DAR). Outline the volume of solid waste expected to be produced on an annual basis and the volume available for storage.
2. Provide aircraft heights and flight paths for the airstrip. Please indicate how often helicopters are expected to be used.
3. Spatially describe prescribed speed limits for vehicles on the road.
4. Will the road have any effect on drainage? If so, there will likely be effects on vegetation. What vegetation communities will be affected? Where and how? What mitigation measures are planned? Please include a description of any study design and methods in coming to the conclusions above.
5. Describe beaver distribution in proximity to the access road and mine. Describe the mitigations that would be used if a beaver dam was going to affect the development.
6. For the initial road construction during spring/summer/fall, describe the potential impacts of vegetation clearing and cut and fill work on wildlife. Include, use of the Weaver grizzly habitat model to assess the potential for grizzly conflicts and describe mitigations.
7. Describe active deterrence measures for bears and wolverines at the mine site (many territorial/provincial and state agencies have programs to use as templates) including:
    a. how food and waste attractants will be stored and handled at the mine site, transfer stations, and at any other locations associated with the development prior to permanent disposal;
    b. management of the Solid Waste Facility to minimize interactions with wildlife;

    c. When operating inside NNPR, consider appropriate wildlife deterrents as provided for in the *Canada National Parks Act and Regulations*, particularly in reference to firearms.
8. Whether and where salts may be used on the road alignment and if so mitigations to address salt as an attractant that leads to traffic related injury or mortality.
9. Describe how dead or injured wildlife that may be encountered will be dealt with inside and outside of NNPR.

IR Number: Parks_Canada_5
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Wildlife Monitoring
References: DAR 4.8, 4.9, 9.4, Appendix 17
Terms of Reference Section: 3.2.4 (8), 3.3.3 (4a, 4b)

Preamble:
Monitoring wildlife populations before and during operation will be critical to ensuring action can be taken to detect and then mitigate significant adverse effects. The DAR does not provide a mechanism to establish either baseline information or monitoring approaches that may be used to determine whether impacts are occurring and what magnitude those impacts are having on wildlife and/or vegetation. While PCA appreciates that the developer has indicated that monitoring will occur, PCA encourages the selection of a monitoring approach and the acquisition of appropriate baseline data, as suggested by Section 3.2.4 of the Terms of Reference, and to establish a method to assess changes in the Ecological Integrity of NNPR caused by the development as per Section 3.3.3. In regard to wildlife, this is particularly relevant for species that are at-risk or of increased harvest interest such as Woodland Caribou, Dall's sheep, and moose. Determination of baseline status and subsequent monitoring approaches are required to determine whether a significant component of NNPR's Ecological Integrity has been impacted by the development.

Request:
1. Indicate when and how baseline estimates for Woodland Caribou, Dall's sheep, and moose in proximity to the development including the access road, and mine site, claims and leases will be obtained prior to construction.
2. Provide details of the monitoring program proposed to detect potentially detrimental changes in distribution and abundance. Geographic distribution, methodology, effect size, power, confidence, sample size, and frequency of sampling should all be addressed.
3. Provide an assessment of harvest potential, and hypothesized local and population level effects along the access route for Dall's sheep, moose, and Woodland caribou in particular. Outline what a harvest will be measured, reported, and subsequent mitigations decided upon and implemented as generically outlined in the DAR (i.e. what adaptive management will entail and how it will be measured).

Information Requests related to Karst topography & the access road

The North Nahanni Karst area is considered to be internationally significant. The Developers Assessment Report does not provide sufficient information to ensure that the route and road building techniques through the karst will provide the best mitigation to potentially significant effects on the karst from spills and damage from use of the road.

IR Number: Parks_Canada_6
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Significant earthquake event and impacts on access road design, re-alignment and operation
References: DAR 10.4.2
Terms of Reference Section: 3.3.3 (4)(c)

Preamble:

It was noted that the likelihood of large rock slope failures occurring due to seismic activity is very remote. Natural Resources Canada reported a 6.9 degree (significant) earthquake in the area of the Prairie Creek mine in 1985. The potential for impacts on the access road resulting from the occurrence of a significant earthquake are unclear and therefore the potential for significant impacts on the environment are unclear.

Request:

1. Provide additional detail on the potential impacts to the access road if a significant earthquake occurred in the area of the access road, including, but not be limited to, the potential for a significant earthquake to generate small, moderate, and large soil/rock failures.
2. Provide additional detail on how earthquake loadings and frequency will be considered in the final design of the road and road re-alignment, including, but not be limited to: slope stability analysis and the magnitude (and return event) of the earthquake that will be considered.

IR Number: Parks_Canada_7
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Karst area access road re-alignment
References: DAR 4.11.2, 4.12.2
Terms of Reference Section: Section 3.2.4, Item 11

Preamble:
It was stated that small scale slope failures are believed to represent the most significant risk to the access road within the karst valley near kilometer 56. A proposed re-alignment of the access road between kilometer 46 and kilometer 59 is proposed to avoid the karst terrain. It is unclear how the access road can avoid the karst formation since it extends over a large area; however, a map showing the locations where karst is present at ground surface, or near ground surface was not provided in the DAR. It is noted that identification and extent of the Nahanni North Karst landform was required as per Section 3.2.4, Item 11 of the MVEIRB's Terms of References.

Request:

1. Provide a map that details the access road alignment and the spatial extents where karst formation exists at, or near, ground surface.

   Refer also to Information Request NRCan 9 (1)

2. Provide a comparison of the current route, the Polje By-Pass, and other routes to demonstrate which route poses the least risk to karst based on the information in IRs Parks_Canada_8 and Parks_Canada_17.

IR Number: Parks_Canada_8
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Road geotechnical field investigation
References: Appendix 16
Terms of Reference Section: 3.3.3 (4)(d)(i), 3.3.7(2)

Preamble:
It is understood that the proposed access road re-alignments were determined primarily through a desktop exercise approach (i.e., terrain maps, aerial photos, etc.) with limited, to no, field geotechnical investigation. It is understood that there are ground features that are important to characterize for access road design and proposed re-alignment, such as: karst formations; ice rich permafrost; sensitive soils, ice-rich soils, weaker surficial geology and geo-hydrology.

It is unclear if a geotechnical field investigation will be completed to aid in the design of the access road, and proposed re-alignment.

Request:

Provide details of any proposed geotechnical field investigations planned to support access road design and re-alignment including, but not be limited to:

a. Scheduling of the geotechnical investigation relative to: road final design; road re-alignment; and, road construction.

b. An overview of the proposed geotechnical investigation approach with specific reference to characterizing and mapping karst formation/features, ice rich permafrost, sensitive ground, weaker surficial geology and geo-hydrology.

c. How the findings from the geotechnical investigation will be used to complete final road design and proposed re-alignment.

Refer also to Information Request NRCan 9 (4) and to NRCan 11(2)

IR Number: Parks_Canada_9
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Operation of access road and potential impacts to karst features
References: DAR 6.21.2, 10.4.2, Appendix 16
Terms of Reference Section: 3.3.3 (4)(d)(i)

Preamble:
It was recognized that the karst landscape has features (e.g., sinkholes between km 50 and km 75) that exist that could result in subsidence and partial or complete loss of road grade locally.

A description of the geotechnical stability of the road in light of the characteristics of the karst, traffic loadings, and traffic activities was not detailed, as required in Section 3.3.3, Item 4(d)(i) of the Terms of Reference.

CZN stated that the proposed re-alignment will avoid karst. It was also recommended that an investigation within 200 m either side of the road be completed in sections of the road within vicinity of sinkholes. Further, periodic reviews of sinkhole features are proposed to be carried out to document changes that may take place. Sinkhole features are considered by Parks Canada to be a feature of the karst. Thus, it is unclear how CNZ can claim that the re-alignment will avoid karst.

Request:

1. As requested in Section 3.3.3, Item 4(d)(i) of MVEIRB's Terms of Reference, provide details for areas of the access road that are constructed where karst is at, or near, ground surface, as well as sinkhole locations. Specifically, describe the geotechnical stability of the road in light of the characteristics of the karst, traffic loadings, and traffic activities.

   Refer also to Information Request NRCan 9 (1) (2)

2. Describe how the 200 m distance from the road over which an investigation to assess road impact on sinkholes was selected, and what information was used to determine this distance is adequate to understand potential impacts.

   Refer also to Information Request NRCan 9 (3)

3. Provide additional details regarding the proposed monitoring of sinkholes, to identify any potential impacts caused by the road including but not be limited to, a description the methods and frequency of measurement.

   Refer also to Information Request NRCan 9 (5)

4. Describe the criteria used to determine the impact of the road to sinkhole features. In the event that the road impacts the sinkholes, describe the mitigation measures and plans that CZN are committed to implementing.

IR Number: Parks_Canada_10
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Access road design/construction
References: DAR 6.21, 6.22
Terms of Reference Section: 3.2.5 (21)

Preamble:
General principles of design/construction of the access road were provided, including: avoidance of side hill cuts and fills; grading with snow and/or ice; and, preservation/maintenance of the organic layer to limit permafrost degradation. The level of detail to describe access road design/construction was insufficient to understand potential impacts.

Request:

Provide additional details for design/construction of the access route, specifically:

a. Criteria for the ground conditions, or other local characteristics, that will be used in the decision to avoid side hill cuts and fills, sensitive soil areas, and, grading with snow and/or ice.

b. Additional information on how the frequency, magnitude and type of rock failures along the access road since construction will be considered in the final road design, and the proposed re-alignment sections of the access road

c. If snow and/or ice are not present in the local area of construction, the alternative plans for construction.

d. The yearly estimate of the volume of snow and ice required for road construction and maintenance.

e. A comparison of snow requirements to site conditions.

f. If cut and fill locations do occur to achieve desired road grade/slope, the mitigation measures to minimize permafrost degradation.

g. Typical cross-section diagrams of the access road to depict the various construction situations that are be encountered on site, including, but not limited to: construction on well drained and poorly drained soils, ice rich permafrost soils, sensitive soils, weaker soils, cut and fill locations, and, approaches for stream crossings.

h. Description of localized surface water drainage and management with specific regards to the likelihood of standing water accumulation adjacent to road shoulders which could lead to permafrost degradation.

i. Additional details of the maintenance activities considered for the organic layer to limit permafrost degradation, as well as, additional alternatives to limit permafrost degradation and minimize disturbance during construction and operation of the road.

j. Discussion on the potential for climate change to impact the road and proposed re-alignment.

k. Details regarding the potential effects of climate change on the operation of the road, permafrost degradation, road settlements, and slope failure in vicinity of access road.

l. If monitoring of the access road occurs during construction and operation, a description of the monitoring program. The response is specifically to address: frequency of access road inspection to assess the need for maintenance/repair; items considered in access road inspections (e.g., signs of permafrost degradation); if road repair/maintenance is required, and, the timeframe to complete repair.

m. Description of potential quarries that may be utilized for road construction, including, maps of quarry locations, approximate volume of quarry materials required, and remediation of the quarries after use.

IR Number: Parks_Canada_11
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Abandonment and restoration planning for the access road
References: DAR 6.21, 6.22
Terms of Reference Section: 3.2.5 (21)

Preamble:
It was proposed to re-align sections of the existing access road. If re-alignment occurs, there will be sections of the existing access route that may not be utilized. The use or abandonment and restoration of these sections of the road are unclear.

Details regarding the abandonment and closure of the existing access road, in areas that will not be in operation as a result of the proposed re-alignment, were not detailed.

Request:

With regards to the existing access road that will be by-passed as a result of the construction the proposed re-aligned sections, provide additional details on the use of these sections of the road during mine operations, and a plan and schedule for abandonment and restoration.

IR Number: Parks_Canada_12
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Operation and maintenance of the access road
References: DAR 6.21, 6.22
Terms of Reference Section: 3.2.5 (21)

Preamble:
It is generally recognized that construction and operation of winter roads too early in the fall and too late in the spring can account for the majority of total environmental damage that occurs over the season[1]. It is unclear what criteria will be used to determine when to open and close the access road each year.

Request:

Provide the criteria that will be applied to determine when the winter road construction and operations is to commence and complete.

[1] Stanley Associates Engineering Ltd. And Sentar Consultants Ltd. 1993. Environmental Guidelines for the Construction, Maintenance and Closure of Winter Roads in the Northwest Territories. Prepared for the Department of Transportation Government of the Northwest Territories.

IR Number: Parks_Canada_13
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Operation and maintenance of the access road
References: DAR 6.21, 6.22
Terms of Reference Section: 3.2.5 (21)

Preamble:
Annual construction and grading of the winter road will partially rely on using snow and ice at specific locations. The locations and volume of water for use in the winter road construction and operation is unclear.

Request:

Estimate the yearly volume of water use for access road construction and operation. Provide the water source locations be detailed on a map, general description of the water source and a description of the potential environmental impacts for its use.

Refer also to Information Request DFO 05

Information Requests related to Spills and Spill Contingency

IR Number: Parks_Canada_14
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Spill Contingency Plan Scope
References: s. 8.9.1 of the DAR, Appendix 28
Terms of Reference Section: 3.3.2 (9)(a)

Spills are of particular importance to Parks Canada for two reasons. First, the history of one spill per year on the access road when it was previously in use suggests that there is a high probability of a spill. Second, a single spill of the wrong substances in the wrong place on the road or at the mine site could have significant negative effects on the ecological integrity of NNPR.

Effective spill response is one approach to mitigating the potential significant effects of a spill. The "2010 Fuel Spill Contingency Plan" in Appendix 28 has numerous deficiencies. At the environmental assessment stage we would expect that the scope of the plan would outline all components of an effective spill response, would use and refer to existing regulatory guidelines, and would develop a link to local agencies responsible for managing the road. Only with this information, can we be confident that potentially significant effects can be mitigated. We have highlighted outstanding issues not currently addressed and request that Canadian Zinc Corporation provide a complete Spill Contingency Plan that incorporates each Request.

Part I

Preamble: Links to regulators and their guidance should be appropriately considered in the plan. Specifically, INAC's 2007 "Guidelines for Spill Contingency Planning" are a recognized guideline referenced by Proponents for development projects on Crown land in the NWT. The CZN 2010 Spill Contingency Plan does not reference this set of guidelines or any other guidelines that may have been utilized to guide plan development. Additionally, PCA may provide onsite assistance in the event of any serious spills.

Request:

1. Modify the plan to use and refer to INAC's 2007 "Guidelines for Spill Contingency Planning".
2. Modify the plan to reference Parks Canada appropriately:
    a. in the formal distribution of the plan
    b. as a source of additional resources and assistance
    c. as requiring notification prior to any planned mock spill exercises within NNPR and an option to observe any on-site exercises

Part II

Preamble: The "2010 Fuel Spill Contingency Plan" is only for fuel, but the Terms of Reference asked for a "Spill Contingency Plan" for all proposed mine site activities and activities along the transportation route. Spills caused by other materials must be considered in the Contingency Plan to ensure appropriate tools and safety mechanisms are in place to protect both the environment and workers.

Request:

1. Modify the plan to consider all relevant substances used at the proposed development. The substances considered in the Plan should include, but are not limited to, materials that have potential to impact the environment or human health, are hazardous, and/or deleterious. Along with fuel this will include, without limitation: water treatment chemicals and concentrate.
2. Include all Material Safety Data Sheets for all substances considered in the plan as an annex to the spill contingency plan.
3. Modify the plan to detail all sources and quantities of all substances stored at the mine site, access road, and transfer stations. The location for storage of all substances should be depicted on a map.

Part III

Preamble: The DAR acknowledges risk to groundwater from a large spill "if the spill is not completely absorbed by snow and surficial soil, and the underlying bedrock is permeable". The DAR claims that the dolomitic rocks of the Ram Plateau "represent probably the only part of the road where [all of] these criteria could be met". This insinuates all other portions of the road will have either: adequate snow or surficial soil to absorb the spill if the underlying bedrock is permeable; or impermeable bedrock if there is insufficient snow or soil to absorb the spill. However, no details of snow cover and surface ground temperature measurements/analysis were correlated with geology along the remainder of the road to support this conclusion.

The assertion that materials transported during a frozen winter environment will limit the risked posed by spills for they are "usually not able to travel far in winter conditions, are easily contained and can be readily completely cleaned-up with minimal risk to surface water and groundwater" is a generalization. This may be realistic if there are frozen ground conditions that have sufficient snow cover. Early and late season transport of materials will not have the same frozen ground conditions, and snow cover, compared to mid season transport. Blowing snow may also result in sections of the transport route that have limited snow cover. Chinooks and warm days may result in partially thawed materials while the ground remains frozen enough to travel on.

Request:

1. Modify the Plan to include spill responses to the following site conditions: frozen and snow covered ground; frozen and non-snow covered ground, and non-frozen and non-snow covered ground.
2. Modify the Plan to include special provisions throughout the plan for the karst landform due to the special circumstances of the "likelihood of rapid spread of contamination via surface or groundwater flows" relative to other landforms.

Part IV

Preamble: Spill contingency planning beyond an initial response is limited in details, or not addressed. If a large spill occurs on land or water, environmental management plans must be in place after the initial response to ensure the remediation of the area to acceptable levels. This will serve to limit impacts to environmental and human health.

Request:

Include procedures to address remediation of spill impacted areas after initial response. This may include, but is not limited to: completion of an environmental site assessment and remedial action plan; characterization of spatial extents of impacted area; dealing with contaminated wildlife (especially waterfowl and aquatic species); transferring, storing, and managing spill-related waste; and environmental monitoring and reporting to demonstrate remediation to acceptable criteria.

IR Number: Parks_Canada_15
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Spill Contingency Plan
References: s. 8.9.1 of the DAR, Appendix 28
Terms of Reference Section: 3.3.2 (9)(a)

Preamble:
The CZN 2010 Fuel Spill Contingency Plan partially relies on 3rd party contractors to assist or complete selected spills. As spills requiring 3rd party contractors are most likely larger, they have the greatest potential for significant effects to ecological integrity of NNPR. Reference to Shell Bulk Petroleum is made to assist with large or complicated spills for they have additional spill response equipment. Further, reference is made to Villers Air Service to assist with aircraft requirements. For example, CZN stated that if fuel escapes under ice, expertise should be sought immediately and "Shell Bulk Petroleum's response team can be made available in a matter of hours". It is unknown if there are formal agreements in place with 3rd party contractors to assist with spill contingency planning, and if so, the limitations of the agreements.

Request:
Provide copies of formal agreements between CZN and all 3rd party contractors that contribute to execution of the spill contingency plan.

IR Number: Parks_Canada_16
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Compliance of 3rd party contractors
References: s. 8.9.1 of the DAR, Appendix 28
Terms of Reference Section: 3.3.2 (9)(a)

Preamble:
The construction and operation of the proposed development will partially rely on 3rd party contractors to complete specific activities on site. For example, hauling of materials to and from site will make use of a 3rd party fleet. The CZN 2010 Fuel Spill Contingency Plan stated that "contractors will be introduced to the salient aspects of initial response actions to a spill as part of site orientation on arrival". It is hypothesized that hauling contractors likely have their own spill contingency protocols that may differ compared to CZN. It is critical that 3rd party contractors follow an approved CZN spill contingency plan in order to ensure that potential significant effects are mitigated.

Further, it was not stated in the DAR if 3rd party contractors will assist with the construction and operation and maintenance of the access road. It is critical that 3rd party contractors follow an approved operations and maintenance plan for the access road in order to ensure that potential significant effects are mitigated.

Request:
1. Provide information on the type of formal agreements between CZN and 3rd party contractors to require the CZN 2010 Spill Contingency Plan to be used while on-site.
2. If 3rd party operators be used for road construction and operation, please provide information on the type of formal agreements requiring they adhere to CZN road construction, operation and maintenance plans.
3. Canadian Zinc provide information on an environmental management system be established to monitor and record the performance of 3rd party contractors to implement the CZN 2010 Spill Contingency Plan and access road construction, operations and maintenance plan in their operations.

IR Number: Parks_Canada_17
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Planning to reduce spills along the road
References: DAR 9.2
Terms of Reference Section: Section 3.3.3, Item 4.d.ii.

Preamble:
The history of one spill per year on the access road when it was previously in use suggests that there is a high probability of a spill on the road. Furthermore, a single spill of the wrong substances in the wrong place on the road or at the mine site could have significant negative effects on the ecological integrity of NNPR. Therefore, Parks Canada requires information to ensure that sufficient mitigative measures from construction to operations are in place to minimize the risk of a significant effect occurring.

The reduction of spill risk along the access road as presented in the DAR relies on three strategies to reduce the risk of spills. These include hauling during freezing conditions, availability of natural materials to either absorb or retain contaminants, and re-alignment of the existing roadway to avoid features that may lead to higher risk.

The DAR states that risk of spills can "be reduced by proper planning and procedures, including design and construction of the road, with avoidance of steep terrain and hairpin turns where possible". Further, controlled "use of the road will also reduce the risk of spills" and "appropriate speed for all sections of the road will improve safety." It is noted that exact route of re-alignment and ground truthing has not been determined. While conceptually positive, there is a lack of detail or evidence to assess the true potential of this mitigation.

Additionally, as recognized but not addressed by the DAR, karst landforms are a special circumstance owing to the "likelihood of rapid spread of contamination via surface or groundwater flows" provided by the porous quality of the rock. Specifically in reference to the three mitigation strategies it can be assumed that when the former two mitigations are not available in sufficient quantities, the likely consequence of a spill in the karst landform is a significant alteration of the ecological integrity of NNPR. As suggested and outlined in Information Request Parks_Canada_12 , these conditions may manifest anytime during the hauling season, but particularly during the early and late winter periods. Given the significant risk posed by this threat, a very strong consideration to the alignment, design and construction of the road as suggested above is critical.

Request:
1. List and define the criteria used to reduce spill risk along the access road including without limitation, the criteria that will be used in road alignment selection, design, and construction. Where possible, the criteria should include measurable/numerical limits.
2. What operational procedures will be in place to minimize the risk of spills? Include speed limits, site specific directions, training for drivers etc.

3. Describe the “likelihood of rapid spread of contaminant via surface or groundwater flows associate with the karst landform” and detail the special consideration of karst landforms in planning to avoid spills.

IR Number: Parks_Canada_18
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Spills risk assessment
References: DAR 8.9, 9.2,10.1.2, 10.2.6,Appendix 28
Terms of Reference Section: 3.3.2 (9), 3.3.3(2), 3.3.4 (2), 3.3.5 (5)

Part I
Preamble:
The history of one spill per year on the access road when it was previously in use suggests that there is a high probability of a spill on the road. Furthermore, a single spill of the wrong substances in the wrong place on the road or at the mine site could have significant negative effects on the ecological integrity of NNPR. Therefore, Parks Canada requires information to ensure that sufficient mitigative measures from construction to operations are in place to minimize the risk of a significant effect occurring.

The CZN 2010 Fuel Spill Contingency Plan provides description of select fuel sources, quantities, storage location, and spill control points for the mine site. A map of the mine site is provided to aid in understanding the location of fuel storage. Fuel storages associated with the access road were less defined; however, will involve fuel storage at each transfer facility and small fuel caches along the route for emergency needs.

The proposed locations and method of storage, of the small fuel caches along the access road are unknown. During road construction, it is hypothesized that temporary fuel storage will be necessary to supply the equipment. The method of temporary fuel storage, and associated spill risk, are unknown.

Select non-fuel substances used to support mine operation, which have potential to spill and have a significant impact the environment, are currently stored at the mine site. Additional substances will be stored at the mine site and at the transfer stations during operations. A list of non-fuel substances that may be important for spill contingency planning was provided in Section 6.14 of the DAR. The quantity and storage of these substances was detailed; however, the spill control points are not detailed.

Request:
Provide an estimate of the size of spill that could occur for each substance stored along the access road, transfer stations, and mine site. Based on the size of the spill and the site specific characteristics (e.g., proximity to water, geology, etc.), it is requested that the potential impacts are described.

Part II
Preamble:
The CZN 2010 Fuel Spill Contingency Plan provided a description of spill kit locations at the mine site. It was stated that mobile storage units containing emergency spill kits and equipment will be placed along the access road. The locations of emergency spill kits along the access road, and transfer station, were not detailed.

The items contained in the spill kit were provided in the CZN 2010 Fuel Spill Contingency Plan. The kit includes standard items for fuel spills; however, it is unknown if the spill kit is acceptable to manage spills of non-fuel substances.

Request:

1. Provide the location of spill kits and materials along the road or the criteria for choosing these locations in the future. Consideration should be given to: the locations where materials will be stored; the location of sensitive areas; timeframes to mobilize spill response equipment and personnel for small and large spills.
2. Conduct an analysis of the substances that will be transported to and stored at the mine and report what items are necessary in spill kits to respond to spills of each substance.

Information Requests related to Geochemical Predications for tailing backfill

CZN proposes to transport all tailings to the subsurface mine workings as backfill. This management approach aims to permanently store the tailings during operation for the mine, eliminating the need for a long term tailings impoundment area on the mine surface.

Over the life of the mine, CZN estimates that approximately 75% of DMS rock and 100% of the tailings generated in the mining and milling process will be used to produce paste backfill, stored in underground voids after mining. The waste will be stored in perpetuity.

The paste backfill method has the potential to cause significant impacts through a variety of pathways, including mobilization of contaminants from the paste, inadequate storage volume, and structural failures during mining operations. The potential for these impacts to occur long after the mine is closed and to affect the water quality flowing into NNPR make them of importance to Parks Canada. It is essential that Parks Canada understand the physical and the geochemical characteristics of the paste backfill in the environment at the Prairie Creek Mine site. Parks Canada poses a number of information requests with respect to paste backfill.

These information requests are based on a review of the following documents:

Prairie Creek Mine Developer's Assessment Report. Main Report. March 2010 (DAR)

DAR Appendix 3. pHase Geochemisty 2010. *Final Humidity Cell Report., Prairie Creek Project, NWT Canada*

DAR Appendix 4. pHase Geochemistry 2010. *Geochemical Characterization of Paste and Paste Components, Prairie Creek Project, NWT Canada.*

DAR Appendix 5. pHase Geochemistry 2010. *Source Term Water Quality Predictions. Prairie Creek Project, NWT Canada.*

DAR Appendix 15A. Golder PasteTec 2009. *Pre-feasibility Engineering study for Cemented Paste Backfill Plant for the Prairie Creek Project.*

DAR Appendix 15B. Golder PasteTec 2009. *Technical Memorandum – Laboratory Evaluation of Prairie Creek Mine Backfill.*

DAR Appendix 15C. Golder PasteTec 2009. *Laboratory Evaluation of Canadian Zinc Mine Tailings for Use as Prairie Creek Mine Backfill.*

IR Number: Parks_Canada_19
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Paste backfill volume balance
References: DAR 6.12.1 Mine Waste Management
Terms of Reference Section: 3.2.5 (10) and (11) (Development Description)

Preamble:

An estimated 3,401,470 tonnes of paste is proposed to be backfilled in the underground voids. Using an assumed density of 1.89 tonnes/m^3 for the paste, the volume occupied by paste is calculated to be 1,799,719 m^3. The volume of underground voids is not provided in the DAR to assess if there is sufficient volume to contain the paste in the underground; however, it was stated that 100% of the tailings will be transported underground.

Request: Complete a volume balance to demonstrate that there is sufficient volume in the underground voids to contain all paste produced.

IR Number: Parks_Canada_20
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Geochemical testing - representative samples
References: DAR 8.2 Waste/Material Characteristics
DAR8.6 Potential Impacts
Appendix 3: Final Humidity Cell Report

Terms of Reference Section:
3.3.2 (3) Key Line of Inquiry: Mine Site Water Quality

Preamble:

A limited number of humidity tests were completed to gain information regarding the geochemical characteristics of the paste backfill, DMS rock, and tailings.

- Paste backfill – 2 samples;
- Tailings – 1 sample for 4-con tailings, 1 sample for 2-con tailings; and,
- DMS – 2 samples.

Further, it is understood that mineralogy of the ore body is heterogeneous. The geochemistry of the tailings, and therefore, paste, may change from that tested if the mineralogy of the mined rock changes. Further details are required in order to understand the confidence of the humidity geochemistry program to represent the characteristics of the paste, and associated leach water characteristics over the duration of mining.

Request:

1. Provide additional details about the humidity geochemistry program, specifically addressing:
   - the limited number of samples tested to date;
   - the heterogeneity of the ore deposit;
   - and, the expected sensitivity of humidity test results if the composition (e.g., material amounts and size, mineralogy, etc.) of the paste changes compared to that initially tested.
2. Describe the geochemical testing program during operation of the mine that will be used to understand the changes and the associated impacts, if any, in paste backfill geochemical characteristics compared to that initially tested. This should include a conceptual understanding of the objectives, sampling frequency, and testing approach that would form the basis of the geochemical testing program.

IR Number: Parks_Canada_21
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Flush and steady state leaching conditions
References: Appendix 3: Final Humidity Cell Report
Terms of Reference Section: 3.3.2 Key Line of Inquiry: Mine Site Water Quality

Preamble:

The humidity cell tests showed that metals are released from the paste. A flush of metals occurs when water initially passes through the paste, and then with time, a quasi steady state flushing of metals occurs. The humidity cell test results show metal concentrations in the drainage waters spike during flush conditions and then stabilize as quasi steady state conditions occur.

Parks Canada requires further information to understand the effects of groundwater interaction with the paste backfill, and the potential for metal leaching.

Request:

1. Develop a conceptual model of groundwater interaction with the paste backfill and use it to support the following additional requests. If relevant, the reliance of bulkheads installed in the underground voids should be included in the response.
2. Describe the potential for flushing and steady state conditions for metal leaching to occur within the paste backfill during mine operations and post-closure?
3. Water that passes through the backfilled paste may contain elevated metal concentrations. Provide a summary description of interaction of groundwater passing through the backfilled paste. Provide an estimate of groundwater flow leaving entering/leaving the paste backfill and the level of certainty in the estimate.
4. Prepare a detailed summary of the uncertainties with regards to groundwater interaction with the backfill material, and how this uncertainty will be addressed.
5. With regards to the paste backfill in the underground voids, further discuss the impact of flushing and steady state conditions on groundwater quality and how this is considered in predictions of drainage water quality from the paste.
6. If flushing conditions are anticipated to occur within the backfilled paste in the underground voids, discuss the estimated timeframe required to establish quasi steady state conditions.
7. In all responses, provide reference to any hydrogeological testing/analysis results that support the discussion. If there are instances where no hydrogeological testing/analysis results are available to support the discussion, provide additional detail on how to fill the information gap (e.g., confirmatory testing/analysis, monitoring, etc.) and provide confidence to interested parties.

IR Number: Parks_Canada_22
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Humidity and permeability cell leachate characteristics for paste backfill
References: DAR 8.6.1 Potential Impacts: Mine Operations
Terms of Reference Section: 3.3.2 (2)(a)

Preamble:

Various laboratory analyses were completed to understand the geochemistry of the paste. Humidity cell tests provided information regarding leach rates that were applied to prediction modeling. Permeability cell leachate was also geochemically characterized, and its composition measured concentrations higher than that of the humidity cell leachate. It is likely that the differences in leachate concentrations between the humidity and permeability cells are a result of the testing conditions. The humidity cells resulted in leachate that did not have metal concentrations above Metal Mines Effluent Regulations (MMER); however, the permeability cells did have leachate with select metal concentrations above MMER. It is understood that future water licence limits may or may not be in harmony with MMER limits. It is unclear if, and how, the permeability cell leachate quality testing was utilized in predicting leachate quality from the paste backfill.

Request:

Provide additional discussion on the application of the permeability cell leachate quality results in predicting leachate quality from the paste backfill.

IR Number: Parks_Canada_23
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Discharge of paste backfill leachate to the environment
References: DAR 8.6.1 Potential Impacts: Mine Operations
Terms of Reference Section: 3.3.2.(2)

Preamble:

The geochemical testing and predictions revealed that select metals (e.g., Zn) and pH of the paste backfill leachate may have values that approach or exceed MMER limits. It is understood that future water licence limits may or may not be in harmony with MMER limits. No mechanism to collect paste backfill leachate, if quality exceeds MMER limited, was presented in the DAR.

Request:

Describe and evaluate options to collect and/or treat the leachate, if it exceeds MMER limits.

IR Number: Parks_Canada_24
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Scaling factors to relate laboratory humidity cell leach rates to field scale leach rates for paste

Preamble:

Scaling factors to translate the laboratory humidity cell leach rates to field scale leach rates were presented. The following adjustment factors were utilized to account for the following differences between laboratory and field scales: temperature; particle size/surface area; and contact water flow path. It is unclear if the scaling factors presented in the DAR are valid for the paste.

Request:

1. *Temperature:* A rate reduction factor of 0.3 was applied to account for reductions of chemical oxidation rates due to differences between laboratory and field temperature. The humidity cell tests reported that the paste is non potentially acid generating. It is unclear if metal leaching occurs as a result of oxidation.

   Clarify whether the metal release from the paste is a result of oxidation. Further, it is requested that additional information is provided to explain the use of a rate reduction factor, which is based on relations between oxidation rate and temperatures, for the paste material.

2. *Particle size/surface area:* A 0.2 adjustment factor was used to account for the larger surface area of the field material size than that used for laboratory testing. Since the paste contains small size particles, it is unclear if there would be a significant particle size difference for the paste between the laboratory and field conditions. It is requested that CZN compare the size of particles in the paste used in the humidity cell test to the typical size particles anticipated for the paste in the field. It is requested that CZN further explain the selection of the adjustment factor with consideration to the differences in particle size of the paste in the laboratory and field.

3. *Contact Water Flow Path:* A 0.1 adjustment factor was adopted to account for flow path differences that exist in the laboratory that may not occur at the field scale for the paste. It is requested that CZN compare flow paths through the paste in the laboratory to those in the field. It is requested that CZN further explain the selection for the adjustment factor with consideration to the differences in flow path in the laboratory and that expected in the field.

IR Number: Parks_Canada_25
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Water quality source term predictions for paste

Preamble:

Predicted source term concentrations for the paste were presented. The source term concentrations are likely to be applied to contaminant loading/water balance predictions for the mine site. The source term concentrations were calculated from the humidity cell test results, application of adjustment factors, and calibration of the water quality model. The humidity cell tests for the paste materials measured Zn concentrations in the leachate to be less than 0.5 mg/L; however, the predicted source term Zn concentrations for the paste leachate were about 1.5 to 2.0 mg/L. If the adjustment factors to translate the laboratory results to field scale are reduction factors, it is unclear how the predicted source term concentration is larger than the humidity cell tests.

Request:

Describe the calculation to develop the source term concentration. It is specifically requested that the calculation for predicted source term concentrations for Zn from the paste be presented as an example.

IR Number: Parks_Canada_26
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Calibration of the water quality prediction model

Preamble:

A calibration of the water quality prediction model was completed for select mine water sources that discharge from the mine site. The calibration was completed to develop adjustment factors to predict field scale water quality from laboratory data. The calibration could not be completed for paste backfill contact water as there are no data to support completion at this time.

Request:

1. Due to the uncertainty associated with using a non-calibrated model to predict paste backfill leachate quality, it is requested that a sensitivity analysis be completed on the predictions of water quality. The analysis should consider varying the adjustment factors, over a reasonable range, to predict the leachate quality of the paste.
2. Further discuss how the calibration of the model to predict leachate quality of the paste will be completed.
3. Provide additional description to further understand model verification (and re-calibration) timing, method, and field data inputs.
4. Further discuss the field testing that is anticipated to be completed during operations of the proposed development to verify if the model adequately depicts site conditions.

IR Number: Parks_Canada_27
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Characteristics of the paste cement

Preamble:

The characteristics of the cement used in the laboratory for paste strength testing and geochemistry testing were not specified in the DAR. It is unclear if the laboratory cement characteristics are representative of the expected cement characteristics that are proposed for use at the mine. Further, it was stated that additional testing is required to explore the use of cement, slag and fly ash binder cement replacement products. It is unclear if the cement characteristics used at the proposed mine will be different from that utilized in the laboratory testing reported in the DAR. If differences in cement exist between field and laboratory, it is unclear if the laboratory geochemistry testing/results will be valid.

Request:

1. Provide additional information on the likelihood of using cement binder replacement products or admixtures for paste backfill.

   Refer also to Information Request NRCan 2(7)

2. Provide a description/technical characteristics of the cement used in the laboratory and that expected for use in the paste backfill plant.

   Refer also to Information Request NRCan 2(7)

   If differences exist between the laboratory and the paste backfill plant, it is requested that description is provided with regards to: the expected changes to the strength and geochemistry compared to that reported in the DAR; and, any additional strength and geochemistry testing that is necessary to characterize the paste.

3. Parks Canada assumes that the amount of cement in the paste will be a controlled operational parameter during operation of the paste backfill plant and that QA/QC testing will be completed to ensure the cement content in the paste is within specification tolerance. It is requested that CZN addresses the validity of this assumption.
4. Based on previous experiences in the operation of paste backfill plants at other mines, it is requested that the typical spread in operating range in cement content is detailed. Considering the typical operation spread in cement content, discuss how the cement content may change the geochemistry and leaching characteristics of the paste compared to that presented in the DAR.

IR Number: Parks_Canada_28
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Paste backfill strength

Preamble:

Preliminary strength testing of paste was presented. Unconfined compressive strengths measured values approximately 150 to 200 kPa, with a couple of measurements with greater strength values. It was stated that additional strength testing should be completed to optimize binder admixtures/concentrations, ensure strength gain, and assess the effect of slump consistency on final strengths. The required unconfined compressive strength of the paste to support underground mining operations was not specified. It is unclear if the strength values of 150 to 200 kPa are reasonable.

Request:

1. Provide additional details on the required unconfined compressive strength of the paste to support underground mining operations.

   Refer also to Information Request NRCan 2(8)

2. Provide additional discussion on the amount of cement necessary to achieve the required unconfined compressive strength. It is requested that CZN provides an opinion on the likelihood that the amount of cement, and its characteristics, will change from the conditions reflected in the completed geochemical testing presented in the DAR.

   Refer also to Information Request NRCan 2(8)

IR Number: Parks_Canada_29
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Paste backfill production

Preamble:

Additional design and testing is necessary to advance the paste backfill plant beyond an advanced conceptual level. For example, testing on paste strength and concrete characteristics may be necessary. Additionally, dewatering and its associated challenges may need to be further discussed. It is unclear if there are other testing and studies that are required to be completed to support final design and operations of the paste backfill plant. The impact of additional tests and studies on the composition of the paste, and therefore paste leaching characteristics, is uncertain.

Request:

Provide a detailed summary of additional tests and studies that are required to support the design and operations of the paste backfill plant. For each test and study, the summary should address the relative impact of the results on the composition of the paste, and paste geochemisty, compared to that presented in the DAR.

IR Number: Parks_Canada_30
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Long term mechanical behavior of paste backfill

Preamble:

The paste backfill is the long-term storage method to manage tailings. The DAR provides limited, or no, discussion on the long-term mechanical behaviour of the paste backfill. For example, the following long-term paste characteristics and associated potential impacts are unknown: strength, degradation rate, and settlements.

Request:

Provide additional discussion on the long term mechanical behaviour of the paste backfill. The response must include, but not be limited to, the importance of long-term strength and settlement/consolidation of the paste; and, the potential impact of cavities created in the underground void as a result of post-mine operation settlement of the paste on ground surface settlement, slope stabilities, and groundwater transport.

Refer also to Information Request NRCan 2(3)

IR Number: Parks_Canada_31
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Cement paste backfill plant

Preamble:

With regards to the paste backfill plant, there is potential for challenging dewatering conditions to occur as a result of mineralogy of the ore body. It was stated that additional test work was required to confirm the implications of the dewatering conditions. The ability to overcome the possible challenging dewatering conditions, at the design stage and/or through additional testing, is unclear.

Request:

Provide professional opinion with regards to the likelihood of anticipated challenging dewatering conditions.

Describe the potential impacts of the challenging dewater conditions on the operations of the paste backfill plant, proposed paste backfilling operations, and paste backfill geochemistry.

Information Requests related to Water Management & Treatment at the Prairie Creek Mine Site

Nahanni National Park Reserve was expanded in 2009 and encompasses the entire southern portion of the South Nahanni Watershed. Protecting the waters in NNPR consistently been a priority for Parks Canada throughout its history, and is a significant concern for the Dehcho in the recent expansion, and in the ongoing management of NNPR.

The proposed mine will involve management and eventual discharge of large volumes of mine and process water to Prairie Creek, a tributary of the South Nahanni River. During mine operations, or in temporary mine shut-downs or emergency situations, there is a potential for contaminated water to be discharged to Prairie Creek, and downstream to NNPR. Degradation of water quality in the South Nahanni watershed could have a significant impact on one of the key ecological indicators for NNPR.

It is important, therefore, that Parks Canada clearly understand how water is proposed to be managed and monitored throughout mine operations, and post-closure. Parks Canada must understand the full nature of the design and operational mitigations proposed, and how effects were predicted, to prevent significant effects to the South Nahanni watershed.

These information requests are based on a review of the following documents:

Prairie Creek Mine Developer's Assessment Report. Main Report. March 2010 (DAR)

DAR Appendix 1A. Robertson GeoConsultants Inc. 2009. *Site Hydrology Report, Prairie Creek Mine Site, Northwest Territories, Canada.*

DAR Appendix 1B. Robertson GeoConsultants Inc. 2010. *Addendum to Site Hydrology Report – Results of Transient Groundwater Modeling, Prairie Creek Mine, NWT.*

DAR Appendix 1C. Robertson GeoConsultants Inc. 2010. *Load Balance Calculations for Mine Water and surface Water, Prairie Creek Mine, NWT.*

DAR Appendix 2. SGS-CEMI 2010. *Prairie Creek Water Treatment Testing, including Appendix A; Relevant Toxicity Data.*

DAR Appendix 6. SNC Lavalin 2009. *Water Treatment Plant Operations.*

DAR Appendix 7. Saskatchewan Research Council 2010. *Development of Site-specific Water Quality Guidelines for Prairie Creek, NWT.*

DAR Appendix 8. CZN 2010. *Mine Area Background Receiving Water Quality.*

DAR Appendix 9. CZN 2010. *Water Balance.*

DAR Appendix 10. CZN 2010. *Receiving Water Quality During Operations and Discharge Criteria.*

DAR Appendix 11. Golder Associates 2010. *Preliminary Design: Waste Rock Pile at Prairie Creek mine NWT.*

DAR Appendix 12. Golder Associates 2010. *Preliminary Design: Water Storage Pond at Prairie Creek Mine NWT.*

DAR Appendix 22. O'Kane Consulting Inc. 2010. *Results of Preliminary Numerical Modelling Program of WRP Cover System Alternatives at Prairie Creek.*

DAR Addendum. Dube (2010) *Aquatic Effects Monitoring Final Plan.*

IR Number: Parks_Canada_32
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Sources of nutrients and their linkages to the selection of environmental indicators as part of the Aquatic Effects Monitoring Plan
References: DAR 10.7 Monitoring and Management Plan; Addendum report (2010) Aquatic Effects Monitoring Plan.
Terms of Reference: 3.3.1 Impact Assessment steps and significance determination factors

Preamble:
As for all aquatic monitoring programs, the choice of appropriate environmental indicators reflects considerations of: i) the chemical composition of the discharge, ii) the extent that the chemical characteristics of the discharge can be can be altered due to waste water treatment processes, and iii) the assimilative capacity of the receiving water.

In June 2010 Canadian Zinc Corporation released a report by Dube (2010) titled "Aquatic effects monitoring final plan". The objective of the report was to present a draft aquatic effects monitoring plan for the Prairie Creek Mine which would focus discussions and ultimately support the development of a final aquatic effects monitoring plan.

The addendum report (sub-section "2.1 Site)" states that: "The sewage effluent flow sent to the WSP [Water Storage Pond] will also be small, and should not contain nutrients (because of the use of non-phosphate detergents)." The above statement by Dube (2010) suggests that the aquatic effects monitoring program framework will be developed: i) assuming that detergents are the sole source of phosphorus loadings, and ii) loadings of other nutrients, such nitrogen, are not being considered. It is doubtful that detergents would be the only source of nutrients to the WSP, and clarification on the exact meaning of the above statement is required.

Request:

1. Provide clarification on sources of nutrient loadings to the water storage pond;
2. Specifically describe how loadings nutrients will influence the selection of appropriate environmental monitoring indicators.

Refer also to Information Request INAC10

IR Number: Parks_Canada_33
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Aquatic ecosystems
References: DAR 9.0 Impact Assessment – NNPR; DAR 9.3 Aquatic ecosystems – Impact Assessment
Terms of Reference Section: 3.3.1; 3.3.2; 3.3.5

Preamble:
As for all environmental assessments, identifying possible environmental effects needs to be accompanied with descriptions of why the effects are likely to occur, and the activities that the developer is proposing to mitigate them. Conversely, dismissing a possible effect needs to be accompanied with supporting documentation for why effects are unlikely to occur.

Section 8.1.3 *Impacts of Historic Mine Water Discharge,* documents projected loadings of zinc, cadmium and sulphate to Prairie Creek and the Flat River. By contrast, assessments of loadings of mercury are not provided despite the fact that the published study by Spencer et al. (2008) in a peer reviewed scientific journal (Integrated Environmental Assessment and Management, 4: 327-343) documented elevated levels of mercury in slimy sculpin body tissues immediately downstream of the Prairie Creek mine (i.e., near-field downstream site, mean Hg level = 0.066 ug/g) compared to the upstream reference site of 0.028 ug/g. This difference represents a 2.35-fold increase in mercury levels. Although the overall mercury levels are low, the data presented by Spencer et al. (2008) identify the potential for enrichment of mercury, and possible food-web bioaccumulation, due to mining activities, and that an additional level of evaluation is warranted.

Request:
Include an evaluation of a potential increase in loadings of mercury to Prairie Creek and an evaluation of their potential environmental effects on biological communities in this system.

Refer also to Information Request INAC09

IR Number: Parks_Canada_34
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Aquatic ecosystems
References: DAR 9.0; 9.3; Appendix 7
Terms of Reference Section: 3.3.1; 3.3.2

Preamble
Toxicity tests are an integral and approved method to assess potential toxic effects of industrial effluents on aquatic life. Appendix 7, completed by Dube and Harwood (2010), reported chronic toxic effects of treated mine water on reproduction of zooplankton. By contrast, their evaluation did not include an assessment of toxic effects of treated process water. This represents a potentially important gap in the assessment of plausible significant environmental effects.

Request
Complete chronic toxicity studies to quantify the chronic effects of treated process water, given its projected chemical characteristics or explain why these studies were not completed and when they will be completed.

IR Number: Parks_Canada_35
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Hydrogeology – zinc concentration in Prairie Creek Alluvium Aquifer

Preamble:

It was stated that the Prairie Creek Alluvium Aquifer (PCAA) currently has elevated zinc concentrations in the groundwater. One source of the zinc to the PCAA may be from water that exits the 870-level portal as surface water and is not currently collected. This surface water can then infiltrate into the PCAA. Another source of the zinc may be elevated zinc groundwater discharging from the bedrock aquifer into the PCAA. The PCAA groundwater discharges into Prairie Creek. It was also identified that Harrison Creek may have elevated zinc concentrations as a result of groundwater discharge from the aquifer into the surface water.

During mine operation, it is predicted that groundwater in the bedrock aquifer will be drawn to the underground workings, and pumped out of the underground as mine water. At closure of the mine, the mine water will no longer be actively pumped from the underground workings. As a result, during post-closure, the groundwater in the bedrock aquifer can discharge to the PCAA.

Also, at closure, a plug is proposed to be installed in the 870-level portal to restrict mine water release to surface water. The installation of the plug will increase the potential for groundwater in the bedrock aquifer to flow into the PCAA.

The groundwater in the bedrock aquifer may contain metals (e.g., Zn, Cd) released from the underground workings (i.e., mine walls, paste, etc.). Therefore groundwater that enters the PCAA from the bedrock aquifer may have elevated metals. This aspect is important for PCAA groundwater discharges into Prairie Creek and therefore has potential to impact surface water.

Request:

1. Describe the potential (if any) after closure of the mine, for groundwater to discharge into Harrison Creek, in addition to Prairie Creek.
2. Provide additional details on proposed monitoring (during mine operations and post-closure) to understand the movement of metals within groundwater in the bedrock, PCAA, and Harrison Creek Alluvium Aquifer.

IR Number: Parks_Canada_36
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Hydrogeologic contaminant transport modeling

Preamble:
The groundwater and contaminant transport modeling contained various simplifications and assumptions to represent the hydrogeology of the mine site subsurface. The results of the hydrogeologic contaminant transport modeling are partially used to predict contaminant loads to the Prairie Creek.

Request:

Provide additional details regarding any proposed hydrogeologic investigations to refine the hydrogeologic model and surface water load balance model predictions for pre-mining, mining, and post-closure, including but not limited to: a summary of the primary assumptions applied in the hydrogeologic model and how future hydrogeologic investigation data will support to confirm the assumptions; and, scheduling to complete future hydrogeologic investigations relative to pre-mining, mining, post-closure phases of the project.

IR Number: Parks_Canada_37
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Load balance calculations

Preamble:
Numerous assumptions and estimations were included in the load balance calculations. For example, various surface water flow rates were selected based on limited information, limited testing, or were estimated/assumed. As a result, there is uncertainty in the predicted values. Further, it was stated that the predicted pre-mining and post-closure concentrations for Prairie Creek are preliminary in nature and should be updated once additional data and/or analysis become available.

Request:

Provide additional details regarding any proposed surface water quality and quantity investigations used to refine the load balance predictions for pre-mining, mining, and post-closure, including, but not limited to: a summary of the primary assumptions applied in the load balance calculations and how future investigation data will support to confirm the assumptions; and, scheduling to complete the investigation relative to pre-mining, mining, post-closure phases of the project.

IR Number: Parks_Canada_38
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Load balance model – pre-mining and post-closure
Terms of Reference: 3.3.3 (1)(a) Ecological Integrity of the Nahanni National Park Reserve

Preamble:

The Terms of Reference require consideration of the potential impacts of contaminated groundwater or surface water on the ecological integrity of Nahanni National Park Reserve (NNPR), with a focus on impacts on water quality where Prairie Creek enters NNPR. The load balance model provides predictions of water quality at the NNPR boundary only for operational conditions. In order to understand the potential impacts on NNPR, Parks Canada requires this information for pre-mining and post-closure conditions as well.

Request:

Provide a prediction of the water quality concentrations in Prairie Creek at the NNPR boundary in the load balance model for pre-mining and post-closure conditions.

IR Number: Parks_Canada_39
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Discharge location and point of compliance
Terms of Reference: 3.3.2 (4) Key Line of Inquiry: Mine Site Water Quality

Preamble:

Treated water will discharge from the mine site catchment pond to Prairie Creek through a diffuser. The proposed location of the diffusion is unclear; however, it is likely to be near the Prairie Creek – Harrison Creek location. No discussion was provided on plume movements in Prairie Creek and mixing zones.

A MMER point of compliance for the Prairie Creek mine was not proposed. It is unclear how the discharge location (and water quality concentrations) would compare to the proposed MMER point of compliance (and water quality concentrations).

Parks Canada understands that future water licence water quality concentrations and location may or may not be in harmony with MMER concentrations and point of compliance. A compliance point for consideration in the water licence was not proposed. The location for the proposed compliance point for consideration in the water licence is critical for Parks Canada to understand environmental impacts to Prairie Creek. It is unclear how the discharge location (and water quality concentrations) would compare to the proposed compliance point for consideration in the water licence.

Request:

1. Provide location information for the diffuser proposed for installation in Prairie Creek; specifically: the map location of the diffuser, and distances from the diffuser to key points within Prairie Creek. The key points of interest include: existing and proposed Prairie Creek water quality monitoring stations; the Prairie Creek – Harrison Creek location; the NNPR boundary; the proposed Metal Mining Effluent Regulations (MMER) point of compliance; and proposed compliance point for consideration in the water licence.
2. Provide additional information with regards to mixing conditions in the Prairie Creek in the vicinity of the diffuser.
3. Provide predicted water quality at proposed MMER point of compliance.
4. Provide predicted water quality at the proposed compliance point for consideration in the water licence.

IR Number: Parks_Canada_40
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Underground mine water flows during operation

Preamble:
To facilitate mining, mine water will be removed from the underground voids. The mine water contains elevated zinc and requires treatment prior to discharge. The water balance calculation assumes a mine water flow rate of 50 L/s. The water treatment plant preliminary design assumed mine flow rate of 32 L/s for mine water flow rate and a treated water maximum flow rate of up to 55 L/s. The load balance calculation during mine operations considered mine flow rates of 29 L/s and 100 L/s. The 100 L/s was considered to be a "worst-case scenario".

The design flow rates appear to be reflective of medium flow rates, not the "worst-case scenario". It is unclear if the water storage facilities (e.g., water storage pond) and water treatment plant are capable of managing/treating water for the "worst-case scenario".

Request:

1. Provide a summary of how the "worst-case scenario" for mine flow rate (i.e., 100 L/s) was considered in the sizing of the water storage facilities (e.g., water storage pond).

   Refer also to Information Request INAC02

2. Describe how mine water will be treated/managed if the "worst-case scenario" mine flow rate occurs.

   Refer also to Information Request INAC02

3. If the "worst-case scenario" was not considered in the sizing of the storage facilities or water treatment plant, describe the contingencies that will be in place to manage/treat the water flows above the design values.

IR Number: Parks_Canada_41
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Water storage pond freeboard volume

Preamble:
It was stated that in cases where the water treatment plant breaks down or for an extreme precipitation event, the freeboard for the water storage pond can be used to store water. The area of the water storage pond is 108,000 m^2. With a 1 m freeboard, this equates to a calculated freeboard storage volume of 108,000 m^3. It is unclear if the entire freeboard elevation can be utilized for storage volume.

Calculations of the time to utilize freeboard volume were presented. For example, if the mine water flow rate was 50 L/s, it would take 25 days to reach this volume. The implications of the "worst-case scenario" for mine water flows (i.e., 100 L/s) on storage were not discussed. Mine flow rates greater than 50 L/s would reduce the time to utilize the freeboard volume to less than 25 days. It is unclear if the reduced timeframe is sufficient to recover from a break down in the water treatment plant or extreme precipitation event.

Request:

1. Provide additional detail with regards to the configuration of the water storage pond dam: specifically, the elevation of the dam crest; 1 m freeboard elevation; dam outlet elevation; spillway elevation; and, water level elevation in the water storage pond that will be used in the design of the dam. Further, identify the location of the dam spillway on a map.
2. Discuss the potential for water to breach the dam crest, if the freeboard is temporarily exceeded.
3. Provide additional detail with respect to the implications should the "worst-case scenario" occur during a water treatment plant break down or extreme precipitation events.

Refer also to Information Request INAC01 with respect to calculation of flow rate in providing detail requested.

IR Number: Parks_Canada_42
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Waste rock pile drainage water

Preamble:
CZN proposes to cover the waste rock piles as part of the closure strategy for the mine. Based on preliminary analysis, a cover would reduce the net infiltration into the waste rock to 18% to 29% of the precipitation. Additional information will be needed prior to closure to facilitate final cover design, such as: characterization of materials, construction of a long-term climate database, installation of a net radiometer, and completion of annual snow surveys.

The drainage from the waste rock pile post-closure is into Harrison Creek. The waste rock pile drainage waters may be high in metals. It is unclear what monitoring and management/treatment of this water source will occur post-closure.

Request:

1. Provide additional information for a monitoring program with regards to the collection of climatic, engineering, and geochemical data that are necessary to complete final design of the waste rock pile, and to predict water quality of the waste rock pile drainage water.
2. Provide additional details on the proposed monitoring and management/treatment of waste rock pile drainage waters post-closure.

IR Number: Parks_Canada_43
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Water treatment plant and water storage pond sludge management

Preamble:
CZN proposed to direct the sludge from the water treatment plant clarifier to the paste backfill plant. The volumes of sludge produced in the clarifier were not estimated. It is likely that the sludge will be high in metals; however the total sludge volume may be low compared to the total paste volume. It is unclear if the addition of sludge to the paste backfill will impact paste backfill geochemistry and paste drainage water quality.

Limited discussion was provided on the sludge that may be produced in the water storage pond, and the management of this sludge. It is likely solids will settle in the water treatment pond and may require periodic removal. The management of sludge from the water storage pond is unclear.

Request:

Estimate the volume of sludge to be removed from the water treatment plant and water storage pond and provide further detail on the management of sludge from the water storage pond. Discuss the impact of adding sludge to the paste backfill, with respect to paste geochemistry and paste drainage water quality.

IR Number: Parks_Canada_44
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Water treatment of mine water

Preamble:
Treatment of mine water is required during mine operations. The treatment of mine water is primarily focused on lime addition to remove zinc. The capability of the proposed water treatment method to remove zinc, as well as other metals that may leach (cadmium, antimony, selenium, and mercury) from the paste backfill is uncertain.

Request:

1. Discuss the likelihood that lime addition could remove the following metals from mine water: cadmium, antimony, selenium, and mercury.
2. Discuss the potential ability of the water treatment plant to be retrofitted if the mine water contains metals that cannot be reduced to adequate levels using lime addition.

IR Number: Parks_Canada_45
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Water treatment of process water

Preamble:
Treatment of process water from the mill is required during mine operations. Based on water treatability studies, treatment may involve pH reduction, addition of coagulants/flocculants (sulphide and/or ferric addition), as well as lime addition to raise the pH. The process water contains metals such as: arsenic, cadmium, lead, antimony, selenium, and zinc that may require removal prior to discharge. The target concentrations for these metals in the treated water are unclear.

The treated process water combines with the treated mine water and is then directed to the catchment pond where it is discharged to Prairie Creek. The load balance calculations for water quality in Prairie Creek during operations considered only cadmium, copper, lead, selenium, and zinc in the predictions. The treated process water may contain arsenic, alkaline pH, and chemicals used in water treatment, that are not considered in the load balance model. These constituents may have potential to impact aquatic life if concentrations are elevated.

Request:

1. Provide target concentrations of metals in the treated process water.
2. For the chemicals used in process water treatment and ultimately discharged into Prairie Creek, provide additional discussion with regards to the impacts of these chemicals to aquatic life.
3. Discuss further the expected concentrations of arsenic, and chemicals utilized in treatment, within Prairie Creek and at the NNPR boundary.

   Refer also to Information Request INAC07

IR Number: Parks_Canada_46
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Discharge criteria to Prairie Creek

Preamble:
It is proposed that discharge of water to Prairie Creek from the catchment pond should consider background water quality concentrations, Prairie Creek flow rate, discharge water quality, and discharge flow rate. There are practical limitations for continuous monitoring of background water quality concentrations. Without background water quality concentrations, the concentrations of water in Prairie Creek cannot be predicted, and the discharge loading rate cannot be calculated.

To overcome this limitation, CZN proposed that a pre-determined background Prairie Creek water quality is selected. It is unclear how the pre-determined concentrations would be selected to account for, without limitation, Prairie Creek flow rate, seasonal variations, and climatic conditions.

Request:

1. Describe how the selection of the proposed pre-determined background Prairie Creek water quality concentrations will consider Prairie Creek flow rate; seasonal variations; and climatic conditions.

   Refer also to Information Request INAC08

2. Present additional options to determine discharge criteria, along with the pros and cons for adoption.

IR Number: Parks_Canada_47
Source: Parks Canada Agency
To: Canadian Zinc Corporation
Subject: Site specific water quality guidelines for Prairie Creek

Preamble:
Site specific water quality guidelines for Prairie Creek were developed for cadmium, copper, lead, mercury, selenium, and zinc using the reference condition approach. The reference condition approach relies on upstream Prairie Creek water quality measurements to determine site specific water quality guidelines. Parks Canada understands that the site specific water quality guidelines may be considered in the selection water licence effluent criteria.

With time, a larger data set for upstream water quality concentrations may be available. It is unclear if there will be updates to the proposed site specific guidelines as more data is produced.

Request:

1. Further discuss how the site specific water quality guidelines may be updated, as additional upstream water quality concentration data becomes available.
2. Further discuss how the site specific water quality guidelines may be updated using data obtained from the environment effects monitoring and aquatic effects monitoring programs, after the mine enters into operation