



April 7, 2017

Mr. Chuck Hubert
Senior Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
5102 50th Avenue,
Yellowknife, NT
X1A 2N7

Dear Mr. Hubert

Re: EA1415-001, Prairie Creek Mine All Season Access Road
Response to Technical Reports

Canadian Zinc Corporation (CZN) is pleased to provide the attached response to the technical reports submitted by parties to EA1415-001.

A revised draft Final Commitments table will be provided by email.

We look forward to the Hearings later this month.

If you have any questions, please contact us at 604 688 2001.

Yours truly,

CANADIAN ZINC CORPORATION

David P. Harpley, P. Geo.
VP, Environment and Permitting Affairs



RESPONSES TO TECHNICAL REPORTS – EA1415-01

Responses to the technical reports are provided below. Where no response or qualification is provided associated with a recommendation, it can be assumed that CZN has no problem with it.

GNWT

CZN appreciates the conclusion of the GNWT that the development is not likely to cause significant adverse impacts to the environment, and that the GNWT is not recommending any measures to the Review Board. CZN provides responses below to GNWT's recommendations.

GNWT #1 and GNWT #2

GNWT recommends that the developer:

- *review its commitments regarding road access and use from the current proceeding and from EA0809-002 to ensure that they are consistent with the legislative and regulatory framework, and*
- *include any necessary revisions in its response to other parties' technical reports.*

GNWT recommends that the developer continue to work with GNWT and INAC to clarify lease requirements related to proposed facilities and activities in the Liard River crossing area.

CZN's commitments regarding road access are consistent with EA0809-002 and the current legislative and regulatory framework. We have recently discussed and documented consensus on lease and licence issues with the NBDB, GNWT and INAC (refer to CZN's letter dated April 6, 2017).

GNWT #3

The GNWT recommends that the developer conduct a preconstruction AIA to assess potential impacts to archaeological sites from the development. Specific targets for the AIA will be based on the results of the AOA and cover areas of elevated archaeological potential within the 60 m road right of way (identified by the GIS Potential Model) that were not included in previous AIAs.

CZN agrees that a preconstruction AIA is required. We have committed to having a professionally-directed AIA completed at the time of road construction pre-planning. However, the proposed road right of way (ROW) is not 60 m. Table 2 on page 9 of the Allnorth road design report (PR #59) indicates that the average ROW width will be 22 m, but up to 40 m in places.

GNWT #4

GNWT acknowledges the developer's commitments concerning harvest monitoring and recommends that MVEIRB recognize these commitments as developer's commitments to be included in the scope of development for this EA and captured in the Report of Environmental Assessment. GNWT recommends that Canadian Zinc provide support to NBDB to develop a harvest monitoring program to track and report to the GNWT on patterns and levels of harvest associated with the road. GNWT suggests that this information could be collected at the check station being proposed on the north side of the Liard River crossing. Otherwise, GNWT recommends that existing environmental monitoring programs supported by Canadian Zinc could be expanded to include formal collection and reporting of harvest information. GNWT is willing to be part of discussions on the design of such a program.

CZN agrees to provide support to NBDB to develop a harvest monitoring program to track and report on patterns and levels of harvest associated with the road. We had already planned to collect this information at the check station proposed on the north-west side of the Liard River crossing.

GNWT #5

To support an adaptive approach to minimizing collision risks along the proposed road, GNWT recommends that Canadian Zinc develop a more formal, detailed approach to identifying and communicating seasonal "wildlife caution zones" in its WMMP that includes:

- *How information collected by drivers will be collected and recorded;*
- *Which datasets will be used to identify "wildlife caution zones," and how often they will be combined and analyzed;*
- *Tools that might be used to facilitate recording and geo-referencing; and*
- *How often the need to add, remove or change signage will be assessed and reported on (seasonally, annually).*

In essence, we agree with the recommendation. We have previously stated that road operations will be controlled using a Journey Management System (JMS). This system includes driver journey and incident logs which are compiled and wildlife sightings logged. Sightings will include the nature of the sighting and the location based on landmark and kilometre post (which will be sign-posted). The information would be noted by the driver at his next stop, and possibly by radio dispatch if animals are proximal to the road. Once a trend has emerged (which may occur over a few weeks), it would likely be discussed at pre-travel tail-gate meetings. Once an occurrence becomes common in terms of location, the road operations Supervisor will consider formalizing the caution zone with signage, although drivers will already be aware, and will have received instructions regarding caution.

It is also worth noting that road maintenance crews and environmental monitors will also be routinely on the road, and they will also record wildlife sightings and provide the records for collation.

GNWT #6

Please refer to the letter from Tetra Tech in Attachment 1.

GNWT #7

GNWT recommends that Canadian Zinc consider designing and implementing as part of its WMMP a trail camera study along the Territorial Lands portion of the all-season road alignment west of the Liard River to confirm presence of boreal caribou and evaluate the need for further monitoring of boreal caribou in this area. This program, including the identification of appropriate study locations, can also help to confirm the effectiveness of mitigations to deter public access on the road.

We agree with GNWT's statement that boreal woodland caribou density and distribution in the area is not well documented, though local knowledge suggests it is low. As we have noted, CZN has not observed boreal caribou during any of our activities proximal to the road. Advice from GNWT's Regional Biologist is that boreal caribou congregations proximal to the Front Range occur further north from the road, and south of Nahanni Butte. We also note that boreal caribou are a forest-dwelling species, whereas the road north of the Liard River traverses the mostly sparsely wooded slopes of the Front Range. Boreal caribou range was extended west to the west side of the Front Range quite recently to provide a 'buffer' area, not in response to caribou sightings.

When the all season road is in operation, there will be haul traffic, maintenance crews and environmental monitors on the road, as well as staging and barge operators at the Liard River crossing in summer. Therefore, there will be many potential observers for the sighting of animals. A trail camera operating by motion would have many 'false' recordings due to the traffic. However, there will be times when traffic is not on the road, at night and during the seasonal spring and fall closure periods when the ice bridge over the Liard River is in either break-up or freeze-up. Trail cameras could be considered on a limited basis for these periods as a check on other road users and caribou occurrence.

GNWT #8

GNWT acknowledges the developer's commitments concerning boreal caribou habitat and recommends that MVEIRB recognize these commitments as developer's commitments to be included in the scope of development for this EA and captured in the Report of Environmental Assessment. GNWT further recommends that the developer revise its WMMP to incorporate Commitment #6 from the technical sessions.

Agreed.

We also agree with GNWT's conclusion that the proposed all-season road alignment will increase the amount of new habitat disturbance within the NT1 range, but not substantially. We understand why the GNWT has estimated the new disturbance at 5590 ha, given that the Recovery Strategy post-dates the approved winter road, and that the road has not yet been developed. However, while it may be a moot point, CZN's estimate of disturbance of

approximately 1700 ha is the procedurally appropriate number for the purposes of the Review Board's consideration of effects because the winter road was previously assessed and permitted, and that footprint must be subtracted from the total. To do otherwise would be to assess the winter road twice, which would be contrary to MVRMA, Part 5, s.115 (2).

GNWT #10

Please refer to the letter from Tetra Tech in Attachment 2.

ECCC

ECCC #1

- 1. All representative units should be sampled at all potential borrow source locations in order to identify any acid rock drainage and/or metal leaching potential that would impact water quality.*
- 2. Testing should be completed using acid-base accounting and metal leaching test methods to characterize representative units.*
- 3. Acid-base and leaching testing should be overseen by a qualified professional geochemist for acid rock drainage and/or metal leaching management.*
- 4. Units classified or identified as marginal borrow material, for sources for construction, should be avoided.*

CZN is essentially in agreement with these recommendations. Regarding item 4, we propose to be guided by the recommendations of a professional geochemist, and have suggested a commitment as follows:

“Any borrow with a positive identification of ARD/ML potential will not be used. The remaining borrows will be used subject to mitigation procedures that may be defined by a professional ARD/ML geochemist”.

ECCC #2

- 1. The SECP should be reviewed and finalized before commencing construction.*
- 2. Erosion and sediment control measures should be put in place when constructing around fish-bearing waters.*
- 3. Appropriate setback distances from fish-bearing waters should be determined and implemented based on site conditions for the storage of potential TSS generating materials.*
- 4. Monitoring should be completed during construction periods, prior to spring freshet, and when rainfall events are forecast to ensure sediment and erosion control mitigation measures are effective.*

CZN is in general agreement. Regarding item 4, we assume this refers to visual monitoring of sediment and erosion control measures to ensure they are correctly in-place and likely to be effective prior to the occurrence of significant runoff.

ECCC #3

1. *Comprehensive Project monitoring of TSS and turbidity should be completed and mitigation should be adjusted if needed.*
2. *Baseline turbidity and TSS monitoring to support development of linear regression with TSS should be completed.*
3. *Engagement with ECCC, to develop monitoring program details up to and throughout the permitting phase, should continue.*

CZN agrees with the concept of TSS and turbidity monitoring, with adjustment of mitigation if needed. We also see value in a pre-construction linear regression of the two parameters as while turbidity can be recorded in the field, TSS requires laboratory analysis. However, there are practical limitations in that different flow conditions may be required to generate different turbidity and TSS relationships in order to generate the data necessary for the linear regression. It is of little value to obtain essentially the same measurements repeatedly. It may not be feasible to acquire data during different flow periods. As such, baseline data may not be very valuable. Certainly, it would not be cost effective to attempt to collect such data via dedicated, heli-supported surveys. What might be practical is to monitor a few accessible and representative streams repeatedly during different flow conditions, and to use that data to construct a linear regression for application to other streams.

Therefore, it may not be possible to generate a reliable linear regression before construction. We suggest more emphasis should be based on the upstream and downstream measurement of turbidity immediately before, during and immediately after construction. We suggest it would be appropriate to consider trigger levels based on percentage differences, for example, more than a 10% change triggers an additional mitigation action, unless the difference can be explained by a natural phenomenon and not the construction, followed by additional monitoring to confirm the additional mitigation action was effective.

It is also worth noting that, while the planned road would cross many streams, many of the crossings are near headwaters and are not fish-bearing. Hence, the potential for impacts is low. This is true for all the crossings along the eastern toe of the Front Range, and in the valley between the Front Range and the Silent Hills.

CZN is receptive to discussing these issues further with ECCC.

ECCC #4

1. *Mitigation approaches to prevent potential contaminant loading should be identified and implemented at the Prairie Creek mine and along the access road.*
2. *Description of the monitoring program, including both baseline monitoring, monitoring during mining operations and along the access road, should be provided.*
3. *Description of trigger or action levels above which adaptive management and contingency plans need to be implemented should be provided.*
4. *Description of adaptive management and contingency plans to be employed if trigger or action levels are exceeded should be provided.*

5. Monitoring of annual soil, snow, dustfall, and ambient dust sampling should be included in CLMP.

For clarity, CZN has said that concentrates will either be transported in bags tied down inside a truck box with a solid locking lid, or in bulk in a containerized system with a locking cover.

Regarding mitigation approaches for dust, we have discussed these at the Mine site. We do not propose mitigation along the access road for dust as this must be done at the Mine to prevent contaminant loading. Mitigation along the access road focusses on minimizing the risk of spills, however this is not the subject of the Contaminant Loading Management Plan (CLMP).

Mitigation proposed for dust is to ensure the haul truck is clean leaving site. If a containerized truck is loaded in a 'drive-through' situation, air lancing may be required with a wheel-wash on exit. If concentrates are in bags that are externally clean and loaded onto trucks via a side bay, the trucks would not enter the concentrate shed and would not require a wheel wash. Whatever approach is taken, the trucks must be clean on leaving site, and this will be verified by monitoring.

Regarding the monitoring proposed for inclusion in the CLMP, CZN concurs.

ECCC #5-#10

Please refer to the letter from Tetra Tech in Attachment 1.

DFO

CZN appreciates the comments and advice provided by DFO in their review. A note we would like to make is that there are several references to "the absence of detailed information" (e.g. section 3.2). We are assuming such comments are more of a statement of fact rather than a criticism, since it is usually not necessary or expected to acquire and provide detailed information at this stage of the project, prior to EA approval and detailed design.

DFO #1-#3, #5, #13-#16

Please refer to the memorandum from Hatfield Consultants in Attachment 3.

DFO #4, #8, #12

Please refer to the letter from Tetra Tech in Attachment 4.

DFO #6, #7

DFO-FPP recommends that the Developer implement all available best management practices to avoid, mitigate, or offset serious harm as defined in the Fisheries Act as a result of water crossing construction, operation, and decommissioning. This includes, but is not limited to: appropriate design of water crossings to facilitate passage at both high and low flows; bank stabilization by protecting and replanting riparian vegetation; adhering to timing windows to

avoid spawning, incubation, and hatch times for all species using the water courses, and the installation and maintenance of sediment and erosion control measures.

DFO-FPP recommends that an appropriate water crossing maintenance and monitoring plan be in place to ensure that barriers to fish passage do not form over time as a result of crossing damage due to ice blockage, flooding or movement of debris, such as may occur at freshet.

CZN is in general agreement with these recommendations, in fact we believe we have already largely committed to them. Detailed designs of crossings will consider passage at both high and low flows, bank stabilization, timing windows as necessary, and the installation and maintenance of sediment and erosion control measures. It is worth noting that nearly all fish-bearing watercourses will be crossed with clear span bridges. In addition, we provided a draft crossing maintenance and monitoring outline which we consider to be sufficiently detailed for this stage of the project.

Natural Resources Canada

Natural Resources Canada reviewed explosives and permafrost issues. Regarding the latter, they concluded that “The approach taken by the developer with respect to the road design and impact assessment including the level of baseline data collection, terrain mapping and terrain sensitivity analysis appears to be reasonable for the preliminary design stage and NRCan finds the conclusions presented in the DAR and DAR Addendum to be reasonable”. Please refer to the letter from Tetra Tech in Attachment 2 for additional comments regarding the recommendations made.

Parks Canada

In its Technical Report, Parks Canada recognises that when the boundaries of NNPR were expanded in 2009 the Prairie Creek Mine was excluded from the expansion area and notes that Parks Canada “has made commitments to respect the rights of existing interests that were in place prior to expansion, including provisions for mining roads” (Technical Report, page 7). In 2009, the *Canada National Parks Act* was amended and at Section 41.1 the Parliament of Canada specifically allowed for a mining access road leading to the Prairie Creek Area, including the sites of storage and other facilities connected with that road.

CZN’s existing rights had been recognised and confirmed by a decision of the Supreme Court of the Northwest Territories in the case *Canadian Zinc Corporation v Mackenzie Valley Land and Water Board* (SCNWT S-0001-CV2004) where the Supreme Court ruled that Canadian Zinc’s permit application for a winter road was “grandfathered” and was therefore exempt from the Environmental Assessment process by virtue of Section 157.1 of the MVRMA.

Parks Canada has recognised this right and in September 2013, after an exhaustive and extensive environmental assessment conducted by the Review Board (EA0890-002), Parks Canada issued to CZN Land Use Permit Parks2012-L001 and Water Licence Parks2012_W001, both valid for a period of five years until August 2018, which permit the construction and use of a winter access road through NNPR to the Prairie Creek Mine. The Land Use Permit incorporated a realignment of the original road route to improve access and reduce potential environmental impacts, which

was made primarily in collaboration with and at the request of Parks Canada, and following consultation with First Nations. In the current project proposal, only relatively minor variations to the route of the proposed all-season road within NNPR are made from the previously assessed road permitted by Parks Canada in September 2013.

In its Technical Report, Parks Canada also records that in July 2008, (prior to the expansion of the Park) Parks Canada and CZN signed a Memorandum of Understanding (MOU). In that MOU, Parks Canada recognises and respects the rights of CZN to develop the Prairie Creek Mine and agrees to manage the expansion of the Park so that the expansion does not negatively affect development of, and reasonable access to and from, the Prairie Creek Mine (as defined by approved access provisions). Parks Canada further acknowledges that CZN's existing legal rights can be exercised and agrees that Parks Canada has taken and will continue to take a reasonable and responsible approach to addressing issues of development near NNPR.

The MOU has been renewed on two subsequent occasions, 2012 and 2015, and CZN remains committed to working collaboratively with Parks Canada to achieve our respective goals of managing NNPR and operating the Prairie Creek Mine and CZN will continue to manage the development of the Prairie Creek Mine so that the Mine does not, in its own right, negatively affect the operation of NNPR.

However, Canadian Zinc does acknowledge that in the MOU, "Parks Canada reserves the right, while recognizing the intent of the MOU, to participate in any such processes and take such positions as it sees fit and this MOU does not, and is not intended to, constrain Parks Canada from doing so".

The respect for the rights of existing interests that were in place and acknowledged prior to expansion of the NNPR, and Parliament of Canada's amendment to the CNPA to provide for a mining access road leading to the Prairie Creek Area, coupled with mutual recognition and co-operation contemplated in the MOU, requires a balanced and reasonable approach to evaluating the potential environmental impacts of the proposed project.

In its Technical Report, Parks Canada has indicated that, in its view, individual components of the project have the potential to cause significant impacts and that, due to the level of project and baseline information it says was provided, a reasonable worst case environmental impact was predicted, on the basis of which Parks have made a number of recommendations for consideration by the Review Board.

CZN recognises that Parks Canada has identified several outstanding concerns about the potential impacts of the project and has made a number of recommendations for consideration by the Board. CZN agrees that most of the issues identified by Parks can and should be addressed but that the appropriate time to do so is during the regulatory phase.

CZN has provided comprehensive project and baseline information, sufficient to enable a determination of possible effects and resulting mitigations. This information has been developed following industry standards and specifically having regard to the fact that part of the proposed road is located within the NNPR. CZN submits that the expected standard for data and the

assessment should be the same for all sections of the road, irrespective of whether they are situated inside or outside of the NNPR.

The very existence of a mining road through the NNPR to the Prairie Creek Mine must at least have some limited impacts that would not exist or arise if there was no road, and therefore it is not realistic or reasonable to expect that the construction and operation of a mining road to Prairie Creek, as contemplated by Parliament, can or should have no impact on the “ecological integrity” of the NNPR. Rather, the assessment of the proposed project should reflect a balanced and reasonable approach to evaluating the potential environmental impacts of the proposed project. That “balanced approach” must take into account the commitments that Parks Canada has made to respect existing rights.

Parks Canada’s Technical Report makes recommendations to the MVEIRB for additional baseline studies and, with a few modifications, CZN agrees to undertake those studies.

Although Parks Canada has evaluated the potential for significant effects as higher than the low level potential advanced by CZN, Parks Canada does not express the opinion that the Project will cause significant adverse effects. Indeed, Parks Canada has proposed mitigation measures that it believes will offset potential effects (even though it has completed its effects analysis using “a reasonable worst case scenario”). Although CZN does not agree that the worst-case scenario is appropriate to use, and does not agree with some of the recommendations proposed by Parks Canada which we believe to be excessive, CZN does agree that through the application of mitigation measures any significant adverse effects can be avoided.

However, Parks Canada has stated that some of the baseline data “is not at the standard expected in a national park”. This statement does not respect existing rights or a balanced approach. A balanced approach does not require a higher standard than that applied by the MVEIRB. CZN submits that, in determining the magnitude of effects and resulting mitigations, both inside and outside of the NNPR, CZN and its consultants have applied the standard required by the MVRMA, which we believe to be a responsible and stringent standard appropriate to allow the MVEIRB to undertake its mandate of conducting fair and timely environmental impact assessments in the Mackenzie Valley that protect the environment, including the social, economic and cultural well-being of its residents. The standard should be the same outside and inside the NNPR.

In its Technical Report, Parks Canada expresses the view that the existing baseline data are not as robust as they would like to see. This view does not appear to reflect the extensive studies that have been carried out and comprehensive data that has been collected.

The request for additional baseline data covers the following technical areas: avian species, rare plants and assemblages, collared pika, and heritage resources, all of which has been studied.

CZN has been advised by its consultant that the potential for effects on avian species from the project is low, nevertheless CZN has committed to undertake a survey of avian species to establish a baseline before construction.

CZN has commissioned three separate rare plant surveys in the NNPR. None have found rare plants of significance.

A survey of collared pika was completed, with a commitment to undertake pre-construction disturbance surveys.

Extensive traditional knowledge was documented previously and the areas of high potential were surveyed, failing to discover any heritage resources. CZN has committed to include a professionally directed extensive heritage resource search during road right of way marking in advance of construction.

In all of these mentioned instances, effects are predicted to be low, but nevertheless CZN has included approaches to further mitigate the potential for effects.

Most of the proposed additional baseline data and effects concerns relate to a perceived increased road footprint associated with an all-season road within the NNPR, that will generally follow the current permitted winter road alignment and the previously used historical winter road route.

CZN agrees with Parks Canada that there are a number of additional studies that will be completed prior to construction, with sufficient time to engage the adaptive management process and develop or adapt mitigation measures prior to any disturbance related to the Project.

However, Parks Canada has recommended that these additional baseline studies be done prior to the permits being issued for the Project. Although the MVEIRB is within its jurisdiction to mandate mitigation prior to construction, CZN submits that the MVEIRB should avoid linking such recommendations directly to the permitting process - leaving the requirements for permitting in the hands of the appropriate regulators.

As noted, for those technical areas where additional baseline data may be useful, predicted effects are nonetheless low and are unlikely to change following any additional baseline data collection. As such, Parks Canada's request that the additional baseline data be followed by an updated effects assessment is not justified (see "updated effects assessment" requested in #4 (pika), #7 (avian species), and #10 (rare plants and assemblages)). The process before the MVEIRB is the environmental assessment process, it is not ongoing and iterative. To the extent that it is agreed that further baseline data collection is reasonable, then the resulting data may be incorporated into adaptive management plans and may, in turn, result in further mitigation actions.

We also note that, in a March 20, 2017 letter (PR #462), the Nahanni Butte Dene Band suggest a more balanced and collaborative approach to additional baseline data collection be adopted.

We submit that CZN has accumulated more than sufficient baseline data for this EA, and that if there is a need or desire to obtain broader data for that portion of the road insider NNPR, CZN is prepared to work collaboratively with Parks Canada to collect such data in due course. We note that there have not been any similar requests from other government departments for additional baseline data outside of the NNPR (e.g. none for vegetation).

CZN has provided evidence that demonstrates that the proposed development is not likely to have a significant adverse impact on the environment, and as such, there is not a basis, according to Section 128 (1) of the MVRMA, to consider the imposition of any of the measures Parks Canada has proposed.

PC #1

CZN shall include mitigations for impacts to Arctic Grayling during construction of km 25-32 of the proposed all season road.

While CZN does not disagree with the recommendation, some additional context is appropriate. Observation of grayling in pools in mid-September is no guarantee that those grayling will survive the winter. As we explained, water levels will drop and water in pools will freeze. Sundog Creek is not considered to be comparable to Funeral Creek. The latter creek has deep pools in an area of groundwater upwelling, and conditions are sufficient for over-wintering of fish. These conditions do not appear to exist in Sundog Creek where groundwater flow occurs several kilometres upstream of the reach in question and freezes before the reach, and the pools downstream are shallower, apart from the plunge pool below the waterfall at Km 25. However, we cannot currently prove that grayling do not survive the winter in this location, so we must assume that they might.

Parks Canada correctly noted that CZN re-aligned the road to avoid crossings of the main stem over the reach in question. Also worth noting is the fact that the re-aligned road is set-back from the main stem from Km 25-28.1, is proximal to the main stem from Km 28.1-28.6, and the original alignment is used from Km 28.6-32 where a road bed already exists. Therefore, the section of concern is Km 28.1-28.6.

Parks Canada contend that “CZN has not identified mitigation relating to Arctic Grayling between km 25-32 of Sundog Creek”. In the DAR Addendum, Appendix C ([PR #90](#)), Hatfield Consultants provided the following mitigations and advice:

- CZN will follow best management practices for blasting and have a management plan specifically designed to mitigate effects on fish
- Blasting will not occur in the spring
- After implementation of mitigation measures, the magnitude and likelihood of a significant effect are low
- Blasting will be done in a way that minimizes impacts on fish by utilizing timing window, encouraging fish to move from the blast area, and minimizing the required blast energy

These mitigations are also captured as commitments. Also in the DAR Addendum, Appendix A ([PR #101](#)), Allnorth provides a draft Sediment and Erosion Control Plan in Appendix C. Therefore, CZN has identified mitigation relating to Arctic Grayling between km 25-32 of Sundog Creek, and no significant effects are expected.

PC #2-#8

Please refer to the letter from Tetra Tech in Attachment 1.

With respect to PC #2, woodland mountain caribou, CZN obtained the collar data from Parks Canada that was used to create the kernel density map provided as Figure 1 in Parks Canada's technical report. We asked for the data because we suspected the scale of the figure masks the true distribution of animals, and incorrectly suggests a high density centred on the Mine and western end of the access road. Also, the basis for the density divisions was not specified.

Kernel figures generated by CZN are provided in Attachment 5. Five different periods are shown, including spring migration, summer calving, summer post-calving, fall and winter. The summer calving figure is directly comparable to Parks Canada's Figure 1. The CZN figures confirm that Parks Canada's Figure 1 does mask the true distribution of animals in proximity to the Mine and road. As we have maintained based on existing data and observations, mountain caribou can congregate to the north and west of the access road, with a few animals crossing the road occasionally.

Parks Canada provided the movements of a single collared animal (PC15-08) as Figure 2 in their report. Parks Canada subsequently provided movement figures for all collared animals. We have reproduced these, also in Attachment 5. Also included in the attachment is a figure showing where the animals were collared in relation to the Mine, road and the official NWT mountain caribou range map, as well as a figure showing collar, pellet and survey locations for each animal.

Of the 18 collared animals, only 2 crossed the road, most notably PC15-08, but also PC15-18 to a lesser extent. Again, this data validates our prior conclusions that a few animals occasionally cross the road, whereas many more caribou congregate and migrate to the north and west. As such, mitigations to minimize the risk of animal collisions along the road are appropriate, and have been committed to, but the potential for significant effects is low because significant numbers of caribou are not proximal to the road.

PC #9

CZN shall conduct baseline vegetation surveys within NNPR to accurately describe vegetation within the proposed project area, including the presence and characteristics of rare plants and assemblages. The necessary field surveys shall be conducted to gather this information prior to permits or licences being issued, should the project proceed to the regulatory phase.

The baseline data on vegetation shall include:

3. *A desktop or pre-survey assessment of rare plant and rare community potential across the study area to inform a comprehensive rare plant assessment. This assessment would take the following information into consideration; the ground-truthed vegetation classification (Tetra Tech EBA July 2016), tracking and watch lists of designated species (GNWT, COSEWIC, SARA), relevant literature on the habitat of rare and designated species, information on rare and uncommon terrain features in the project area from analysis of remotely sensed images*

(ex. air photos, SPOT, etc.) and other information sources (ex. Parks Canada and other reports on karst, unglaciated terrain, permafrost, etc.).

These sources of information shall be used to assess the presence of rare plant species and rare assemblages that could occur along the project alignment, and shall be used to identify high priority areas for field surveys. This desktop assessment shall describe any rare plants or plant assemblages that may occur along the route including areas of high potential i.e. sensitive areas (wetlands, alluvial, permafrost), glacial refugia, unusual landforms (karst) or unusual substrates. Where there are no assemblages listed or designated, CZN shall evaluate plants and assemblages that may occur in the study area by ecotype, and generate a list of potential rare or valued (locally significant) assemblages.

4. *Survey data to describe areas of high rare plant potential and high rare vegetation assemblage potential.*

Note: For the assessment of rare species and vegetation communities, assessment of methodologies shall be consistent with best practices outlined by Alberta Native Plant Council (2012) and for rare ecological communities by Allen (2011). Additionally, survey methodology shall include an appropriate spatial distribution and replication of sample sites to be an adequate representation of ecosystems along the proposed alignment.

In a letter dated October 19, 2016 from Tetra Tech, submitted as part of Public Registry document #315, Tera Tech stated the following regarding vegetation:

“To date, three rare plant surveys have been conducted, June 2009, August 2010, and July 2016. No federally listed rare plant species have been documented, however, in 2009, one plant species, Few Flower Meadow Rue (*Thalictrum sparsiflorum*) listed as being rare in McJannet et al. (1995) was documented along the Prairie Creek winter road and an adjacent wetland. The status of this species has since changed, and the Government of the Northwest Territories (GNWT) does not list this species as being rare. Also in 2009, two plant species ranked as ‘May Be At Risk’ by the GNWT were identified along the existing winter access road [Hornemann willowherb (*Epilobium hornemanni*) and linear-leaved willowherb (*Epilobium leptophyllum*)]; these species have also been delisted. Six plant species ranked as ‘Sensitive’ by the GNWT in 2009 [alpine anemone (*Anemone drummondii*), bog birch (*Betula pumila*), lesser black-scaled sedge (*Carex atosquama*), one-glume spike rush (*Eleocharis uniglumis*), alpine groundsel (*Packera pauciflora*) and yellow mountain heather (*Phyllodoce glanduliflora*)] that were identified adjacent to the Prairie Creek winter road have now all been delisted with the exception of one-glume spike rush which remains listed as ‘Sensitive’. It was concluded that potential effects to these local occurrences can be avoided or reduced by limiting the amount of additional land disturbance required for upgrades and operation of the all access road.

As the surveys conducted to date did not cover the early flowering period (mid-June), there is a possibility that some of the currently listed species are present in the project area but were not detected. As a result, Tetra Tech has recommended conducting further

rare plant surveys in mid-June as part of the pre-construction phase of the all season road, and CZN has committed to do this.”

Therefore, CZN has largely already committed to undertake the work recommended by Parks Canada. However, we do not agree that the work must be completed prior to permitting. No significant rare plants have been found to date, which should be sufficient for Parks Canada to agree that the potential for significant effects is low, and other than the precautionary additional survey prior to construction, no other restrictions should be imposed.

PC #10

Based on collection of baseline information outlined in Measure 9, CZN shall provide an updated effects assessment on vegetation. The effects assessment shall identify specific mitigations that will be implemented and any thresholds for the implementation of adaptive management.

CZN shall provide the updated effects assessment prior to permits or licences being issued, should the project proceed to the regulatory phase.

This recommendation will likely be moot since it appears unlikely any rare plants of significance will be found, and therefore the effects assessment will not require an update. However, even if this is not the case, we do not agree that a revised effects assessment is appropriate. It would serve no purpose since the EA will already be complete. We do agree that study findings would inform adaptive management and the possibility of additional mitigation. We maintain that there is no basis to require the baseline survey prior to permitting.

PC #11-#12

The Terms of Reference for the proposed all season road AIA (PRD #379) shall be developed in collaboration with, and approved by, Parks Canada. The AIA shall incorporate systematic shovel testing as well as ground sleuthing in areas of enhanced archaeological potential based on #s 1-3 below.

The AIA shall: (1) be based on elevated areas of archaeological potential identified in the GIS Potential Model Categories 1-4 outlined in the AOA and further clarified in the TOR developed with Parks Canada; (2) assess areas of project impacts including borrow sources, water course crossings including bridge and culvert installation, borrow access roads, camps, staging areas, right of way and road realignments; and (3) incorporate traditional knowledge from all Indigenous communities that may have all season knowledge of the project area including place names, traditional land use and harvesting in areas directly impacted by the expanded footprint of an all season road.

CZN shall conduct the AIA prior to permits or licences being issued, should the project proceed to the regulatory phase.

The Cultural Heritage Protection Plan and heritage resource booklet proposed by CZN, or any other product developed to educate the contractor on cultural resources, will incorporate the

findings of the AOA and AIA. Parks Canada will have an opportunity to review the content of the Cultural Heritage Protection Plan. The Cultural Heritage Protection Plan and heritage resource booklet will be used to provide training and direction on the accidental recovery of heritage resources during the construction phase and will not be used to replace an AIA conducted by a qualified archaeologist. Within the Cultural Heritage Protection Plan, mitigations associated with the accidental discovery of heritage resources in NNPR shall stipulate that all work is stopped and Parks Canada is contacted for advice prior to proceeding.

CZN is largely in agreement with the suggested scope of the proposed AIA. While we will review the extent and sources of available traditional knowledge data, we believe it to be unlikely that data is available that is more comprehensive and relevant than that provided by the NBDB based on a commissioned TK study (PR #18). However, we do not agree that the AIA is required to be completed prior to permitting. Completion as a condition of a permit, and prior to construction, should be satisfactory.

CZN agrees with the recommendations regarding a Cultural Heritage Protection Plan and heritage resource booklet.

PC #13

Please refer to the letter from Tetra Tech in Attachment 4.

PC #14

CZN shall install water gauge stations at the lakes from which water will be withdrawn for dust control within NNPR.

CZN shall create a monitoring program based on the water gauge stations, specifying when lake level and recharge readings will be taken and outlining actions to be taken if the recharge assumptions are not met. The program must be reviewed and approved by Parks Canada during the regulatory phase, should the project proceed to that phase.

CZN has demonstrated that the very small volumes of water proposed to be extracted from local lakes in proportion to the volume of water in those lakes will cause a minimal loss of littoral zone seasonally. All of the lakes have surface water inflows and outflows (see PR #156 for lake properties (Table 1 and Attachment 1)). Lake water level is controlled by the outflow elevation, with a small reduction in level and a short period of no outflow resulting from net evaporation in summer. Representative climate data for the area were generated during EA0809-002. An excerpt from Table 4-1 of the DAR is provided below.

Parameter	Jan	Feb	Mar	Apr	May	Jun	
		-					
Mean Daily Temp °C	-25.6	19.4	-13.3	-3.9	4.4	10.6	
Rainfall mm	0.0	0.0	0.0	2.5	25.4	58.4	
Precipitation mm	22.9	22.9	20.3	25.4	40.6	58.4	
Evaporation mm	-	-	-	-	<25	76.2	
Parameter	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Daily Temp °C	12.8	11.1	5.0	-4.4	-16.7	-20.6	-5.0
Rainfall mm	86.4	71.1	48.3	7.6	0.0	0.0	299.7
Precipitation mm	86.4	71.1	58.4	48.3	30.5	22.9	508.0
Evaporation mm	101.6	76.2	50.8	<25	-	-	330.2

The climate data indicate that net evaporation occurs in June-August, with net precipitation during the rest of the year. The small loss of water volume from water extraction in summer will be more than compensated for by precipitation and runoff before the next summer, with each lake resuming discharge during the spring period, or the previous fall. Therefore, there will be no cumulative impact on lake volumes – they will return to the outflow elevation by the spring of each year at the latest. Hence, there is no potential for cumulative impacts on lake water levels, and water gauges and the related monitoring is not necessary or justified.

PC #16

To support the monitoring programs requested in Measures 15 and 16, CZN shall undertake a comprehensive baseline of turbidity measurements at all road crossing sites (both upstream and downstream), the Sundog Creek realignment, and at all water bodies (e.g., lakes and wetlands) located adjacent to the road. This information will be used to support the development of a linear regression model of the TSS – Turbidity relationship that may serve as a surrogate measure of TSS. CZN shall provide Parks Canada and Environment and Climate Change Canada (ECCC) an opportunity to review the data and agree that turbidity is a suitable surrogate for TSS.

Parks Canada encourages CZN to consider developing a linear regression between TSS and turbidity so that TSS levels can be inferred from field measures of turbidity. Assuming that the linear regression between turbidity and TSS is rigorous (coefficient of determination is high [e.g., .90%] and relationship is linear), the use of turbidity as a real time surrogate for TSS would provide cost savings to CZN and avoid time delays of days to weeks for laboratory analysis while not compromising estimates of TSS.

See our response to ECCC #3 above. While we agree that the use of turbidity as a real time surrogate for TSS would provide cost savings, there are practical difficulties acquiring the data necessary to obtain a suitable linear progression. We suggest that baseline data in advance of construction may not be very useful, and that a more practical approach is to rely on detectable differences between upstream and downstream, with differences of a certain degree triggering adaptive responses.

We accept that monitoring is required to verify that significant effects are not occurring, and that the proposed mitigation to avoid these effects is satisfactory, as expected.

PC #17

CZN shall develop a detailed program to monitor the short-term effects of construction on surface water quality. This program shall include:

- *At all waterbody crossings:*
 - *At least two sampling sites located upstream beyond the potential influence of the construction to define the unimpacted, reference condition.*
 - *At least three sampling sites located downstream of the construction representing: “near-field”, “intermediate-field”, and “far field”.*
- *At the Sundog Creek realignment:*
 - *3 sites located upstream beyond the potential influence of the realignment to define the unimpacted, reference condition.*
 - *3 sites, located downstream of where the realign channel reconnects with the existing channel.*
 - *At least 2 sites, located within the lower half of the new channel.*
 - *Reference sites may also be required upstream in the tributary that enters Sundog Creek from the north shortly after the realigned channel if suitable downstream sites are not available prior to its influence*
- *Specific locations of all monitoring sites, determined by a qualified aquatic specialist (retained by the proponent) based on a field assessment and upon review from PCA and ECCC.*
- *Sampling frequency and intensity during and following construction, and when monitoring would commence*
- *Measurements of TSS, turbidity, dissolved oxygen, conductivity and water pH. If initial measurements of dissolved oxygen, conductivity and water pH indicate that levels are only minimally influenced by construction activities (based on comparisons with data collected at the two upstream sites) then measurement of these variable can cease.*
- *Assessments of deterioration in water quality due to the stream realignment shall be based on comparisons between the upstream with those in the realigned channel and downstream of the realignment.*
- *A comparison of results to the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG PAL). If these thresholds are exceeded in the realignment or downstream, but not the reference sites, adaptive management efforts to reduce impacts will need to be identified or, if construction occurs during the open water period (albeit this is unlikely), a temporary stop work order will come into effect.*

The duration of this short-term monitoring program will be determined by the magnitude of difference between the upstream reference sites and the downstream exposed sites water quality variables, but should at a minimum extend for several months following construction. The program is subject to review and approval by Parks Canada during the regulatory phase, should the project proceed to that phase.

The first part of this recommendation, “CZN shall develop a detailed program to monitor the short-term effects of construction on surface water quality”, CZN has no problem with. While the subsequent details are a useful reference for future discussions, we believe this level of detail is unnecessary and premature at this stage. However, we provide some initial thoughts here.

The two sampling sites upstream are very likely to produce the same results. There is logic in collecting two samples at different sites for the purpose of having duplicate readings to verify accuracy. However, the spatial separation of the sites need not be large. We tend to agree that three downstream sites is reasonable, since this provides multiple confirmatory readings, addresses the potential for runoff carrying sediment entering the watercourse further downstream, and also perhaps will define the extent or plume of possible increased sediment content. Spatial separation of the sites should be such to achieve these objectives without making the distances onerous.

We are concerned by the comment that monitoring sites should be “determined by a qualified aquatic specialist (retained by the proponent)”. What is the definition of an ‘aquatic specialist’? Is it a professional geoscientist or a professional biologist? We believe most would consider that either would be suitable. Therefore, the recommendation should rather cite the need for a ‘qualified professional’. We also believe that it is inappropriate for Parks Canada to be directing CZN to ‘retain’ someone for this task, implying we need to hire a consultant. CZN has a professional geoscientist on staff with more than 35 years of experience in environmental consulting, and formerly a consultant. Such an individual should be considered to be a suitable aquatic specialist.

Regarding measurements, TSS is a laboratory analysis, while the others parameters can be measured using portable meters. Five TSS measurements at each crossing location is excessive and unnecessary. Turbidity readings should be used as an indication of elevated sediment content. A 10% increase between upstream and downstream should trigger an upstream and downstream TSS sample, downstream for regulatory significance and upstream to confirm that the TSS elevation is not from natural causes. We do not think dissolved oxygen, conductivity and pH measurements are necessary, however they are relatively easily collected, and can be dispensed with once initial reading confirm that there is minimal influence by construction activities.

PC #18

CZN shall develop a detailed long-term (i.e., multi-year) program to monitor water quality at a subset of road crossing sites (both upstream and downstream), at water bodies (e.g., lakes and wetlands) located adjacent to the road, and in the realigned Sundog Creek channel. This program requires a reduced sampling effort (i.e., frequency) compared to the short term program and will include:

- *Sampling frequency: Parks Canada recommends samples be taken three times a year at all sites, one during each of spring freshet (June), fall recession (September) and winter base flow (March) or following significant storm events.*
- *Measurements of TSS, turbidity, dissolved oxygen, conductivity and water pH.*
- *A comparison of results to the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG PAL). If these thresholds are exceeded, adaptive*

management efforts to reduce impacts will need to be identified or, if construction occurs during the open water period (albeit this is unlikely), a temporary stop work order will come into effect.

- *This monitoring program needs to demonstrate how the resulting monitoring data will be incorporated into adaptive management. The program is subject to review and approval by Parks Canada during the regulatory phase, should the project proceed to that phase.*

Consistent with our response to PC #17, we believe this level of detail is unnecessary at this time. However, comments are provided.

We concur with the monitoring of crossing sites and waterbodies. The realigned Sundog Creek should not require long-term monitoring for water quality since after the initial short-term adjustment period, realignment behaviour will be natural and the same as other parts of the creek. However, we do propose to monitor the realignment for long-term stability and hydraulic performance.

For sampling frequency, we suggest spring freshet and significant summer storms. Fall recession is a quiescent time and the data are unlikely to be useful. Winter base flow is impractical (snow/ice cover) and unnecessary because runoff potentially carrying sediment is not occurring.

Regarding measurements, refer to our comments in PC #17 above.

PC #19-#21

Please refer to the letter from Hatfield Consultants in Attachment 6.

PC #22 and #23

All grey water within Nahanni National Park Reserve shall be managed through a septic system as outlined in the Yukon Government's Standards and Guidelines. This will included the treatment of grey water to remove waste materials prior to disposal into the environment.

CZN shall provide a grey water management plan for the development, management and decommissioning of all grey water septic systems within NNPR. This plan must be approved by Parks Canada during the regulatory phase, should the project proceed to that phase, and will include:

- a. a design of the grey water septic system being proposed,*
- b. the soil stratification for all proposed locations,*
- c. the depth of the water table,*
- d. the distance to nearest water course/ water body and potable water source.*

All camps of a temporary nature (with a wastewater system that serves a non-permanent population) must have a closure plan submitted as part of preliminary design. As with the design for site facilities, the closure plan must be prepared by a qualified professional and detail how the treatment works will be decommissioned upon camp closure.

CZN does not find these requirements to be unreasonable, so will adopt them as commitments, with the qualification that the treatment of grey water is by simple filtration prior to disposal.

PC #24 and #25

Preferentially, CZN shall store all sewage (brown water) within NNPR in holding tanks for removal and treatment off site at an approved location. Details on the storage, removal and transportation must be provided.

If CZN chooses to manage sewage for camps at km 65 and 87 within NNPR rather than at an approved off site location, a sewage management plan shall be completed for the development, management and decommissioning of the proposed sewage treatment systems at each site. This plan must be approved by Parks Canada during the regulatory phase, should the project proceed to that phase, and will include:

- a. a design of the sewage treatment system being proposed in accordance with accepted standards and guidelines,*
- b. in the case of a septic system, a soil stratification for all proposed locations,*
- c. the depth of the water table,*
- d. the distance to nearest water course/ water body and potable water source,*
- e. depending on the choice of sewage treatment system, a ground water quality monitoring program may also be required which will include thresholds for active management*

All camps of a temporary nature (with a wastewater system that serves a non-permanent population) must have a closure plan submitted as part of preliminary design. As with the design for site facilities, the closure plan must be prepared by a qualified professional and detail how the treatment works will be decommissioned upon camp closure.

The plans for km 65 and 87 will be evaluated on a case by case basis; should the risks be deemed too high, Parks Canada will require that the sewage be removed and treated off site.

CZN has said that we will either store brown water for off-site disposal, or treat it on-site in a suitable treatment plant, with effluent disposal via a soak-away. The selection of which approach will be used will depend on the selected road construction contractor and the equipment available. If off-site disposal is chosen, the water would be taken to a suitable facility, however Parks Canada need not refer to an “approved location” since Parks Canada would not be responsible for the approval.

If on-site brown water treatment is selected, there is no reason to suspect that the treatment would not be effective. Such treatment is commonplace and not complicated, even in cold climates. Effluent would be free of contaminants, other than bacteria which will have a short lifespan in the soak-away. There will be very little potential to affect local surface water and shallow ground water.

If we propose to use on-site brown water treatment, CZN is not opposed to most of the requirements detailed in #25. However, plan approval would need to be a condition of a permit because we may not appoint a construction contractor until after permit issue, and therefore we

may not know the brown water disposal approach to be taken, or the details of a treatment plant, during the regulatory process. If there is to be on-site treatment, that treatment would be expected to be sufficiently thorough such that groundwater quality monitoring would not be necessary.

PC #26

Spill Contingency and Response Plans shall be informed by the updated risk assessment of accidents and malfunctions to mitigate the potential impacts on the environment, as well as, the updated road design and operation plans. They shall address each phase of the project, including: construction, operations, and closure. Due to the time span between construction to closure, it is recommended that a separate Spill Contingency and Response Plan be developed for each project phase to ensure the environmental setting, response resources (equipment and personnel), and types of spills best reflect the project at the time of implementation.

The updated Spill Contingency and Response Plans are subject to review and approval by Parks Canada for portions.

There have been two risk assessments completed for the road. In our 2nd submission to the Board regarding Oboni's risk assessment (PR #407, which Parks Canada does not refer to), we included a screening of Oboni's results on p. 8 (Integration of Results and Mitigation Proposals) and performed a revised risk appraisal. The conclusion of that appraisal was that further review is warranted, during detailed design, for additional mitigations regarding the road sections Km 12.3-17 and 25.2-28.7, with some consideration also of Km 53.5-57.4 (additional mitigations being potentially moderate road widening and/or perimeter barriers). Further, we proposed an operational level risk assessment before operations commence.

Regarding locations assessed in Undertaking #46 and Parks Canada's additional mitigations with respect to specific locations, while Km 7.4-12 (outside of the NNPR) is adjacent to a stream hosting spawning bull trout, this section of the road is essentially flat where it is proximal to the creek and relatively straight with a limited number of broad bends. Hence, the likelihood of an accident is low. The Km 23.5-25.2 road section would be on a bench, not a steep slope to a watercourse (Sundog Creek), which for this section is not fish-bearing. For Km 95.8-102, Km 95.8-96.8 has a very shallow slope with low accident likelihood and easy spill recovery. Km 96.8-102 is steeper but densely vegetated, such that any spill is unlikely to migrate very far and thus spill response should not be challenging. Otherwise, CZN's proposals for road sections requiring additional mitigation consideration agree with Parks Canada's.

In terms of Parks Canada's recommendation, there is a problem in the sequencing of events given the suggestion of an update to spill contingency and response plans "during the regulatory phase". Firstly, as explained above, an update to the risk assessment has already been completed. Secondly, updates to the road design and operation plans would only be completed after permitting, with associated additional mitigations. Therefore, these updates need to be considered as conditions of a permit, not "during the regulatory phase" which implies during the permit issue phase. The sequence is: obtain a permit; conduct further investigation and perform detailed design considering additional mitigations in the process; update environmental plans (e.g. Spill Contingency Plan); obtain approvals for road construction per conditions of a permit;

construct the road; update operational plans considering additional mitigations in the process; operate the road. With these qualifiers, CZN agrees with the intent of recommendation #26.

Regarding a spill contingency plan for each project phase, we are receptive to developing a plan for road construction. A plan for reclamation would likely be similar, however we suggest this plan could be deferred until operations have commenced (say within 12 months), when it would be informed by the construction and operating phase plans.

PC #27

The detailed design and operations of the road shall be informed by an updated risk assessment of accidents and malfunctions to mitigate accident occurrence and the associated consequences. The updated risk assessment shall conform to the Terms of Reference 7.2.2 Effects of Potential Accidents and Malfunctions and address each phase of the project (construction, operation and closure).

The updated risk assessment shall be completed during to the regulatory phase prior to construction of the road. The updated risk assessment, road design and road operations plans are subject to review and approval by Parks Canada for portions of the road within NNPR during the regulatory phase and prior to construction.

As for PC #26, Parks Canada does not refer to CZN's 2nd response to Oboni (PR #407). That response considers Oboni's results and identifies those road sections we believe require additional consideration in terms of minimizing the likelihood of off road excursions and the associated consequences. Therefore, the risk assessment has already been updated in terms of requirements prior to detailed design which will include additional consideration of the noted road sections.

Regarding the consequences of spills, CZN did not agree with Oboni's findings because Oboni did not account for any the relevant information provided in the DAR and DAR Addendum, nor CZN's response to Undertaking #16. Oboni applied a 'relative energy, spread of contaminants and recovery' approach, noting that this "avoids complex toxicological reasoning". Oboni did not consider the actual consequence of a spill. Oboni did, however, rely too heavily on Parks Canada's reply to Undertaking #16, which CZN also had a number of issues with. For example, Parks Canada identified "sensitive drainages and wildlife" in the Tetcela area, where apart from two relatively straight-forward and low risk clear span stream crossings, the terrain is gentle with a low risk of excursions and low significance due to vegetation cover and distance from surface water. Parks Canada's incorrect characterization led Oboni to assign a high consequence to Stratification 5, resulting in an incorrect high risk definition for the road section. This and other information is detailed in PR #407, and was used to update and validate the risk assessment.

Regarding a risk assessment for each phase of the project, CZN considered all project phases in the risk assessments contained in the DAR and DAR Addendum. The Board decided to engage Oboni Riskope for a defined scope of work, which was not the same scope as defined in the Terms of Reference. Whether Oboni did or did not consider project phase is immaterial. In any event, the practical outcome of a risk assessment is to guide road design and construction, operating practices and a suitable spill response plan. Only the latter is relevant to risk

assessment for the construction and decommissioning phases, and spill response plans specific to these phases were addressed in our response to PC #26. Therefore, the requirement for risk assessment by project phase has been completed and the relevant outcomes are already provided for. No further risk assessment update is necessary.

Regarding the second part of the recommendation as it relates to additional mitigations (road design, operations plans), refer to our response to PC #26 above where we discuss the sequence of activities (i.e. obtain a permit; conduct further investigation and perform detailed design considering additional mitigations in the process; update environmental plans). As such, Recommendation #27 has either already been completed or is already addressed by the content of Recommendation #26 and our response to it.

PC #28-#30, #32

Please refer to the letter from Tetra Tech in Attachment 2. The content of the letter makes it clear that Parks Canada's recommendations will be addressed by the planned geotechnical and permafrost investigations.

Regarding PC #32 and a Permafrost Monitoring and Response Action Plan, Tetra Tech's comments on GNWT #10 make it clear that such a plan should not be considered until after detailed design, and they note that the monitoring plan for the Inuvik to Tuktoyaktuk Highway was only completed after the bulk of the construction had occurred. Therefore, we propose that a draft of such a plan be required after detailed design and before construction as a condition of a permit, with plan review and update within 12 months of the completion of construction.

PC #31

The detailed road design is subject to review and approval by Parks Canada for portions of the road within the NNPR during the regulatory phase and prior to construction. The road design shall include, without limitation:

- *Design report, drawings and construction specifications that are signed and stamped by a NAPEG engineer.*
- *The road design be informed by industry best practices, including, Transport Association of Canada (2010). Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions. May 2010.*
- *The road design considers the construction, operations and closure phases of the project.*
- *Factual reports that document the site specific geotechnical and permafrost investigations and results that is utilized in the production of the road detailed design.*

In essence, we are in agreement with the recommendation, but with the clarification that detailed design will occur after permit issue. Review and approval before construction would be a condition of a permit. Given that the road construction is expected to occur over 3 years, with some sections built before others, detailed designs for road sections may be provided in more than one report, rather than one report. Designs for those sections planned to be built first would be provided first for approval. This will reduce the report production and review burden, and hopefully expedite the approval process.

PC #33

CZN shall commit to providing detailed reclamation plans by vegetation / terrain type to demonstrate that ground stabilization and revegetation to restore ecological integrity will be implemented in a timely manner that meets Parks Canada standards and industry accepted best practices. For example, rather than just scarification, ripping and roughening of surfaces is more effective at promoting natural regeneration (Polster, 2016).

Each detailed reclamation plan, including the monitoring plan, is subject to review and approval by Parks Canada during the regulatory phase and prior to construction.

Each reclamation plan shall include:

- The collection of baseline information for the system that is being replicated. This baseline work will need to be done before the system is disturbed by construction and road operations.*
- Detailed information on the short term (beginning during construction and continuing until properly-timed revegetation) and long term (beginning with revegetation and continuing into the post-closure phase) methods and timelines for restoration. It will be important to provide specific information on how the relevant reclamation plans will address areas around borrow sources in floodplains to ensure that bermed areas are properly reclaimed, that water is prevented from ponding, and that sediment / deleterious substances are prevented from entering watercourses.*
- Methods and materials that are consistent with ecological restoration objectives*
- Monitoring plan to evaluate the effectiveness of these mitigation and reclamation measures including targets (ex. percent cover, species diversity, community composition) thresholds for adaptive management, and strategies for implementing adaptive management.*
- Details on how the loss of high and medium quality riparian habitat, as defined by the proponent in PRD # 368 and Hatfield memo (Sept 6, 2016), will be compensated for.*

Preventing the introduction of non-native seed stock is critical in national parks. As such, seed stock must be obtained by collecting and planting local seeds and cuttings. The restoration approach should follow best practices outlined in the Principles and Guidelines for Ecological Restoration of Canada's Natural Protected Areas (public registry document 342), and techniques and prescriptions should reference the Yukon Revegetation Manual (public registry document 340), Densmore et al (2000), or other appropriate studies.

We envisage one detailed reclamation plan which will address all vegetation/terrain types, to the extent necessary. The request to rip and roughen surfaces is not unreasonable, so will be adopted. The other requirements listed are overly prescriptive and unnecessary. Sufficient baseline data already exist defining vegetation/terrain types along the road alignment. We agree that preventing the introduction of non-native seed is important, hence our preference to foster and rely on natural invasion for revegetation supplemented with available local seed and cuttings. We suggest it would be appropriate to prepare an updated draft reclamation plan prior to construction, with a further update immediately after construction when actual reclamation requirements are known in more detail.

Dehcho First Nations

DFN #1

Road alignment should be expanded from 4 m to 5 m along the proposed road alignment where there are steep hills or where the line-of-sight is poor.

After on-going review, the total length of road which will utilize a 4 m width related to sections that require blasting is likely to be less than 1 km. Those sections will not have excessive grade or poor line-of-sight, so the proposed road will be consistent with the recommendation.

A breakdown of sections which currently have a 4 m width design approach is as follows:.

Section	Preliminary Design 4 m wide road length (m)	Revised Approach 4 m wide road length (m)	Description
5.38 to 5.5	120	0	Steeper rock face adjacent to Prairie Creek. Detail design will apply 5 m width
23.0 to 23.7	700	130 (23.38 to 23.45; 23.54 to 23.6)	Only apply 4 m road to “cut through” portions of the design.
25.0 to 26.0	1,000	200 (25.2 to 25.33; 25.43 to 25.5)	Only apply 4 m road to “cut through” portions of the design.
28.0 to 28.9	300	220 (28.28 to 28.5)	Full bench cut adjacent to Sundog Creek
Totals	2,120	550	

If heavy rock at some locations is less than presently estimated, additional opportunity exists to reduce the length of 4 m wide road sections.

Also worth noting is that “cut through” sections are those that will have a rock cut on both sides of the road, thus providing a protective berm on the outside of the road. Excluding these sections, only 220 m of road with a current 4 m width remains.

DFN #2

Avalanche risks.

In CZN’s response to DAR Adequacy dated April 11, 2016 (PR #178), we provided the following advice regarding avalanches:

“Regarding avalanches, an avalanche assessment of the permitted winter road alignment was completed in May 2012 by Avalanche Solutions. Avalanche maps were referred to by Tetrattech EBA in their geotechnical report, and included as an appendix. The full report is attached. CZN will be following up on the recommendations in the report at the appropriate time in advance of winter road construction. CZN did not include the

avalanche report in the DAR because it was our understanding that avalanche assessment was only applicable to road sections where re-alignment was proposed (confirmed in the Board's January 22, 2016 Note to File regarding the content of a teleconference), and no re-alignments were proposed in the DAR in terrain where avalanche risk was identified as a concern. The exception is Km 25-28 where a re-alignment is planned to move the all season road to the south side of Sundog Creek, thus avoiding identified avalanche paths on the north side of the valley.

The Alpine Solutions report confirms that the scope of the avalanche assessment was the whole road. Alpine Solutions identified avalanche paths between Km 4-35, and provided frequency and magnitude projections.”

The point here is that avalanche risks were previously assessed in EA0809-002. CZN committed to follow through on the Alpine Solutions recommendations in that EA, and we reiterated that in this EA. In our opinion, no further consideration of avalanche risks is necessary or procedurally appropriate in this EA.

Regarding blasting and its potential to alter avalanche paths along the all season road, no blasting is expected in the areas of the identified avalanche paths.

DFN #4

DFN believes that the GNWT's disturbance calculation of 5,590 ha for the preferred 160405 Alignment Option is appropriate.

Please see our response to GNWT #8.

DFN #5

Boreal and Northern Mountain Caribou Commitments

CZN's comments/qualifications of the proposed commitments are as follows:

- Some of the information we committed to collect would be compiled and reported on at regular intervals, such as caribou observations by aircraft. Other information will be relayed to all road users as operational advice, such as observations of caribou proximal to the access road. As such, observations may be recorded in real-time, but the timing of relay of the information will vary.
- Monitoring activities and caribou observations are discussed by DFN in the context of adaptive management and mitigation actions, without explaining what the mitigations are and what would trigger a re-evaluation of them. To be clear, we expect to observe caribou periodically along the access road between the Mine and Polje Creek (Km 54). Provided caribou are >500 m from the road, no mitigation is considered necessary. Within 500 m, mitigation is provided to avoid collisions. A collision or near-miss would trigger a review of mitigative approaches.

- The 500 m buffer zone applies to the access road from north of the airstrip. It does not apply to the Mine footprint, which includes the airstrip, neither of which are the subject of this EA. The buffer zone is to minimize the risk of animal-vehicle collisions. If caribou are on the mountain range due west of the Mine, they are highly unlikely to be at risk of a vehicle collision, even if they are within 500 m.

DFN #6

Northern Mountain Caribou

Please refer to the letter from Tetra Tech in Attachment 1 and the response to PC #2. Regarding monitoring including local members, CZN has already committed to hire NBDB members as environmental monitors along the road, with tasks including the observation and recording of caribou sightings as well as monitoring non-mine road use and activity.

DFN #7

Access Management

Regarding access control and remote cameras, please see our responses to GNWT #2 and #7. Regarding road patrols, see our response to DFN #6.

DFN #8

Cultural Heritage

CZN has already made commitments regarding completion of an AIA and cultural resource protection plan, involving local members. The AIA will include pedestrian surveys. Given that previous assessments of ‘high’ potential areas did not find any heritage resources, the potential for heritage resource discovery leading to a significant modification to the project is considered unlikely. Hence, the assessment need only be completed prior to construction.

DFO Supplementary

DFO #1, #7-#8

Please see the memorandum from Hatfield Consultants in Attachment 7.

DFO #2-#6

DFO-FPP recommends that the Developer confirm that the water withdrawal calculations in Table A1.7 “Littoral habitat lost as a result of water withdrawal” reflect the rates proposed (1% at Mosquito and Km70 lakes; 2% at Km 139 and 141 lakes; and 5% at Km 115 and 121 lakes) in the letter to MVEIRB submitted on August 11, 2016.

DFO-FPP recommends that the Developer clarify if water withdrawal, including winter withdrawal, is proposed to occur throughout the construction, operation, maintenance and

decommissioning of the road. If so, DFO-FPP requests that the Developer quantify cumulative anticipated water withdrawal and littoral losses for the construction, operation, maintenance and decommissioning of the road, taking into consideration that lake discharge and recharge rates may vary from year to year.

DFO-FPP recommends that the Developer clarify if water withdrawal, including winter withdrawal, is proposed to occur throughout the construction, operation, maintenance and decommissioning of the road. If so, DFO-FPP requests that the Developer quantify cumulative anticipated water withdrawal and littoral losses for the construction, operation, maintenance and decommissioning of the road, taking into consideration that lake discharge and recharge rates may vary from year to year.

DFO-FPP recommends that the Developer install water level gauges at Mosquito Lake and lakes at Km 70, Km 141, Km 115, and Km 121, and any other lake to be withdrawn from in order to monitor baseline conditions, and discharge and recharge rates.

DFO-FPP recommends that the Developer provide information on littoral habitat (e.g. suitable nursery, rearing, spawning, foraging habitat) for any fish species that might use the area at any point during their life cycle. This information is to be provided for Mosquito Lake and lakes at Km 70, Km 139, Km141, Km 115 and Km121. DFO-FPP also recommends that the Developer provides information on the risk of the formation of barriers to fish passage between lakes, if applicable. This information may be provided during the regulatory phase.

DFO-FPP recommends that the Developer submit a Request for Review and/or apply for a Fisheries Act Authorization for the Project.

Before we address the specific recommendations, additional background information is provided below to better inform DFO. Please refer to our response to PC #14 above for some of that information. We ask DFO to review PR #156 which contains useful information.

Of the six lakes in question, only one is confirmed as being fish-bearing, the Km 121 lake (Gap Lake). However, that lake is near the Grainger River headwaters, and in a lowland muskeg setting. In September 2014, we witnessed new beaver activity in the area of the lake outlet downstream. Two dams were in the process of being built. The photo below provides an aerial image of the area, although the most downstream dam is out of view. Gap Lake is in the background. It is considered likely that the new beaver dams will represent migration barriers to fish. Further, the photo shows that the dams were causing water ponding such that the water level in Gap Lake was raised above its normal level.

Mosquito Lake is part of the closed poljes system that has no surface outlet to a watercourse. The lake is fed by a stream from a small lake, and discharges via a stream to the Third Polje.

Lake Km 70 is a headwater lake formed by a depression in the karst terrain. The lake has no stream inflow but there is an outflow stream. However, the outflow stream has a sustained steep gradient which is likely to be a barrier to fish migration.



Beaver dams downstream of Gap Lake (in background)

Lake Km 115 is near the headwaters of an extensive un-named wetland system that drains north to the Tetcela River. The system is dominated by beaver dams and the habitat for fish is poor (low dissolved oxygen, elevated temperature).

The lakes at Km 139 and 141 are also headwater lakes. Both have outlets and their downstream reaches are characterized by a series of beaver dams, judged to be barriers to fish migration based on reconnaissance. These streams are crossed by the proposed all season road and the crossings were characterized as not fish-bearing.

In summary, all of the lakes proposed for water withdrawal do not now support the migration of fish. Apart from Gap Lake, there is no evidence that fish are present, although this has not been confirmed. As noted, Gap Lake has recently been ‘flooded’ by beaver activity. We believe this context is important when considering the possible effects of water withdrawal. We would also encourage DFO to visit the area and assess and confirm the described conditions themselves.

CZN has confirmed that the withdrawal calculations in Hatfield’s habitat calculations are consistent with the withdrawal percentages proposed.

Water withdrawal will occur in winter during the construction period to build and maintain winter roads, over two winters. Water withdrawal may occur in summer during the 2nd and 3rd years of all season road construction for dust suppression. During operations and decommissioning, water withdrawal is only expected in summer for dust suppression. As noted in our response to PC #14, all of the lakes proposed to be used for water withdrawal will have a positive annual water balance. The lakes will fully recharge from evaporation and withdrawal losses each spring after melt, if not before as a result of fall inflows. CZN will monitor the volume of water withdrawn to ensure it does not exceed the voluntary and daily Water Licence limits. Therefore, there will be no cumulative littoral loss between years because of fall and spring recharge.

Because of the above noted conditions, the installation of water level gauges is not considered to be necessary.

Considering the very small volume of water to be withdrawn in summer relative to lake capacity (1-5%), combined with the very small relative predicted area of maximum (because inflows will likely mean it is much less) temporary littoral zone loss (1-2%), we suggest the risk posed to the littoral zone is negligible, and certainly not of a nature that would warrant a need for the littoral information listed above.

CZN intends to apply for an Application Form for Paragraph 35(2)(b) Fisheries Act Authorization (Normal Circumstances).

ADDENDUM 1

April 5, 2017

Canadian Zinc Corporation
Suite 1710, 650 West Georgia Street
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Vancouver, BC V6B 4N9

ISSUED FOR USE
FILE: ENG.YARC03070
Via Email: david@canadianzinc.com

Attention: David Harpley
VP Environmental & Permitting Affairs

Subject: Technical Report, Wildlife Responses
Environmental Assessment, EA1415-01
Proposed All Season Access Road to Prairie Creek Mine, NT

1.0 INTRODUCTION

As part of the Environmental Assessment process for Canadian Zinc Corporation's (CZN) proposed Prairie Creek Mine all-season road (EA1415-01), Parks Canada, Environment and Climate Change Canada (ECCC), and the Government of the Northwest Territories (GNWT) have submitted Technical Reports to the Mackenzie Valley Review Board (MVRB) based issues relating to the All-Season Road Developers Assessment Report (DAR) and related information requests. This letter provides responses from Tetra Tech Canada Inc. (Tetra Tech) to Technical Report comments that pertain to wildlife.

2.0 RESPONSE TO PARKS CANADA

2.1 Magnitude of Impacts to the Northern Mountain Population of Mountain Caribou

Parks Canada Issue Statement

There are potential impacts to the Northern Mountain Population of Woodland Caribou (*Rangifer tarandus*), a COSEWIC-listed species of Special Concern, resulting from the proposed all season road. CZN indicates that the magnitude of these impacts is low. Parks Canada disagrees with this conclusion and believes that there is potential for the magnitude of these impacts to be significant.

Parks Canada's Conclusion and Rationale

The Northern Mountain Population of Woodland Caribou is a species listed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), with known occurrence in the project area. Within the assessment of impact of the project on the Northern Mountain Population of Woodland Caribou the DAR repeatedly states that the project area is "outside the defined species range", citing a website map source (ENR, 2014). This is incorrect, outdated information. Wildlife studies in the project area, albeit limited, consistently report caribou in the project area.

Information from hunting outfitters, park staff observations, remote camera images, and recent satellite collar data confirm caribou in the project area and their year-round presence. The DAR also states that the project area is "well outside known calving and wintering areas" for caribou; however, there is reference to multiple observations of caribou calves in the camp logs, including one calf reported as early as 01 June (DAR Addendum, Appendix E).

The conclusion in DAR Addendum, Appendix E, that potential disturbance related effects on the Northern Mountain Population of Woodland Caribou are low is inconsistent with information provided. Section 7.3 cites several references stating that caribou avoid roads, and active roads to a greater extent than inactive ones (up to 35 km avoidance for Dempster Hwy). Caribou are known to be in the project area year-round, so construction and use of an all season road is reasonably expected to have an impact.

To further Parks Canada's understanding of caribou use in the project area, a total of 18 satellite collars were placed on female caribou in the vicinity of the mine site and proposed all season road in February and December 2015. Of these collared females, the majority spend part of the year in the Prairie Creek valley, and migrate northwest in summer. A smaller number of these caribou spent the entire year in close proximity to the project area. Figure 1 provides an example map of the density of locations for all collared caribou, in the calving season; note the mine site and first 20 km of the proposed access road fall within the southeastern area of high density use.

A subset of these caribou were collared east of the mine site, on the other side of Tundra Ridge, in the lower Sundog Creek area. Previous studies and incidental observations have repeatedly shown caribou in this area, and although there were only two caribou fitted with collars, their movement pattern supports the idea that they may comprise a small, sedentary population. Throughout the entire period of data collection (six months for one collar and just under one year for the other), both of these female caribou stayed within a home range of less than 600 km², and both crossed the proposed road alignment (Figure 2; refer to Parks Canada's Technical Report). It is unknown at this time how many caribou may be part of this localized group.

Additional information on the sedentary and migratory caribou within the study area is being gathered through genetic analyses. Preliminary analyses have been conducted on DNA from caribou fecal pellets within the study area, including collared animals (samples from 108 individuals). Results to date indicate that caribou within the study area belong to the Redstone herd, and that the sedentary animals may comprise a genetically distinct subgroup (Manseau, 2017). Additional analyses are underway to further elucidate the genetic structure of Mountain caribou populations within the study area and region.

Parks Canada considers the use of the project area by caribou to be important, which is supported by the collar data gathered to date. The satellite collars represent only a small sample of animals, yet, caribou were found north, south, east and west of the mine site and proposed all season road, and, within a few months of collar deployment, at least 3 of 18 caribou (17%) had crossed the proposed road alignment, and several others spent time close to the mine site and proposed all season road. The more sedentary animals described above could be a distinct local population, and the TOR asks for effects on local populations.

Parks Canada considers the potential impact on Northern Mountain Caribou to be significant. Potential impacts include, but are not necessarily limited to, avoidance of the road (resulting in fragmentation / loss of habitat effectiveness), noise disturbance, increase in predation risk, and direct mortality.

Parks Canada's Recommendation(s)

Parks Canada recommends that the Review Board apply the following measures to prevent potentially significant adverse impacts to the Northern Mountain Population of Woodland Caribou from the proposed all season road.

#2

CZN shall develop a systematic monitoring program to address potential impacts to the Northern Mountain Population of Woodland Caribou from the all season road. This monitoring program must include annual aerial surveys to provide a population index and composition during rut and additional seasonal ungulate surveys as required. Track and scat surveys or the use of a camera trap design could also be implemented.

The monitoring program needs to demonstrate how the resulting data will be incorporated into adaptive management (i.e., define thresholds and actions) and must be developed in collaboration with (and approved by) Parks Canada during the regulatory phase, should the project proceed to that phase. Further mitigations may be required, such as timing windows or identified sensitive areas with limitations on use. Parks Canada supports an adaptive management approach based on the results of the monitoring program. Until notified otherwise by Parks Canada, CZN shall provide annual monitoring updates to Parks Canada to ensure that appropriate management responses/mitigation adjustments can be implemented. These responses/mitigation adjustments must be approved by Parks Canada.

The program implemented by Selwyn-Chihong Mining Ltd. could provide an example (minimum of annual rut and winter surveys).

Tetra Tech's Response

Tetra Tech does not anticipate the proposed all-season road will have an adverse effect on the Northern Mountain Population of Woodland Caribou, as suggested by Parks Canada. The Northern Mountain caribou in NT, Yukon, and west-central and northern BC represent one population (COSEWIC 2014). The DAR indicates a potential for low significance, adverse effects to the few caribou that are distributed near the road year round. Effects are at the scale of individuals, not at the population level.

Parks Canada's Technical Response and data indicate that collared cows near the proposed Prairie Creek mine and proposed all-season access road are part of the Redstone subpopulation (formerly referred to as herd). As indicated in the DAR, the Redstone subpopulation is one of the largest in the NWT, estimated at 10,000 animals, and covers an annual range of nearly 90,000 km² (and includes the Deh Cho, Sahtu, and Gwich'in regions). The Redstone's 20-year population trend is considered stable. Their calving and summer periods are generally spent in the Mackenzie Mountains near the NT and Yukon border at the headwaters of the South Nahanni watershed. In winter, they move down into the boreal forest of the Sahtu and Deh Cho regions. COSEWIC (2014¹) provides additional detail regarding this subpopulation, and indicates individuals may remain in certain areas year round (i.e., sedentary).

¹ COSEWIC. 2014. COSEWIC assessment and status report on the Caribou *Rangifer tarandus*, Northern Mountain population, Central Mountain population and Southern Mountain population in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxii + 113 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Sedentary Individuals:

COSEWIC (2014) provides supporting evidence of sedentary individuals of the Redstone subpopulation. These sedentary individuals have been documented to occur at Drum Lake, Sahtu region (Wilson and Haas 2012²):

“In the Northern Mountain DU [Designated Unit], caribou generally migrate between summer and winter ranges (Farnell and Russell 1984, Culling et al. 2005, Parker and Gustine 2007). However, in some subpopulations, individual caribou may remain on the winter range (Gullickson and Manseau 2000, Culling et al. 2005) or on the summer range (Cichowski 1993, 2010, Backmeyer 2000) all year. For example, some collared individuals of the Redstone showed seasonal migratory movements while others were sedentary year round.” (COSEWIC 2014).

Similarly, some individual caribou in the A La Peche subpopulation of the Central Mountain DU are also known to remain year round on their winter range (Mike Russell, Alberta Environment and Parks, Senior Wildlife Biologist pers. comm. March 10 and 29, 2017). Sedentary individuals of the A La Peche subpopulation behave similarly to boreal woodland caribou with respect to calving in isolation and congregating in small groups (approximately 6; maximum of 12 individuals) during rut on their winter range (Mike Russell, pers. comm. March 29, 2017). Anecdotal observations suggest sedentary animals are more often bulls; however, cows have also been observed (Mike Russell, pers. comm. March 29, 2017).

Thus, sedentary animals are individuals of a larger subpopulation. Parks Canada’s collaring data for PC15-07 and -08 animals seem to support the idea of sedentary individuals of the Redstone subpopulation. Similarly, Parks Canada’s Technical Response indicates that *“previous studies and incidental observations have repeatedly shown caribou in this area, and although there were only two caribou fitted with collars, their movement pattern supports the idea that they may comprise a small, sedentary population.”* Parks Canada’s response to CZN’s March 20, 2017 inquiries also reported that caribou have been repeatedly observed in the Sundog Lake area during winter aerial and fecal pellet collection surveys. These visual observations are supported by PC15-07 and -08 collaring data, which shows a large cluster of GPS locations in the Caribou Lakes area; a minimum of 6 km from the proposed all-season road alignment. Tetra Tech agrees that Parks Canada’s current data indicate a small number of sedentary individuals occur in the region. A few caribou present near the proposed all-season road were considered in the DAR effects assessment.

Non-Sedentary Individuals:

The large winter range of the Redstone subpopulation extends across the Sahtu and Deh Cho regions. COSEWIC (2014) indicates that *“although caribou return to the same general area during winter, they may use different parts of the winter range in different years and/or move between portions of the winter range during each winter”*. Thus, individual caribou may overwinter in the vicinity of the proposed all-season access road one year (or portions of that winter), but not the next. Parks Canada’s 2015 and 2016 data indicate collared animals either overwintered in the same area or approximately 40 km away, between years. This suggests that overwintering individuals may not be in the vicinity of the proposed all-season road each winter.

In addition during the calving period, Parks Canada collaring data suggest the collared animals generally returned to the same region in 2015 and 2016. Of the five animals with both 2015 and 2016 location data during the calving period, PC15-01 was the only animal located as close as approximately 5 km from the proposal all-season road in both 2015 and 2016. The other four animals with two years of calving data (PC15-03, -4, -5, and -6) consistently returned to the NT/Yukon border region to calve each year. With exception, the PC15-04 animal was located

² Wilson, J.M. and Haas, C.A. 2012. Important Wildlife Areas in the Western Northwest Territories. Manuscript Report No. 221. Environment and Natural Resources, Government of the Northwest Territories.

approximately 33 km (from nearest GPS point location during calving period) from the proposed all-season road during the 2015 calving period, but at the NT/Yukon border during the 2016 calving period.

A single year of data (2016) is available for eleven additional cows (PC15-07, -08, -09, -10, -11, -12, -13, -15, -16, -17, and -18). Of these 2016 locations, two animals (PC15-07 and -08) calved 7.7 and 7.1 km, respectively near the proposed all-season road. The remaining nine animals migrated to the NT/Yukon border for the calving period.

Together, Parks Canada's 2015 and 2016 collaring data represent 21 calving periods (all years and all collared animals). During the 21 calving periods, 9.5% (or two calving periods) were spent a minimum of 5 km from the proposed all season road, 9.5% (or two calving periods) 7 km minimum distance, 4.8% (or one calving period) at 33 km, and 76.2% (or 16 calving periods) ≥ 220 km from the proposed road.

Parks Canada's kernel density analyses for the calving period predicts a high density of collared animal locations over the Prairie Creek Mine and first 20 km of road (approximate). This cluster analysis seems to suggest two large and equally high density zones near the Mine and the NT/Yukon border. Tetra Tech's opinion is that the data show a small number of calving period locations near the Mine and proposed all-season road; and the cluster density is not equal to the calving density at the NT/Yukon border. Only three calving periods (two in 2015 and one in 2016) were spent in the "high" density zone identified by Parks Canada near the Mine, and 16 in the NT/Yukon border high density zone. Based on the actual number of calving periods generated by the data, a medium-low density characterization near the Mine and first 20 km of road (approximate) would be anticipated.

Overall, the Parks Canada collaring data provide high-quality year round data. These data show seasonal variability of individual caribou occurring near the proposed all-season road. Tetra Tech is of the opinion that the proposed all-season road represents an area of trace, year round, occurrence for individuals of the Redstone subpopulation, consistent with the range map in "Species at Risk in the Northwest Territories, 2016".

Monitoring:

The Selwyn-Chihong Mining Ltd.'s mine and Howard's Pass access road are located inside the 1) summer and rut range of the South Nahanni subpopulation, and 2) the calving and early to mid-summer ranges of the Redstone subpopulation (Wilson and Haas 2012; Weaver 2006³). Both of these areas have been identified as Important Wildlife Areas for Mountain Woodland caribou in the NT (Wilson and Haas 2012). The Howard's Pass access road bisects these ranges; with caribou to "*likely cross the road or frequent the adjacent area*" as they move between their summer and winter ranges (SLR Consulting (Canada) Ltd. 2015⁴). The caribou survey/monitoring program proposed by Selwyn-Chihong Mining Ltd. is appropriate for development inside these Important Wildlife Areas. In contrast, the proposed Prairie Creek all-season road is located outside a defined caribou range in an area considered "trace occurrence", and utilized by a small number of individuals from the Redstone subpopulation year round.

The DAR acknowledges that some caribou may occur near the Project and assesses potential Project-related effects to Northern Mountain Caribou. Monitoring is needed to directly correlate road-related activities to effectively integrate reasonable Project-specific mitigation and adaptive management. Monitoring is required at a local scale appropriate to determine road-related effects.

Tetra Tech understands fall composition surveys are used to determine age/sex ratios to understand trends at a regional or subpopulation level (i.e., calves/100 cows, or cows/100 bulls). Based on this understanding, Tetra Tech

³ Weaver, J. L. 2006. Big Animals and Small Parks: Implications of Wildlife Distribution and Movements for Expansion of Nahanni National Park Reserve. Conservation Report No. 1. Wildlife Conservation Society. 108 pp.

⁴ SLR Consulting (Canada) Ltd. 2015. Howard's Pass Access Road Upgrade Project, 2015 Project Description Report. Prepared for Selwyn Chihong Mining Ltd.

is of the opinion that fall composition surveys are not a preferred method to monitor Project-related effects on local caribou.

Larter (GNWT Dehcho Regional Biologist, 2012⁵) indicated “for species such as northern mountain caribou, that move dynamically in time and space, conducting more standard fall aerial surveys to get estimates of demographic data can not only be extremely expensive and dangerous, but also has a high probability of providing a very restricted sample from an isolated part of the range. Costs and survey weather conditions often preclude annual surveys, resulting in sporadic surveys of variable quality over time.”

Therefore, it is not practical or necessary for CZN to conduct aerial caribou surveys in terms of project effects and adaptive management. However, CZN has previously offered to provide logistical and monetary support to Parks Canada for the continuation of their more broadly-scoped Northern Mountain Caribou monitoring programs. This would be combined with the opportunistic but structured recording of caribou observations along the proposed all-season road by truck drivers and environmental monitors, as an effective monitoring program appropriate for the caribou near the road and possible adaptive management.

2.2 Baseline Requirements, Effects Assessment and Monitoring of Potential Impacts to Collared Pika

Parks Canada Issue Statement

There are potential impacts to Collared Pika (*Ochotona collaris*), a species of Special Concern on Schedule 1 of the Species at Risk Act (SARA), resulting from the proposed all season road. While CZN has committed to conducting presence/not detected surveys for pika along km 12-39, Parks Canada believes this type of survey will not provide adequate baseline information to inform the mitigations and monitoring legally required under SARA.

Parks Canada's Recommendation(s)

#3

The proposed all season road alignment, and proposed borrow sources, from approximately KP 12 – 39, shall be surveyed to determine species presence, distribution and relative abundance of Collared Pika.

- Survey methodology shall use recognized and standard methods.
- Survey methods and overall sampling design shall be developed in collaboration with, and approved by, Parks Canada.

The necessary field surveys shall be conducted to gather this information prior to permits or licences being issued, should the project proceed to the regulatory phase.

#4

Based on collection of baseline information outlined in Measure 3, CZN shall provide an updated effects assessment on Collared Pika. This assessment shall identify specific mitigations that will be implemented.

CZN shall provide the updated effects assessment prior to permits or licences being issued, should the project proceed to the regulatory phase.

⁵ Larter, N.C. 2012. Preliminary Analysis of Hunter Observations of Northern Mountain Caribou in the Mackenzie Mountains, 1991-2010. Manuscript Report No. 217. Department of Environment and Natural Resources, Government of the Northwest Territories.

#5

CZN shall develop a systematic monitoring program to address potential impacts to Collared Pika from the all season road. The monitoring program needs to demonstrate how the resulting data will be incorporated into adaptive management (i.e., define thresholds and actions) and shall be developed in collaboration with (and approved by) Parks Canada during the regulatory phase, should the project proceed to that phase. The baseline information outlined in the Measure 3 can be used to inform the extent and design of the required program. Until notified otherwise by Parks Canada, CZN shall provide annual monitoring updates to Parks Canada to ensure that appropriate management responses/mitigation adjustments can be implemented. These responses/mitigation adjustments must be approved by Parks Canada.

Tetra Tech Response

CZN has previously committed to conducting a pre-construction field program for Collared Pika. The survey will be developed in cooperation with Parks Canada and the GNWT. However, we reiterate that we consider the potential for significant adverse effects on Collared Pika to be low, and therefore, we believe the additional survey can be performed at any time before construction and need not be a pre-permit survey.

CZN is amenable to updating the WMMP to include a Collared Pika monitoring program in collaboration with Parks Canada and the GNWT (refer to Section 4.3) to monitor potential effects associated with the proposed all-season road.

2.3 Baseline Requirements, Effects Assessment, and Monitoring of Potential Impacts to Forest Birds, Waterfowl, Migratory Birds and Avian Species at Risk

Parks Canada Issue Statement

There are potential impacts to birds (including waterfowl), including several SARA-listed species, resulting from the proposed all season road. CZN indicates that additional baseline data are not needed at this time as they are unlikely to alter the predicted low magnitude of project effects. Parks Canada disagrees with this conclusion and notes that the baseline data provided does not meet the requirements of the TOR for the current proposed all season road EA.

Parks Canada's Recommendation(s)

#6

CZN shall collect baseline data as outlined in the Terms of Reference (Sections 3.2.3, 5.1.4 and 5.1.6) (PRD #42), for the following: species presence, distribution, relative abundance, use of the project area by species, and use of habitat in the project area for forest bird communities, waterfowl, migratory birds and avian species at risk (population characteristics and habitat use of the project area by forest bird communities, waterfowl, migratory birds and avian species at risk).

- PCA defines population characteristics as including species presence, distribution and relative abundance.
- PCA defines habitat use as including use of habitats for foraging, reproduction and rearing of offspring and that includes seasonality in their use.
- Data describing population characteristics and habitat use can be collected, simultaneously, through the use of automatic recording units, which can be deployed in the field and later retrieved, then transcribed and analyzed.

- Survey methodology shall include the appropriate spatial distribution and seasonal timing for adequate representation of species along the entire proposed all season road alignment (not just the realignments that go beyond the approved winter road alignment).
- Survey methods and overall sampling design shall be developed in collaboration with, and approved by, both Parks Canada and Environment and Climate Change Canada.

The necessary field surveys shall be conducted to gather this information prior to permits or licences being issued, should the project proceed to the regulatory phase.

#7

Based on collection of baseline information outlined in Measure 6, CZN shall provide an updated effects assessment on Forest Birds, Waterfowl, Migratory Birds and Avian Species at Risk. This assessment shall identify specific mitigations that will be implemented. CZN shall provide the updated effects assessment prior to permits or licences being issued, should the project proceed to the regulatory phase.

#8

CZN shall develop a systematic monitoring program for migratory birds, including avian species at risk, to address potential impacts from the all season road. The monitoring program needs to demonstrate how the resulting data will be incorporated into adaptive management (i.e., define thresholds and actions) and shall be developed in collaboration with (and approved by) Parks Canada during the regulatory phase, should the project proceed to that phase. Until notified otherwise by Parks Canada, CZN shall provide annual monitoring updates to Parks Canada to ensure that appropriate management responses/mitigation adjustments can be implemented. These responses/mitigation adjustments must be approved by Parks Canada.

The baseline information outlined in the Measure 6 can be used to inform the extent and design of the required program. If multiple years of data can be collected prior to construction, this would allow some understanding of inter-annual variation within the bird community, and improve the monitoring program and potential mitigations / adaptive management actions.

Tetra Tech Response

CZN has previously committed to conducting a pre-construction field program. The survey will be developed in cooperation with Parks Canada and Environment and Climate Change Canada (ECCC). However, we reiterate that we consider the potential for significant adverse effects to be low, and therefore we believe the survey can be performed at any time before construction and need not be a pre-permit survey.

3.0 RESPONSE TO ENVIRONMENT AND CLIMATE CHANGE CANADA

3.1 Impact Assessment for Migratory Birds and Avian Species at Risk

ECCC's Recommendation(s)

1. A robust monitoring program, including pre-construction information, should be implemented for migratory birds and avian species at risk along the proposed all season access road alignment. This recommendation is consistent with the recommended monitoring described in the PCA letter to MVEIRB, dated September 30, 2016.

2. Information should be collected to obtain a minimum of one year of baseline conditions. Survey protocols should optimize detectability and sufficient survey effort should be provided to obtain comprehensive coverage of habitat types.
3. Results of monitoring programs should be summarized in annual wildlife monitoring reports.

Tetra Tech Response

CZN has already committed to a field program using automatic recording units. The survey will be developed in cooperation with ECCC and Parks Canada.

ECCC noted that such a survey would be “unhelpful to validate or minimize impacts if it is not collected before clearing of the winter road commences”. However, it should be noted that CZN already holds winter road permits that do not have an avian survey pre-development requirement.

3.2 Trumpeter Swans

ECCC's Recommendation(s)

1. Frequent, long-term and large disturbances, multiple sources of disturbances, and noise emissions greater than 50 dB (or greater than 10 dB above ambient) should be avoided within 800 m of observed Trumpeter Swans.
2. Mitigation and monitoring efforts should be focused in sections where the Project overlaps the Southeastern Mackenzie Mountain Key Migratory Habitat Site (NT Site 17).

Tetra Tech Response

CZN will ensure mitigation and construction monitoring efforts will focus on areas where the Project overlaps the key Migratory Bird Habitat Site (including between KM 98 to 117), and where Trumpeter Swans are observed (including between KM 98 to 117).

ECCC also expressed concern that construction activities (if critical for development, but excluding blasting) may occur within 800 m of observed Trumpeter Swans (from April 1 to September 30). CZN acknowledges this concern, and commits to extending the prohibited activities to also include crushing activities. Additional construction-related activities may be required during this Trumpeter Swan restricted activity period, and will be conducted with the assistance of a CZN Environmental Monitor.

3.3 Migratory Bird Mitigation and Monitoring

ECCC's Recommendation(s)

1. All phases of the Project should be carried out in a manner that protects migratory birds and avoids harming, killing or disturbing migratory birds or destroying, disturbing or taking their nests or eggs. In this regard, the Proponent should take into account ECCC's guidelines (<http://www.ec.gc.ca/paom-itmb/>).
2. A scientifically sound approach to determine the likelihood of nesting birds should be used in the event that clearing or disturbance cannot be scheduled outside of the nesting season. If necessary, the use of non-intrusive search methods (e.g., point counts) could be undertaken to conduct an area search, for evidence of nesting, prior to the commencement of clearing.

3. Migratory bird surveys should be carried out by an avian specialist with experience with migratory birds and migratory bird behaviour indicative of nesting (e.g., singing birds, alarm calls, distraction displays, carrying nesting material or food).
4. Results from all pre-clearing surveys should be reported in the annual wildlife monitoring report.
5. Options such as avoiding, adapting, rescheduling or relocating activities, should be considered and implemented if there are indications of migratory bird nests where disturbance activities that have the potential to disturb or destroy nests are proposed.
6. All disruptive activities in the nesting area should be halted if migratory bird nests containing eggs or young are discovered. An appropriate buffer zone (i.e., setback distance) should be determined and observed until the young have naturally and permanently left the vicinity of the nest. Buffer zones should be appropriate for the species and take into consideration the intensity of the disturbance and the surrounding habitat. Buffer zones should also be adjusted after assessing their effectiveness.
7. A buffer zone for forest songbirds should be included in Appendix C of the WMMP.
8. If required, ECCC (ec.eenordrpntno-eanorthpnrnw.ec@canada.ca) should be contacted for advice and/or additional mitigation measures.
9. All of the above recommendations should be incorporated into the next revision of the WMMP.

Tetra Tech Response

1 to 4. A clearing schedule has been planned for implementation outside the nesting season, and thus, CZN is not anticipating the need for pre-clearing surveys. Should clearing be required, CZN will work collaboratively with ECCC to develop a pre-clearing survey design.

5 to 9. A 250 m buffer distance to forest songbirds during nesting season was included in Appendix C of the WMMP under “all wildlife and birds, general”. CZN will update Appendix C specifically stating forest birds, and will incorporate ECCC’s above recommendations in the next WMMP version. CZN’s Environmental Monitor, with support from CZN’s Site Superintendent, will be responsible for identifying and providing options (including buffer zones) to avoid, adapt, reschedule, or relocate activities to the extent possible (throughout the life of the proposed all-season road) where Project-activities have the potential to disturb or destroy nests, eggs, or young. A recommendation for CZN’s Environmental Monitor to seek additional advice and/or mitigation measures from ECCC, as required, will also be added to the next WMMP version.

3.4 Species at Risk

ECCC’s Recommendation(s)

1. Section 2.3.2 of the Updated Draft WMMP should be revised to reflect that the general prohibitions for migratory birds and aquatic species listed on Schedule 1 apply wherever these species are found.
2. Table 1 of the Updated Draft WMMP should be revised to reflect current status of species listed on Schedule 1 of SARA or assessed by COSEWIC. Table 1 should be revised and included as part of the annual monitoring reports to aid the Proponent in remaining aware of status changes while minimizing the number of revisions to the WMMP. The Proponent should consult the Species at Risk Registry on a regular basis (<https://www.registrelepsararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1>) to maintain the most

current information for their operations including new COSEWIC assessments and/or species added to Schedule 1 of SARA.

3. If species at risk are encountered or affected by the Project, the primary mitigation measure should be avoidance. The Proponent should avoid contact with or disturbance to each species, its habitat, and/or its residence.

Tetra Tech Response

CZN agrees and commits to ECCC's requests; these will be included in the revised WMMP.

3.5 Quarry Operations and Avian Species at Risk

ECCC's Recommendation(s)

1. ECCC (ec.eenordrpntno-eanorthpnrnwt.ec@canada.ca) should be consulted regarding migratory bird mitigation measures and advice for Project areas outside the Nahanni National Park Reserve.
2. The absence of nesting avian species at risk (and other migratory birds) should be confirmed in borrow and gravel pits prior to commencing disruptive activities during the general nesting period. If work commences, monitoring for the absence of nests at borrow and gravel pits should continue throughout activities.
3. Staff and contractors should be made aware of the conservation status of all species at risk that could be encountered at the Project. Staff and contractors should also be made aware of the potential of species at risk to use anthropogenic habitats and structures for nesting, the reporting protocol and all appropriate mitigation measures.

Tetra Tech Response

CZN agrees and commits to ECCC's requests. Monitoring for nesting avian species at risk (and other migratory birds), prior to commencing disruptive activities during the general nesting period (May 1 to August 20), will be included in the revised WMMP. Similarly, CZN commits to notifying staff and contractors of the potential for species at risk encounters, and the proper reporting and mitigation protocol.

3.6 Boreal Caribou

ECCC's Recommendation(s)

1. The Proponent should review disturbance estimates for the Project, and may wish to consult the GNWT on these and the adequacy of proposed mitigation and monitoring measures to minimize Project effects on Boreal Caribou.

Tetra Tech Response

CZN will consult with the GNWT regarding the adequacy of the proposed mitigation and monitoring measures for Boreal Caribou.

4.0 GOVERNMENT OF THE NORTHWEST TERRITORIES (GNWT)

4.1 Collared Pika

GNWT Recommendation(s)

- That Canadian Zinc include in its final WMMP the Collared Pika commitments outlined in its response to MVEIRB IR#5 (PR 320); and
- That Canadian Zinc conduct long-term monitoring of Collared Pika abundance and patch occupancy in talus habits within 300m of the road.

Tetra Tech Response

CZN will update the WMMP to include commitments outlined in the MVEIRB IR#5 response, as well as a Collared Pika monitoring program developed in collaboration with the GNWT and Parks Canada (refer to Section 2.2) to monitor potential impacts from the proposed all-season road.

5.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Canadian Zinc Corporation and their agents. Tetra Tech Canada Inc. (operating as Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Canadian Zinc Corporation, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech Canada Inc.'s Services Agreement. Tetra Tech's General Conditions are provided in Appendix A of this report.

6.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.



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Reviewed by:
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ADDENDUM 2

April 3, 2017

Canadian Zinc Corporation
Suite 1710, 650 West Georgia Street
Vancouver, BC V6B 4N9

ISSUED FOR USE
FILE: ENG.YARC03070-01
Via Email: david@canadianzinc.com

Attention: David Harpley
VP Environmental & Permitting Affairs

Subject: Permafrost Issued Identified in Technical Reports to MVEIRB by GNWT, NRCan, and Parks Canada, Proposed Prairie Creek All Season Road, NT

1.0 INTRODUCTION

As part of its review of Canadian Zinc Corporation's (CZN) Prairie Creek Mine All-Season Road Project, the Mackenzie Valley Environmental Impact Review Board (MVEIRB) received Technical Reports from the Government of the Northwest Territories (GNWT), Natural Resources Canada (NRCan), and Parks Canada and these were forwarded to CZN. The reports cover a wide range of topics, this letter, prepared by Tetra Tech Canada Inc. (Tetra Tech) responds to some of the comments and suggestions made in the reports regarding permafrost.

It is noted that all of the reviewers identified in their technical reports that a sufficient amount of information had been considered and the level of evaluation of terrain sensitivity and design was reasonable for the preliminary design stage as presented in the DAR. They also identified that with an appropriate level of final design, careful construction, and maintenance during operation that the environmental effects associated with construction and operation of the all season road could be minimized to an acceptable level.

2.0 GNWT COMMENTS

In Section 7.2.1 of their technical report the GNWT stated the following:

The developer's October 2016 table of commitments (PR 355) include confirmation that all recommendations by consultants have been accepted by Canadian Zinc and will be assumed as commitments, and the following items specific to permafrost monitoring:

- *CanZinc commits to developing a permafrost monitoring plan as a permit condition, informed by a detailed investigation of permafrost along the road alignment;*

In Section 7.2.3 of their technical report the GNWT therefore recommended the following:

Recommendation GNWT #10:

GNWT recommends the establishment of a permafrost monitoring plan during the regulatory process and that these commitments are captured in the Report of Environmental Assessment.

Tetra Tech fully supports the establishment of a permafrost monitoring plan. However, Tetra Tech does not feel that it would be appropriate to develop a permafrost monitoring plan at this time, in fact CZN would not be able to do that until after the required geotechnical and geophysical investigations and final geometric design have been carried out. This is what was done on the Inuvik to Tuktoyaktuk Highway (ITH) for example. The detailed permafrost monitoring program for the ITH was not developed until well after detailed design and the bulk of construction

completed, the instrumentation is just now being installed. Tetra Tech does feel that it would be reasonable to develop a concept of what that monitoring plan would likely entail during the regulatory process. At the current time it is suggested that the permafrost monitoring plan would comprise the following:

1. At least two instrumented sections of the road with ground temperature cables (vertical and horizontal), settlement plates, and survey stakes.
2. At least four ground temperature cables installed in native undisturbed permafrost areas to monitor natural permafrost conditions (it is possible that some cables installed to measure ground temperatures as part of the geotechnical program carried out for detailed design could be used for this).
3. A plan for regular (at least annual) inspection by a geotechnical engineer to identify any adverse impacts on the permafrost terrain from the construction and operation of the road and the borrow sources. The frequency of the inspections could possibly be lessened after a few years if the road is performing adequately.
4. At least monthly documented inspections (with photographs) of the road and borrow sources by the senior road maintenance superintendent. Of particular importance will be visual monitoring at culvert and bridge locations.
5. Documented records of all maintenance that can be reviewed by the geotechnical engineer during the annual inspection.

Certainly, detailed geotechnical and geophysical investigations need to be carried out to define permafrost conditions along the road route, at structure locations (bridge, etc.), in adjacent challenging terrain, and at proposed borrow/quarry sites to inform detailed design and allow appropriate construction and management plans to be developed. This information will also be very important in the development of the appropriate closure plan for the road.

3.0 NRCAN COMMENTS

In general, NRCan's comments regarding permafrost revolved around the need for detailed geotechnical investigation including geophysical surveys to better define the locations and characteristics of permafrost soils. Additionally NRCan identified the need for geothermal modelling to determine appropriate embankment thicknesses and configurations for the road, as well as to investigate the impact of climate change on the road and stability of nearby terrain that could impact the operation of the road over its life. NRCan mentioned the potential need to install slope inclinometers and carry out slope stability assessments. Also identified is the need to characterize the potential for surface icing and blockage of drainage.

For the most part, the suggestions put forward by NRCan provide excellent guidance and are very much in line with Tetra Tech's opinion of what should be considered during detailed design in areas of permafrost terrain.

Tetra Tech fully supports the suggestion that geophysics should be considered as part of the geotechnical program that generates the information required for detailed design. Tetra Tech would suggest a combination of Ground Penetrating Radar (GPR) coupled with resistivity (OhmMapper) be carried out during the winter in conjunction with the intrusive geotechnical program. Geophysics should cost effectively assist in determining the distribution of frozen soils in suspected permafrost areas as well as give an indication of whether the soils are ice-poor and hence thaw stable, or ice-rich and therefore prone to excessive thaw settlement. Geophysics should also be of great assistance in determining the characteristics (material type, ice content, and thickness of overburden soils) in borrow pits and therefore inform the preparation of the borrow pit development and management plans. Geophysics

must of course be calibrated against geotechnical boreholes that are advanced in a manner that collects thermally undisturbed samples of the permafrost soils.

Detailed geotechnical/geophysical investigations are required for both the road and borrow/quarry sources.

During the field work for detailed design, it is possible that some slopes are identified that may have potential to be at risk of slope instability (creep or failure in permafrost soils). Slope stability assessments would certainly be carried out as part of the detained design. It may be prudent to install slope indicators in some very high risk slopes, but currently it is felt that most of these have been avoided by careful road routing. It is more likely that visual assessment of slopes following construction and during operation may indicate some slope movement. Inclinometers would then likely be installed to warn of potential failure, allowing safe operation of the road.

Geothermal simulations/analyses will need to be carried out for the road embankment, including estimating the impacts of climate change on the underlying permafrost. However, the regulators are reminded that the design life of the road is quite short and therefore unlike a public road that has a much longer life, the potential for impact to the road due to climate change is relatively small.

Tetra Tech fully supports the suggestion of identifying the potential of icing and drainage blockage along the road during detailed design. These are often the most common causes of permafrost degradation, subsequent environmental impact, and impacts to road operation in permafrost terrain. Water blockage and changes to water flow patterns tend to have a much more significant and rapid impact on roads in permafrost terrain than does climate change.

4.0 PARKS CANADA COMMENTS

Parks Canada Agency (PCA) identified the need for permafrost mitigation and management plans for the borrow sources thereby requiring intrusive geotechnical investigations, similarly for the road. PCA also suggests that the road and borrow sources be design, following suggested national guidelines for permafrost terrain. Additionally, all components must be designed with closure in mind, particularly important is the need to leave borrow pits and quarries in a condition that will not lead to long term environmental impact as they adjust to climate change over the long term.

As noted above, Tetra Tech fully agrees with the need to undertake detailed geotechnical and geophysical investigations to be able to develop a robust design that will address all the impacts of the permafrost terrain on the infrastructure. As one of the authors of the Transport Association of Canada (2010) Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions, Tetra Tech absolutely agrees that these should be followed during detailed design.

Tetra Tech agrees with developing a design that allows CZN to walk away by designing for closure. There also needs to be a documented permafrost monitoring plan (see above) that includes triggers and suggested potential responses to address degradation (additional fill, better water management etc.).

This road will be at highest risk due to changes in precipitation and hence runoff rather than climate warming simply because the anticipated life of the road is too short. That is not to say that the geothermal analyses that will be carried out should use average monthly temperatures from the past few years in the evaluation. Of most importance will be to investigate the impact of one or two 1:100 year warm years in a row on the stability of the road, not looking at the impact of global warming over the next 100 years. Borrow pits must be designed for the longer term as they probably have the potential for more impact if not properly closed in a configuration that will thaw in a similar manner to the surrounding natural ground. In that regard, management of water and elimination of any potential for ponding will be a key design criteria for the borrow pits and quarries in permafrost terrain.

5.0 LIMITATIONS OF REPORT

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6.0 CLOSURE

We trust this letter meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.



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/jf



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PERMIT TO PRACTICE TETRA TECH CANADA INC.	
Signature	<i>[Signature]</i>
Date	<i>APRIL 3, 2017</i>
PERMIT NUMBER: P 018	
NT/NU Association of Professional Engineers and Geoscientists	

ADDENDUM 3

Date: April 5, 2017
From: John Wilcockson
To: David Harpley, Canadian Zinc Corp
Subject: Response to technical report (DFO)

HCP Ref No.: CZN7932-600

This memo addresses recommendations (1-3, 5, 13-16) made within in DFO's technical report.

HIGH WATER MARK DEFINITION

DFO #1

3.1.1 Recommendation: The Program recommends that the Developer submit a Request for Review and/or apply for a Fisheries Act Authorization for the Project. When submitting, in order to avoid confusion, DFO-FPP recommends habitat within the 1:2 year High Water Mark is not divided into categories as outlined by Hatfield.

Reply: The Developer assumes that this comment is referring to the proposed Sundog Creek diversion, the proposed diversion berm footprint and road encroachments on Sundog Creek, since these are the only incidences where habitat was categorized as A, B or C. We derived the habitat classes to roughly classify fish habitat quality within Sundog Creek. The intent of this approach was to quantify habitat to be permanently lost or altered. Following DFO's recommendation above, Category "C" habitat exists outside the 1:2 year HWM, thus this category will be excluded from the habitat accounting table. In the revised account, we will no longer refer to habitat within Categories A and B. Instead, we will provide descriptions and approximate percentages of habitat to be lost or altered.

DFO #2

3.1.2 Recommendation: DFO-FPP recommends that CZN utilize the terms serious harm, permanent alteration, and destruction as provided in the Fisheries Protection Policy Statement (defined above in Section 2.0 Mandate) instead of using terms such as habitat categories A, B, C, and habitat of low/medium/high importance.

Reply: We will apply the terminology as requested by DFO.

SUNDOG CREEK CHANNEL REALIGNMENT

DFO #3

3.2.1 Recommendation: The Program recommends that the Developer submit a Request for Review and/or apply for a Fisheries Act Authorization so that DFO-FPP can review proposed mitigation.

Reply: It is the Developers intent is to apply for a Fisheries Act Authorization (Paragraph 35(2)(b) Fisheries Act Authorization [Normal Circumstances]). Furthermore, the aquatic habitat (below the HWM) and under the planned footprint of the diversion berm will be included in our habitat accounting.

DFO #5

3.2.3 Recommendation: DFO-FPP recommends that the Developer implement natural channel design principles into the proposed constructed channel.

Reply: CZN has already committed to implement natural channel design principles into the proposed constructed channel. More information will be provided in our application for a Fisheries Act Authorization [Normal Circumstances]. It should be noted that CZN plans to reactivate a pre-existing flood channel (having natural characteristics) as the new channel. We will also apply other natural features (e.g., boulders) at regular intervals to mimic habitat currently available in the old channel. Finally, we will ensure that the new channel provides similar flow capacity and velocities (throughout) as the current channel.

FLOWS**DFO #13**

3.5.3 Recommendation: DFO-FPP recommends that the Developer implement all available best management practices in the design of the proposed constructed channel to avoid and mitigate serious harm to fish as a result of the realignment. This includes, but is not limited to, appropriate design of the new channel to facilitate fish passage at both high and low flows for Arctic Grayling and any other species of fish that may use Sundog Creek at all relevant life stages. Such fish may have different capacities for swimming performance (Gervais & Katopodis 2015), which may affect the design of the new channel.

Reply: The new channel will aim to provide channel capacity, velocities, and habitat comparable to that which currently exists, and as such, there should be no change in terms of fish passage.

BLASTING**DFO #14**

3.6.1 Recommendation: DFO-FPP recommends that the Developer utilize an instantaneous pressure threshold limit of 50 kPa, which may require appropriate setback distances, in order to develop adequate mitigation measures to address the effects of blasting on fish and reduce the risk of serious harm to fish as a result of the Project.

Reply: CZN intends to follow DFO's operational guidance for blasting¹. If appropriate setback distance is not possible, temporary fish removal from the area may be necessary.

DFO #15

3.6.2 Recommendation: DFO-FPP recommends that the Developer avoid blasting during sensitive spawning periods as per DFO's NWT fish spawning timing windows.

Reply: CZN will only blast within specified windows as per DFO spawning timing windows.

¹ Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

OFFSETTING OPPORTUNITIES

DFO #16

3.7.1 Recommendation: The Program recommends that the Developer submit a Request for Review and/or apply for a Fisheries Act Authorization so that offsetting and monitoring plans can be reviewed in more detail.

Reply: As noted in DFO #5 above, CZN will submit an application for a Fisheries Act Authorization [Normal Circumstances], which will include details specific to offsetting and associated monitoring plans.

A handwritten signature in black ink, appearing to read 'John Wilcockson', written in a cursive style.

John Wilcockson, MSc RPBio

Environmental Specialist

HATFIELD CONSULTANTS

ADDENDUM 4

March 23, 2017

Canadian Zinc Corporation
Suite 1710, 650 West Georgia Street
Vancouver, BC V6B 4N9

ISSUED FOR USE
FILE: 704-ENG.YARC03070-01
Via Email: david@canadianzinc.com

Attention: David Harpley
VP Environmental & Permitting Affairs

Subject: Agency Recommendations Relating to Hydrotechnical Topics
Proposed Prairie Creek All Season Road, NT

1.0 INTRODUCTION

As part of their reviews of Canadian Zinc's (CZN) Developer's Assessment Report (DAR) for the Prairie Creek All Season Road Project, Fisheries and Oceans Canada (DFO) and Parks Canada Agency (PCA) have each submitted a technical report to the Mackenzie Valley Environmental Impact Review Board with comments. The reports are dated March 10, 2017.

This letter has been prepared to respond to recommendations in the DFO and PCA reports that involve hydrotechnical information and recommendations prepared and/or presented by Tetra Tech on behalf of CZN.

2.0 FISHERIES AND OCEANS CANADA RECOMMENDATIONS

2.1 Recommendation #4 regarding Sundog Creek No Net Loss

DFO Rationale from Technical Report Section 3.2.2: *It is expected and intended that fish will no longer access habitat in the existing channel via downstream migration (due to the berm), nor upstream migration (due to insufficient flows or intentional barriers to avoid stranding of fish). Since this habitat will no longer be available, by definition, serious harm to fish and fish habitat may result. In the absence of detailed information, it is unclear at this time what the full suite of measures is that CZN intends to implement to avoid, mitigate or offset serious harm as defined in the Fisheries Act as a result of activities, undertakings, or works proposed for the Sundog Creek realignment. During the regulatory phase, DFO-FPP will determine the extent of serious harm that may result from the project.*

DFO Recommendation: *DFO-FPP recommends that hydrographs, modelling, and detailed designs for the existing channel and the proposed channel are submitted to DFO-FPP during the regulatory phase.*

Response: Tetra Tech has prepared preliminary designs with hydraulic modelling results for 2-year and 100-year peak flows to demonstrate performance. Our expectation for the next stage of work is to refine the design considering the hydraulic model results for the preliminary design as well as comments by others, and provide updated hydraulic model results for a recommended final design. The final design will still be subject to field modification to accommodate selective use and placement of larger size alluvium materials as may be encountered during construction. Such modification would be made to improve habitat variability/value with best use of the materials available, while maintaining the recommended design geometry (i.e., slope/width combinations). We note that DFO does not appear to be requesting additional or different information at this time, but is asking that the information already submitted should be re-submitted for a subsequent regulatory phase, at which time it would be re-evaluated.

2.2 Recommendation # 8 regarding Water Crossings

DFO Rationale from Technical Report Section 3.3.3: *The Developer has highlighted the use of timing windows, freshet monitoring, and culvert installation best practices. However, in the absence of detailed plans for sediment and erosion control and decommissioning of the water crossings, it is unclear what the full suite of measures are that the developer intends to implement to avoid, mitigate or offset serious harm to fish as defined in the Fisheries Act as a result of watercourse crossings proposed for the project.*

DFO Recommendation: *DFO-FPP recommends that the Developer provide DFO with detailed engineering plans of all water crossings that are fish bearing, supported by measured or modeled stream flow data, for review prior to construction.*

Response: Tetra Tech has already provided design flows for the crossings, and have stated in a hearing that we believe that the flows for the smaller catchments may be conservative (high). DFO 8 is not requesting revisions to these flows. The detailed engineering plans are being prepared by others. We note that, generally, erosion and sediment control plans conform to regulatory approval conditions, and are not submitted for the regulatory approval.

2.3 Recommendation # 12 regarding Flows in Sundog Creek

DFO Rationale from Technical Report Section 3.5.2: *Sundog Creek is a braided and relatively dynamic system in a mountain environment. The substrate is coarse and permeable, and there are subsurface inputs throughout the floodplain (in both the existing and historic channel). In the absence of detailed information, the full suite of measures that the Developer intends to implement to avoid causing serious harm to fish is also unclear at this time.*

Once diversion takes place, depending on the saturation of the alluvium in the presently historic channel, the channel could exhibit a period of adjustment and flows may “go to ground” for a length of time. If this scenario were to take place, water levels in the new channel may be insufficient for the passage of fish for a period of time.

DFO Recommendation: *DFO-FPP recommends the Developer consider the possibility of a channel readjustment phase and develop a plan to mitigate these potential adverse effects.*

Response: Tetra Tech (Rozeboom) participated in a conference call with DFO on March 7, 2017 to discuss the low flow hydrology of the Sundog Creek channel and the rationale why the low flows in the relocated channel will be functionally equivalent to those in the existing channel, without a “readjustment” phase. The shallow alluvial storage drains out during the fall and winter and then the following spring will recharge the aquifer adjacent to whichever channel is active. Because the construction of the new channel will occur under low water and/or dry conditions, and the switch-over between channels will occur in the subsequent spring, we do not anticipate any sort of adjustment period in shallow subsurface flows that would be detectable or which would warrant a mitigation plan.

3.0 PARKS CANADA AGENCY RECOMMENDATION

3.1 Recommendation #13 regarding Hydrotechnical Calculations

DFO Rationale from Technical Report Section 3.7: *CZN has produced one hydraulic model for Sundog Creek and indicates that alternative modelling methods to support or refute the results from this original model are not possible given the available information. Parks Canada believes that at least one alternate hydrotechnical calculation is possible using the available information and that this calculation is required to support or correct the hydraulic model utilised and to determine if the potential exists for significant impacts to the aquatic ecosystem and road infrastructure from the proposed realignment.*

In response to Parks Canada's request to provide an additional hydraulic model for Sundog Creek through alternate modelling methods to increase confidence in the hydraulic modelling for Sundog Creek (PRD #357), CZN indicated that:

"Alternative hydrologic modelling methods would typically involve developing a basin model with representative soil storage and runoff characteristics, and then impose meteorological inputs including precipitation, temperature, snow pack, solar radiation, etc., depending on the model. For the present study, necessary climate data are not available to represent the mountain headwater areas of Sundog Creek. The adopted regional analysis approach, which incorporates a peak flow frequency analysis for Prairie Creek at the project mine site, in close proximity to Sundog Creek, is the most reliable method, especially considering the physical similarities of the Prairie Creek and Sundog Creek basins, and we consider this to be an appropriate and suitable approach."

In other jurisdictions it is standard practice to provide multiple hydrotechnical calculations. For example, both Alberta Transportation and BC Ministry of Transportation recommend more than one design flow calculation for bridge crossings. As these desktop calculations are not onerous, such a check is seen simply as design due diligence.

PCA Recommendation: *CZN shall provide at least one supplementary hydrotechnical calculation (based on existing information) for Sundog Creek as a check to support or correct the hydraulic model utilised for Sundog Creek. This calculation shall be provided during the regulatory phase, should the project proceed to that phase.*

Response: Tetra Tech has completed hydrotechnical analyses for hundreds of watercourse crossings throughout BC and Alberta, including numerous bridge and culvert sites for the agencies referenced. Where information is available and appropriate, multiple methods are examined. A single best method is used in situations where potential alternative methods cannot be relied upon to provide a useful check, such as when required information is not available, (insufficient for basin level modelling), or simple methods (such as modified rational calculations) are inappropriate for large basin sizes.

We stand by our original response which establishes that the single approach used to establish design flows for Sundog Creek is appropriate and reliable, for reasons stated in the original response. With respect to due diligence, Tetra Tech independently re-ran the regional analysis originally prepared by NHC to be satisfied that the previously used formula to derive 100-year flows was still good including incorporation of the more recent available Water Survey of Canada data.

4.0 LIMITATIONS

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5.0 CLOSURE

We trust this report meets your present requirements. If you have any questions, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.



Prepared by:
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A handwritten signature in blue ink, likely belonging to Doug Johnston.

Reviewed by:
Doug Johnston, P.Eng. (Yukon)
Senior Hydrotechnical Engineer
Direct Line: 778.945.5808
Doug.Johnston@tetrattech.com

/db

PERMIT TO PRACTICE	
TETRA TECH EBA INC.	
Signature	
Date	<u>MARCH, 23, 2017</u>
PERMIT NUMBER: P 018	
NT/NU Association of Professional Engineers and Geoscientists	

ADDENDUM 5



CANADIAN ZINC
CORPORATION

Mountain Caribou Collar Study

SPRING MIGRATION (Apr 16 to May 20)



Date: April 5, 2017
Drawn by: K. Cupit
Scale: 1:300,000
Datum: NAD 1983 UTM Zone 10N
Drawing: Caribou ranges 1-3









**NAHANNI
NATIONAL
PARK RESERVE**

 **Prairie Creek Mine**

SYMBOL LEGEND

-  Prairie Creek Access Road
-  Prairie Creek Mine Location

Collar ID (population)

-  PC15-01 (10)
-  PC15-04 (10)
-  PC15-07 (8)
-  PC15-08 (2)
-  Steams (NHN - all)
-  Lakes (NHN - all)

Expected Counts (Spring Migration)

-  1 - 5
-  0 - 1





CANADIAN ZINC
CORPORATION

Mountain Caribou Collar Study

SUMMER CALVING (May 21 to Jun 5)

Date: April 5, 2017
Drawn by: K. Cupit
Scale: 1:300,000
Datum: NAD 1983 UTM Zone 10N
Drawing: Caribou ranges 1-3



**NAHANNI
NATIONAL PARK
RESERVE**

★ **Prairie Creek Mine**

SYMBOL LEGEND

- Prairie Creek Access Road
- ★ Prairie Creek Mine Location

Collar ID (population)

- PC15-01 (10)
- PC15-04 (10)
- PC15-07 (8)
- PC15-08 (2)
- ~ Steams (NHN - all)
- ~ Lakes (NHN - all)

Expected Counts (Summer Calving)

- 1 - 5
- 0 - 1





CANADIAN ZINC
CORPORATION

Mountain Caribou Collar Study

SUMMER POST CALVING (Jun 6 to Sep 24)

Date: April 5, 2017
Drawn by: K. Cupit
Scale: 1:300,000
Datum: NAD 1983 UTM Zone 10N
Drawing: Caribou ranges 1-3




**NAHANNI
NATIONAL PARK
RESERVE**


 **Prairie Creek Mine**


SYMBOL LEGEND


 Prairie Creek Access Road


 Prairie Creek Mine Location


Collar ID (population)


 PC15-01 (10)

 PC15-04 (10)

 PC15-07 (8)

 PC15-08 (2)

 Steams (NHN - all)

 Lakes (NHN - all)

Expected Counts (Summer Post-calving)

 12+

 5 - 12

 1 - 5

 0 - 1





CANADIAN ZINC
CORPORATION

Mountain Caribou Collar Study

FALL (Sep 25 to Dec 31)

Date: April 5, 2017
Drawn by: K. Cupit
Scale: 1:300,000
Datum: NAD 1983 UTM Zone 10N
Drawing: Caribou ranges 1-3

**NAHANNI
NATIONAL PARK
RESERVE**

Prairie Creek Mine

SYMBOL LEGEND

- Prairie Creek Access Road
- Prairie Creek Mine Location

Collar ID (population)

- PC15-01 (10)
- PC15-04 (10)
- PC15-05 (12)
- PC15-07 (8)
- PC15-08 (2)
- PC15-09 (6)
- PC15-10 (10)
- PC15-11 (5)
- PC15-12 (7)
- PC15-13 (4)
- PC15-14 (8)
- PC15-15 (~20)
- PC15-16 (1)
- PC15-17 (~20)
- PC15-18 (6)
- Steams (NHN - all)
- Lakes (NHN - all)

Expected Counts (Fall)

- 12+
- 5 - 12
- 1 - 5
- 0 - 1





CANADIAN ZINC
CORPORATION

Mountain Caribou Collar Study

WINTER (Jan 1 to Apr 15)

Date: April 5, 2017
Drawn by: K. Cupit
Scale: 1:300,000
Datum: NAD 1983 UTM Zone 10N
Drawing: Caribou ranges 1-3



SYMBOL LEGEND

- Prairie Creek Access Road
- Prairie Creek Mine Location

Collar ID (population)

- PC15-01 (10)
- PC15-02 (10)
- PC15-04 (10)
- PC15-07 (8)
- PC15-08 (2)
- PC15-09 (6)
- PC15-10 (10)
- PC15-12 (7)
- PC15-14 (8)
- PC15-16 (1)
- PC15-17 (~20)
- PC15-18 (6)
- Steams (NHN - all)
- Lakes (NHN - all)

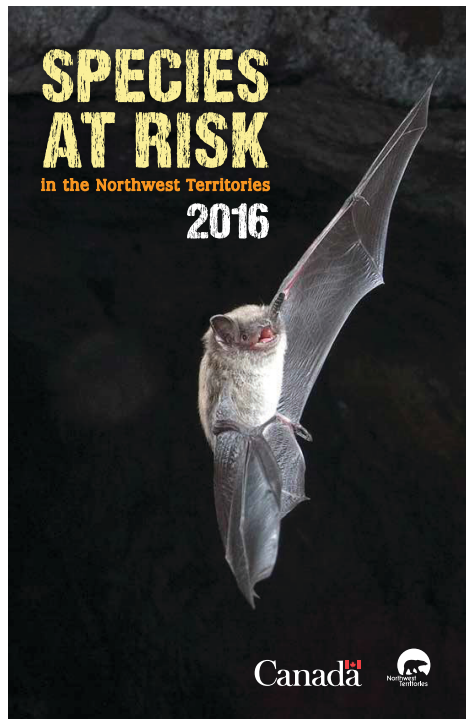
Expected Counts (Winter)

- 12+
- 5 - 12
- 1 - 5
- 0 - 1

Prairie Creek Mine

**NAHANNI
NATIONAL PARK
RESERVE**





FOR MORE INFORMATION

GOVERNMENT OF CANADA

Environment and Climate Change Canada
Canadian Wildlife Service

867-669-4765
EC.SANIT.ELP.NTEC@Canada.ca
saranregistry.gc.ca

Fisheries and Oceans Canada

204-983-0600
aquaticspeciesatrisk.ca

Parks Canada Agency

1-888-273-8888
pc.gc.ca

GOVERNMENT OF THE NWT

Department of Environment and Natural Resources
Toll-Free 1-855-783-4301

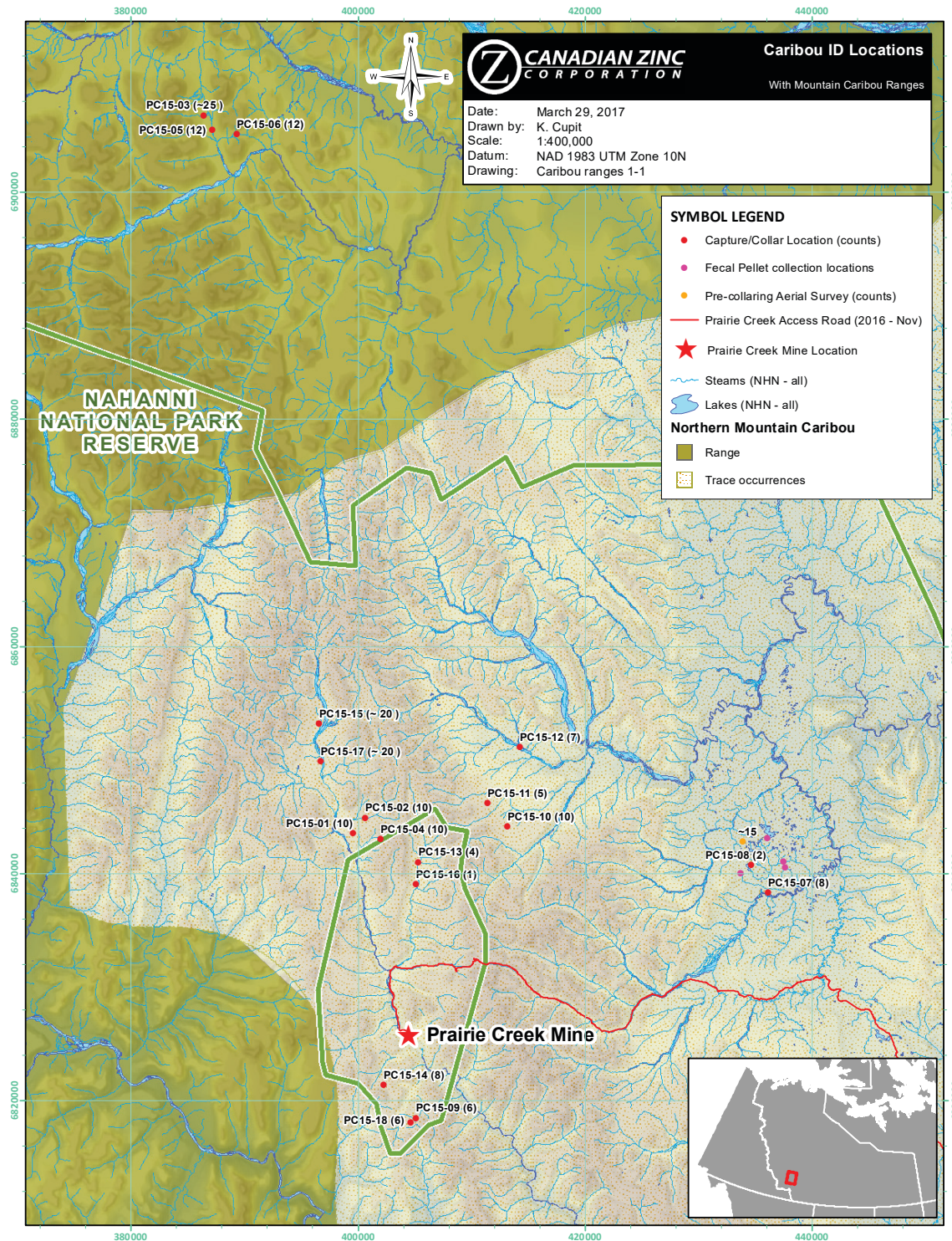
or contact your regional Environment and Natural Resources office
sara@govint.ca
nwt-speciesatrisk.ca

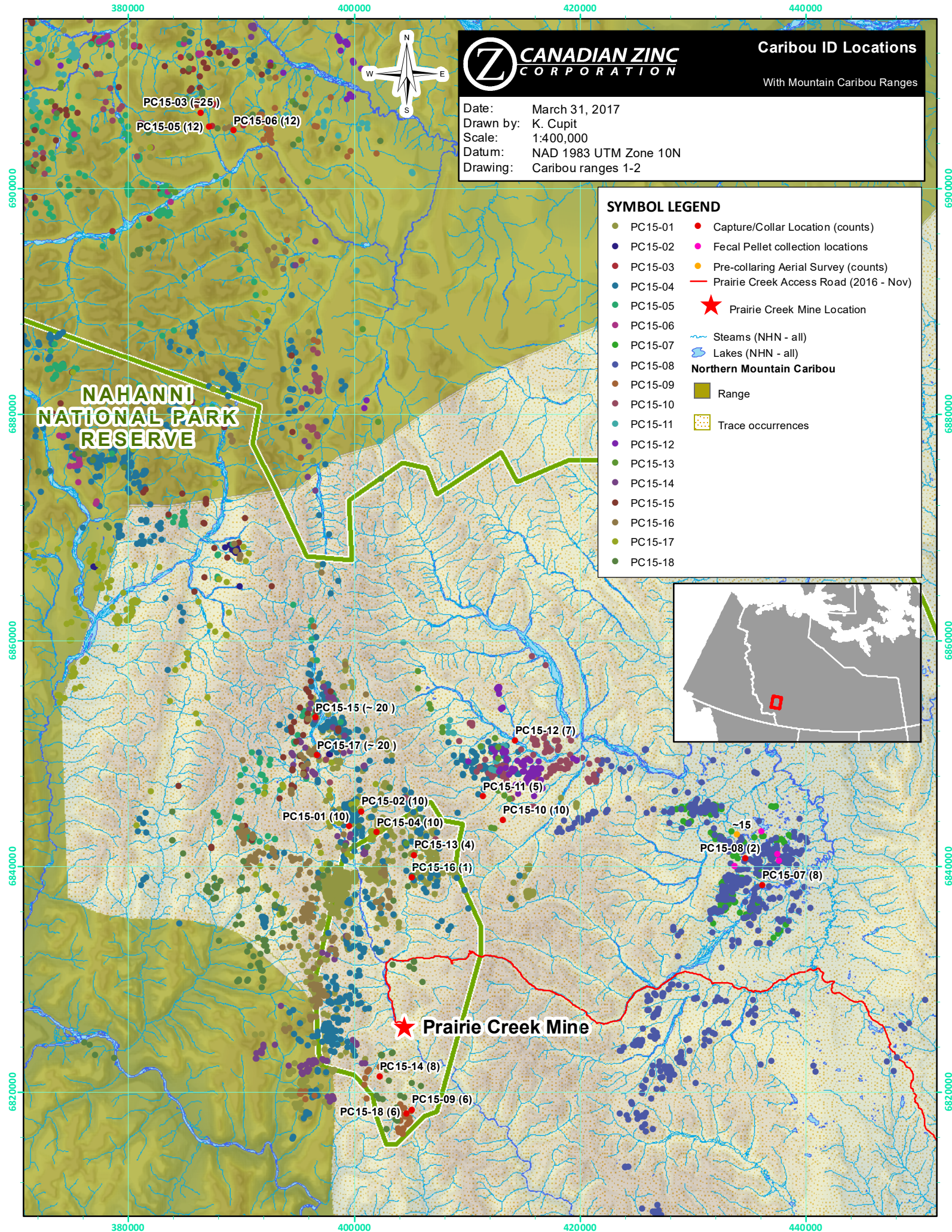
OTHER AGENCIES

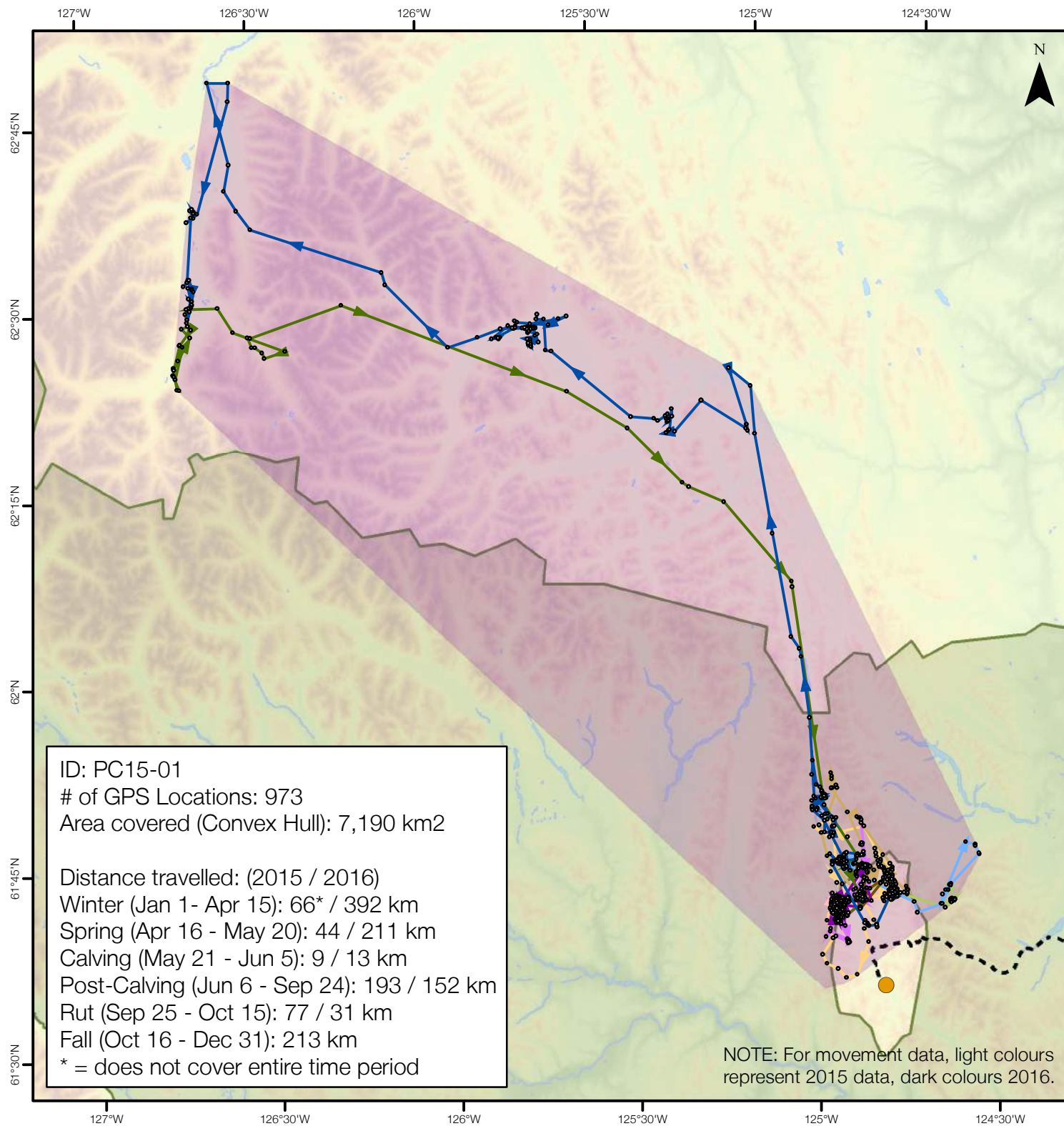
Committee on the Status of Endangered Wildlife
in Canada (COSEWIC)
cosewic.gc.ca

Species at Risk Committee
nwt-speciesatrisk.ca/SARc

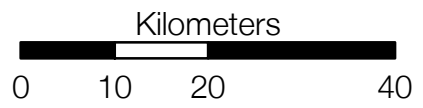
Conference of Management Authorities
nwt-speciesatrisk.ca/CMA







Prairie Creek Collar Study
PC15-01

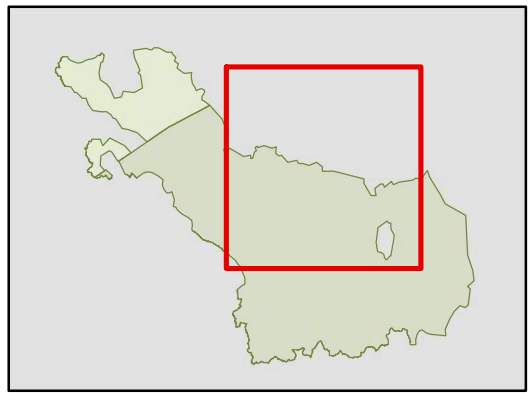


- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Fall Movement (2015)
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nahanni NPR

ID: PC15-01
of GPS Locations: 973
Area covered (Convex Hull): 7,190 km²

Distance travelled: (2015 / 2016)
Winter (Jan 1 - Apr 15): 66* / 392 km
Spring (Apr 16 - May 20): 44 / 211 km
Calving (May 21 - Jun 5): 9 / 13 km
Post-Calving (Jun 6 - Sep 24): 193 / 152 km
Rut (Sep 25 - Oct 15): 77 / 31 km
Fall (Oct 16 - Dec 31): 213 km
* = does not cover entire time period

NOTE: For movement data, light colours represent 2015 data, dark colours 2016.





Nahanni
National Park Reserve

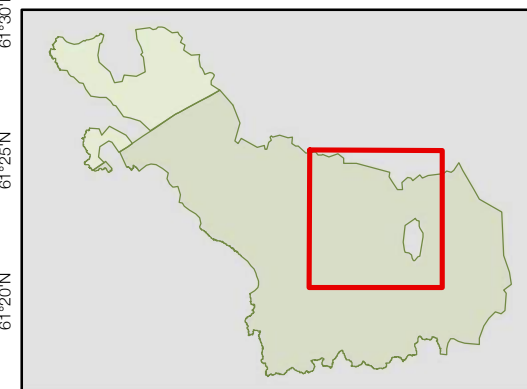
Prairie Creek Collar Study PC15-02

Kilometers
0 5 10 20

- Winter Movement
- Spring Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nahanni NPR

ID: PC15-02
of GPS Locations: 124
Area covered (Convex Hull): 1,013 km²

Distance travelled:
Winter (Feb 21- Apr 15): 105 km
Spring (Apr 16 - End of Transmission (May 5)): 27 km





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-03

Kilometers

0 20 40 80

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Fall Movement (2015)
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-03

of GPS Locations: 768

Area covered (Convex Hull): 22,372 km²

Distance travelled: (2015 / 2016)

Winter (Jan 1 - Apr 15): 151* / 181 km

Spring (Apr 16 - May 20): 234 / 295 km

Calving (May 21 - Jun 5): 24 / 119 km

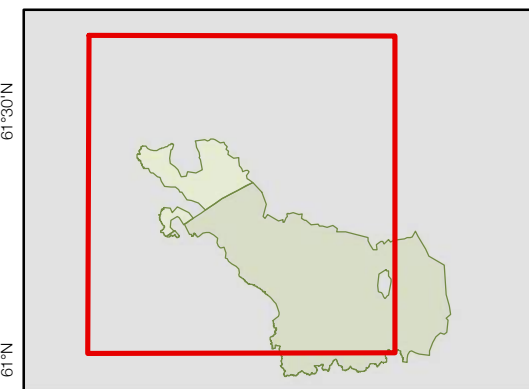
Post-Calving (Jun 6 - Sep 24): 407 / 451 km

Rut (Sep 25 - Oct 15): 79 / 43 km

Fall (Oct 16 - Dec 31): 154 km

* = does not cover entire time period

NOTE: For movement data, light colours represent 2015 data, dark colours 2016.





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Prairie Creek Collar Study PC15-04



- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Fall Movement (2015)
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-04

of GPS Locations: 942

Area covered (Convex Hull): 21,769 km²

Distance travelled: (2015 / 2016)

Winter (Jan 1 - Apr 15): 65* / 371 km

Spring (Apr 16 - May 20): 26 / 264 km

Calving (May 21 - Jun 5): 47 / 47 km

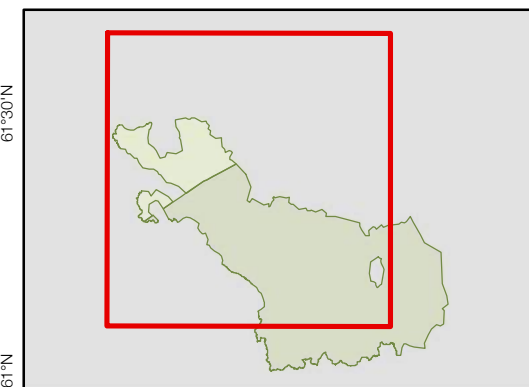
Post-Calving (Jun 6 - Sep 24): 218 / 626 km

Rut (Sep 25 - Oct 15): 23 / 42 km

Fall (Oct 16 - Dec 31): 202 km

* = does not cover entire time period

NOTE: For movement data, light colours represent 2015 data, dark colours 2016.





Nahanni
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Prairie Creek Collar Study PC15-05

Kilometers

0 20 40 80

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Fall Movement (2015)
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-05

of GPS Locations: 940

Area covered (Convex Hull): 17,756 km²

Distance travelled: (2015 / 2016)

Winter (Jan 1 - Apr 15): 85* / 275 km

Spring (Apr 16 - May 20): 262 / 351 km

Calving (May 21 - Jun 5): 46 / 64 km

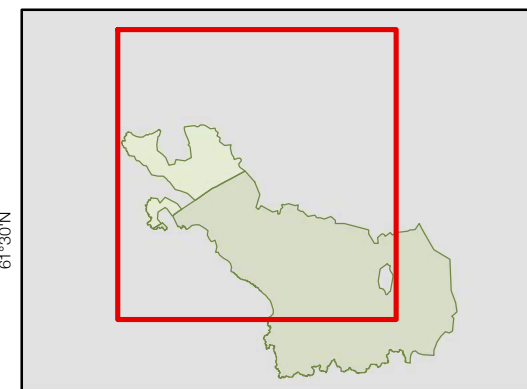
Post-Calving (Jun 6 - Sep 24): 574 / 519 km

Rut (Sep 25 - Oct 15): 86 / 28 km

Fall (Oct 16 - Dec 31): 301 km

* = does not cover entire time period

NOTE: For movement data, light colours represent 2015 data, dark colours 2016.





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Prairie Creek Collar Study PC15-06

Kilometers

0 20 40 80

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Fall Movement (2015)
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-06

of GPS Locations: 685

Area covered (Convex Hull): 22,503 km²

Distance travelled: (2015 / 2016)

Winter (Jan 1 - Apr 15): 168* / 350 km

Spring (Apr 16 - May 20): 264 / 274 km

Calving (May 21 - Jun 5): 18 / 56 km

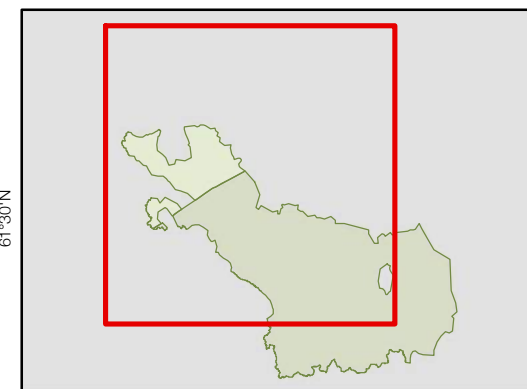
Post-Calving (Jun 6 - Sep 24): 570 / 541 km

Rut (Sep 25 - Oct 15): 55 / 65 km

Fall (Oct 16 - Dec 31): 297 km

* = does not cover entire time period

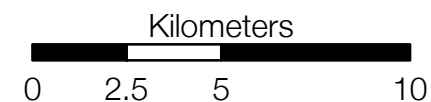
NOTE: For movement data, light colours represent 2015 data, dark colours 2016.





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-07



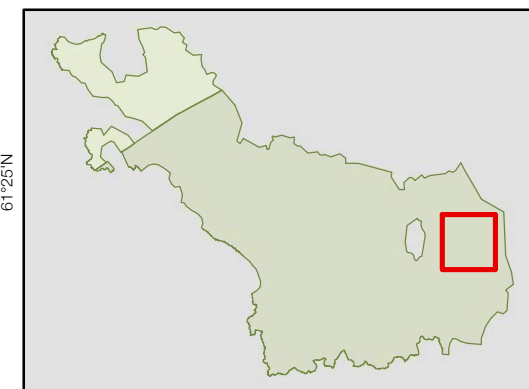
- Winter Movement
- Spring Movement
- Calving Movement
- Minimum Bounded Area
- GPS Point
- Proposed Access Road
- Nahanni NPR

NOTE: Collar data locations
don't change significantly
(< 1 km) after April 27, but
data records go until July 9.

ID: PC15-07
of GPS Locations: 161
Area covered (Convex Hull): 244 km²

Distance travelled:
Winter (Jan 1 - Apr 15): 88 km
Spring (Apr 16 - May 20): 41 km
Calving (May 21 - Jun 5): 0.3 km
Post-Calving (Jun 6 - End of Transmission (July 9)): 0.2 km

Date road was crossed
April 19, 2016





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-08

Kilometers
0 2.5 5 10

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nahanni NPR

ID: PC15-08

of GPS Locations: 328

Area covered (Convex Hull): 573 km²

Distance travelled:

Winter (Jan 1 - Apr 15): 106 km

Spring (Apr 16 - May 20): 63 km

Calving (May 21 - Jun 5): 2 km

Post-Calving (Jun 6 - Sep 24): 246 km

Rut (Sep 25 - Oct 15): 34 km

Dates road was crossed

May 9, 2016

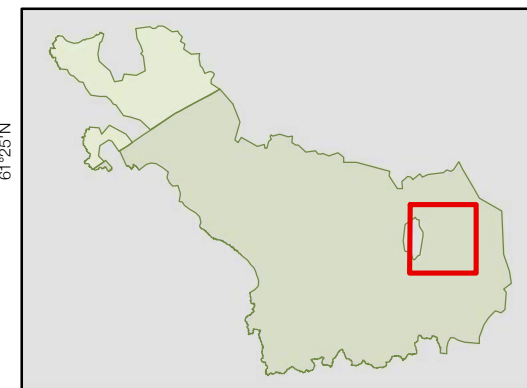
Jul 14, 2016

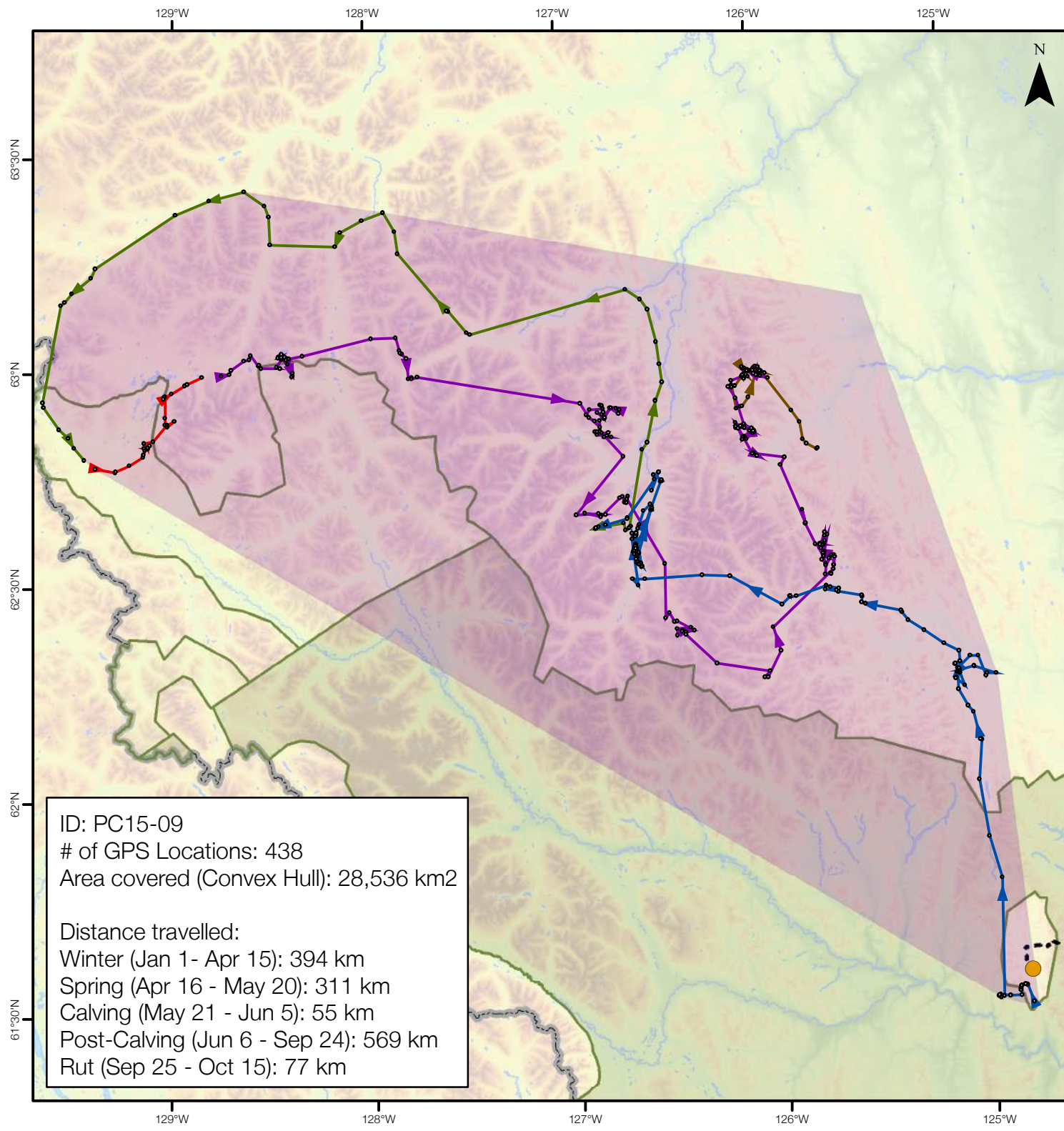
Aug 16, 2016

Aug 23, 2016

Aug 27, 2016

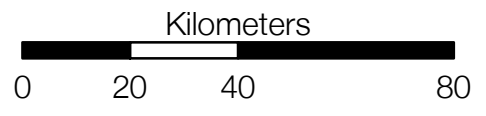
Oct 14, 2016





Nahanni
National Park Reserve

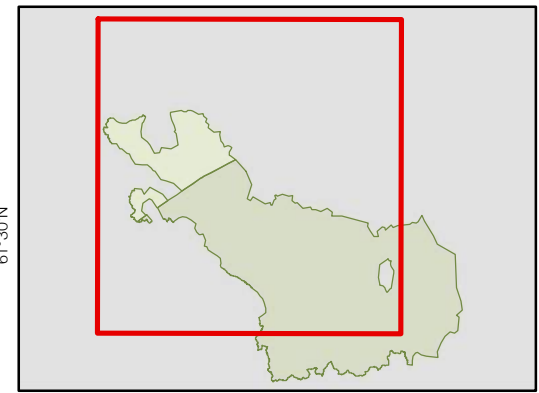
Prairie Creek Collar Study
PC15-09



- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-09
of GPS Locations: 438
Area covered (Convex Hull): 28,536 km²

Distance travelled:
Winter (Jan 1 - Apr 15): 394 km
Spring (Apr 16 - May 20): 311 km
Calving (May 21 - Jun 5): 55 km
Post-Calving (Jun 6 - Sep 24): 569 km
Rut (Sep 25 - Oct 15): 77 km





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-10

Kilometers

0 20 40 80

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-10

of GPS Locations: 369

Area covered (Convex Hull): 17,721 km²

Distance travelled:

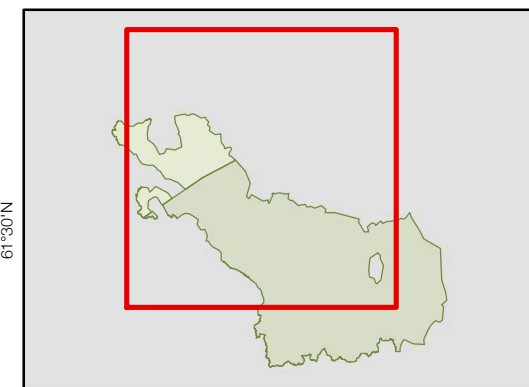
Winter (Jan 1 - Apr 15): 207 km

Spring (Apr 16 - May 20): 244 km

Calving (May 21 - Jun 5): 70 km

Post-Calving (Jun 6 - Sep 24): 649 km

Rut (Sep 25 - Oct 15): 52 km





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-11

Kilometers

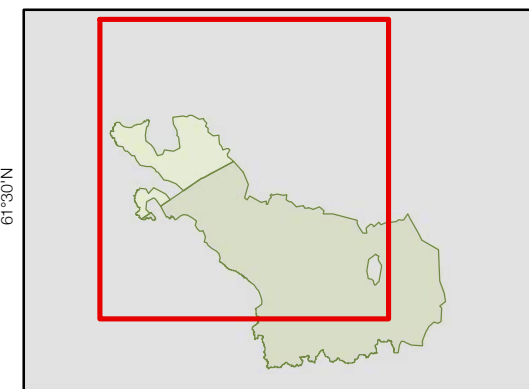
0 20 40 80

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-11
of GPS Locations: 450
Area covered (Convex Hull): 29,058 km²

Distance travelled:
Winter (Jan 1 - Apr 15): 384 km
Spring (Apr 16 - May 20): 351 km
Calving (May 21 - Jun 5): 70 km
Post-Calving (Jun 6 - Sep 24): 549 km

* No significant movement after Aug 30,
collar records until Oct 11.





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-12

Kilometers

0 20 40 80

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-12

of GPS Locations: 373

Area covered (Convex Hull): 25,817 km²

Distance travelled:

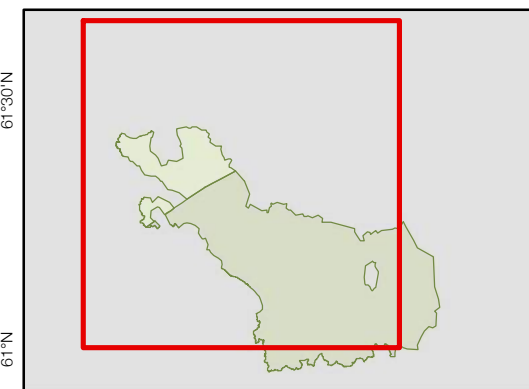
Winter (Jan 1 - Apr 15): 343 km

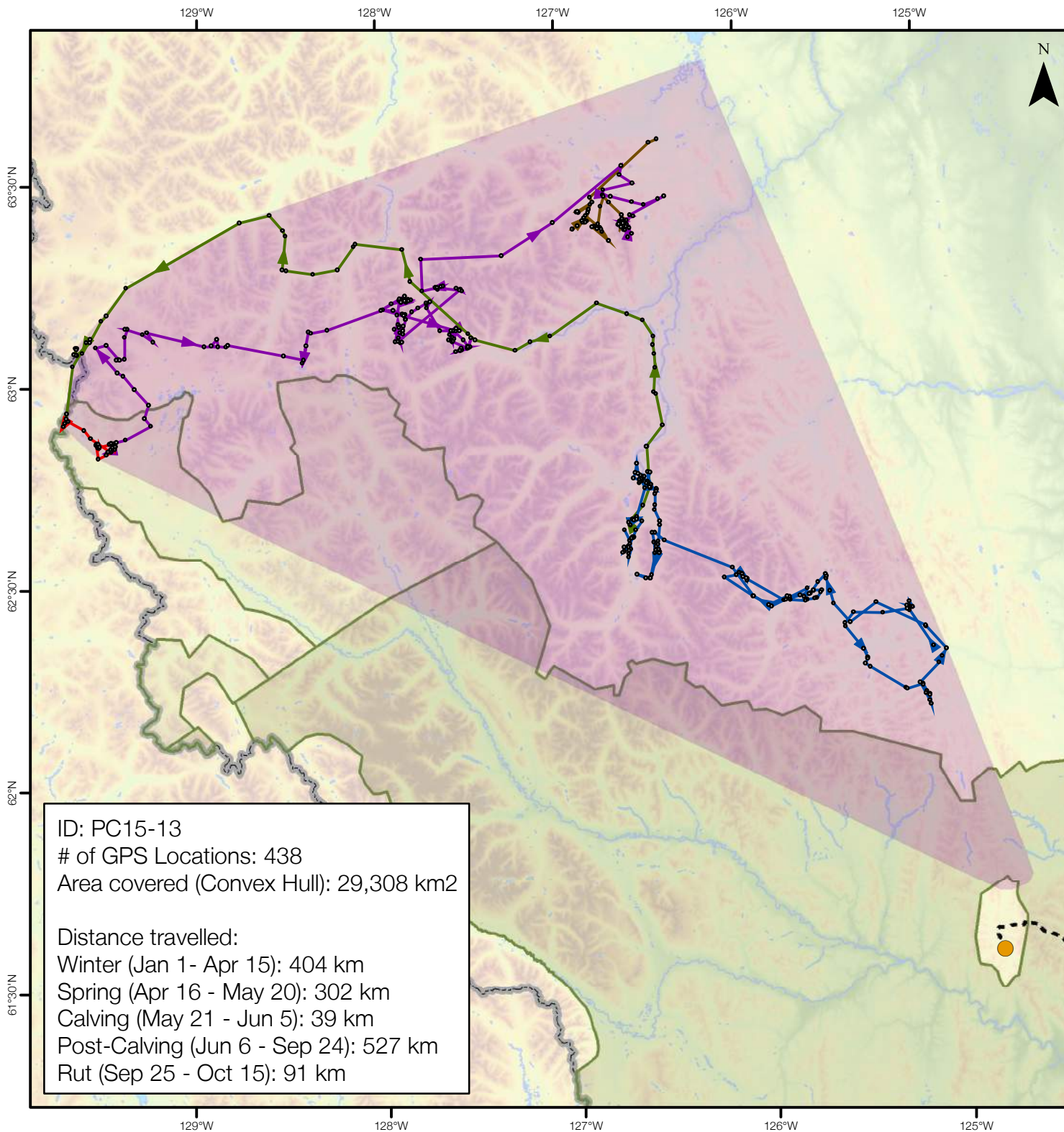
Spring (Apr 16 - May 20): 228 km

Calving (May 21 - Jun 5): 62 km

Post-Calving (Jun 6 - Sep 24): 734 km

Rut (Sep 25 - Oct 15): 84 km





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-13

Kilometers

0 20 40 80

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-13

of GPS Locations: 438

Area covered (Convex Hull): 29,308 km²

Distance travelled:

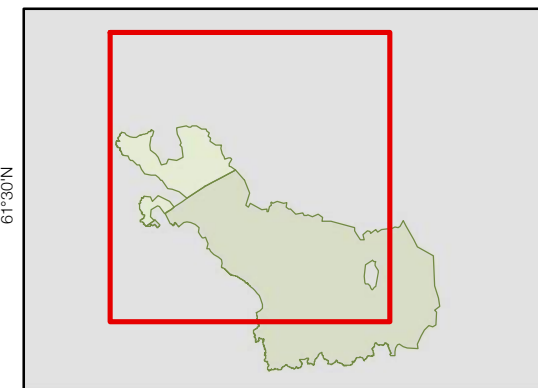
Winter (Jan 1 - Apr 15): 404 km

Spring (Apr 16 - May 20): 302 km

Calving (May 21 - Jun 5): 39 km

Post-Calving (Jun 6 - Sep 24): 527 km

Rut (Sep 25 - Oct 15): 91 km



127°W

126°W

125°W

124°W










Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-14

Kilometers

0 12.5 25 50

-  Winter Movement
-  Minimum Bounded Area
-  GPS Point
-  Prairie Creek Mine
-  Proposed Access Road
-  Nááts'ihch'oh NPR
-  Nahanni NPR

ID: PC15-14

of GPS Locations: 130

Area covered (Convex Hull): 4,282 km²

Distance travelled:

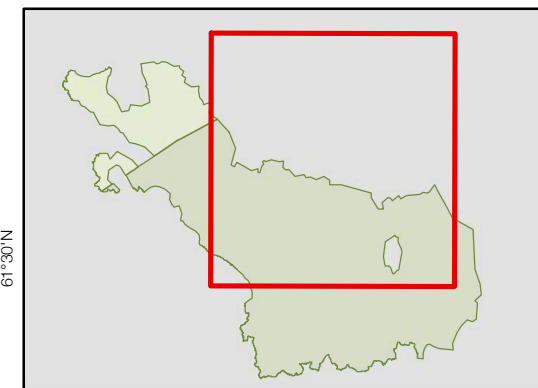
Winter (Jan 1 - End of Transmission (Mar 25)): 289 km

127°W

126°W

125°W

124°W





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-15

Kilometers

0 20 40 80

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-15

of GPS Locations: 349

Area covered (Convex Hull): 22,803 km²

Distance travelled:

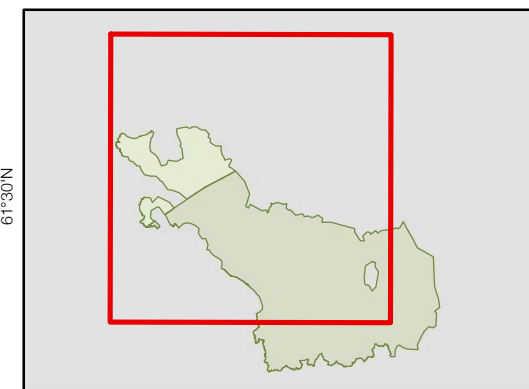
Winter (Jan 1 - Apr 15): 411 km

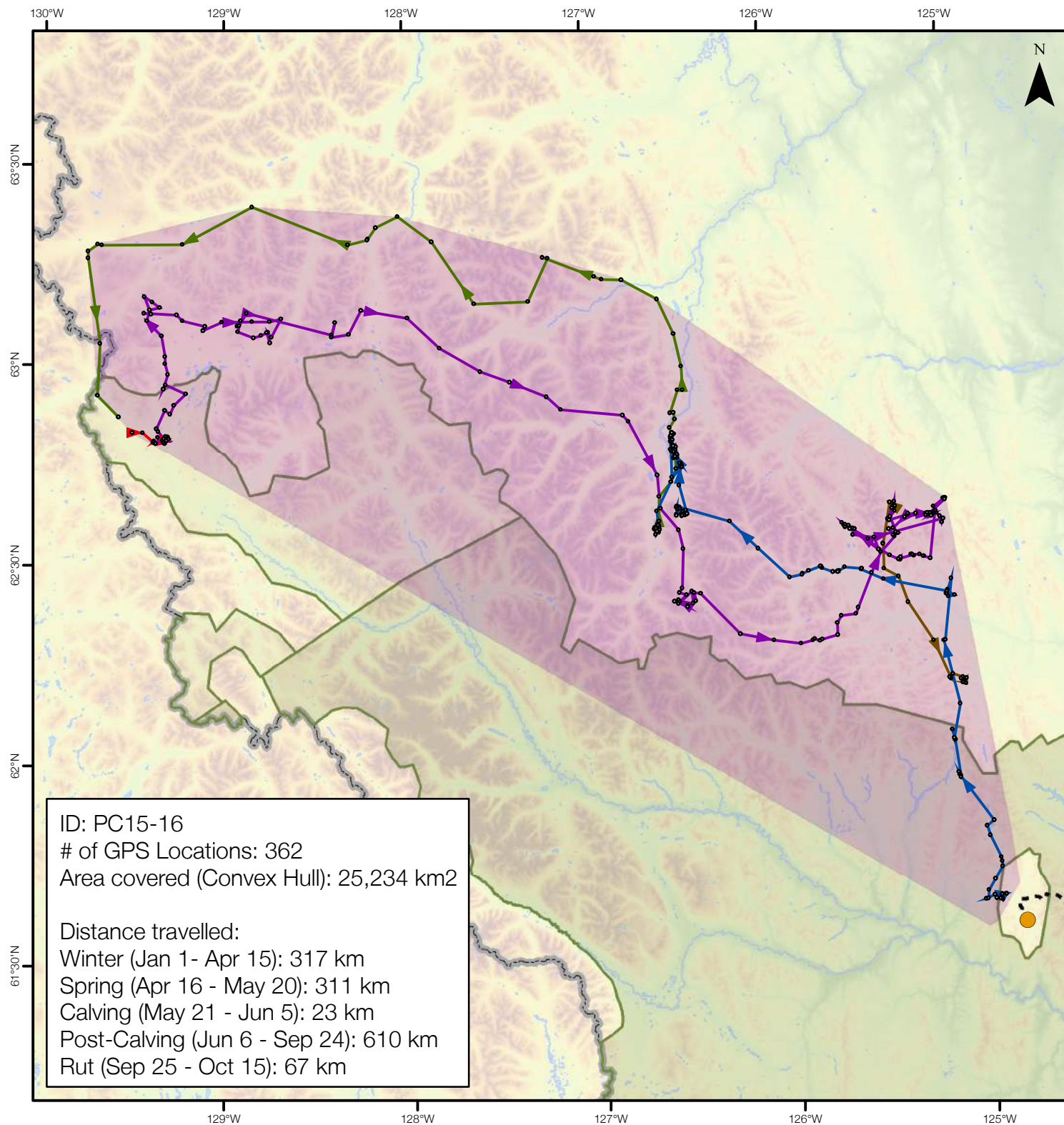
Spring (Apr 16 - May 20): 322 km

Calving (May 21 - Jun 5): 43 km

Post-Calving (Jun 6 - Sep 24): 646 km

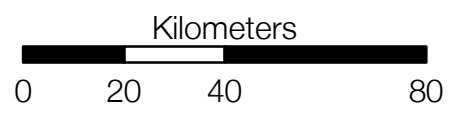
Rut (Sep 25 - Oct 15): 39 km





Nahanni
National Park Reserve

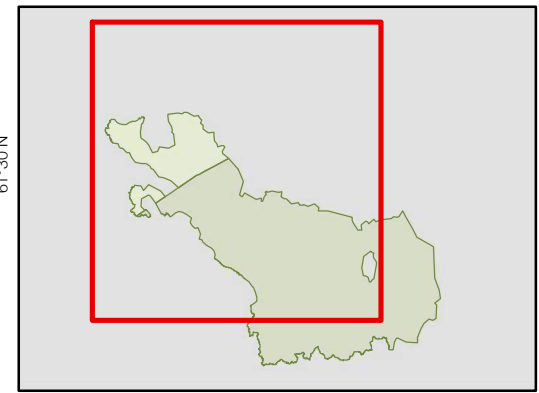
Prairie Creek Collar Study PC15-16



- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-16
of GPS Locations: 362
Area covered (Convex Hull): 25,234 km²

Distance travelled:
Winter (Jan 1 - Apr 15): 317 km
Spring (Apr 16 - May 20): 311 km
Calving (May 21 - Jun 5): 23 km
Post-Calving (Jun 6 - Sep 24): 610 km
Rut (Sep 25 - Oct 15): 67 km





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-17

Kilometers

0 20 40 80

- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-17

of GPS Locations: 450

Area covered (Convex Hull): 25,590 km²

Distance travelled:

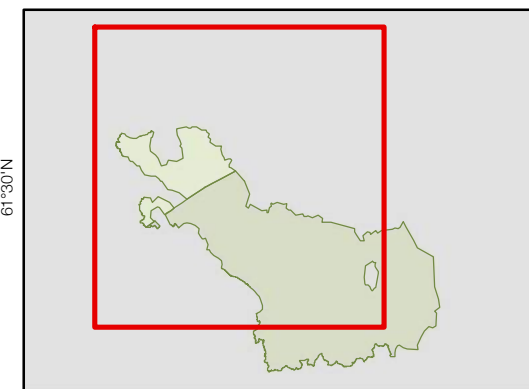
Winter (Jan 1 - Apr 15): 330 km

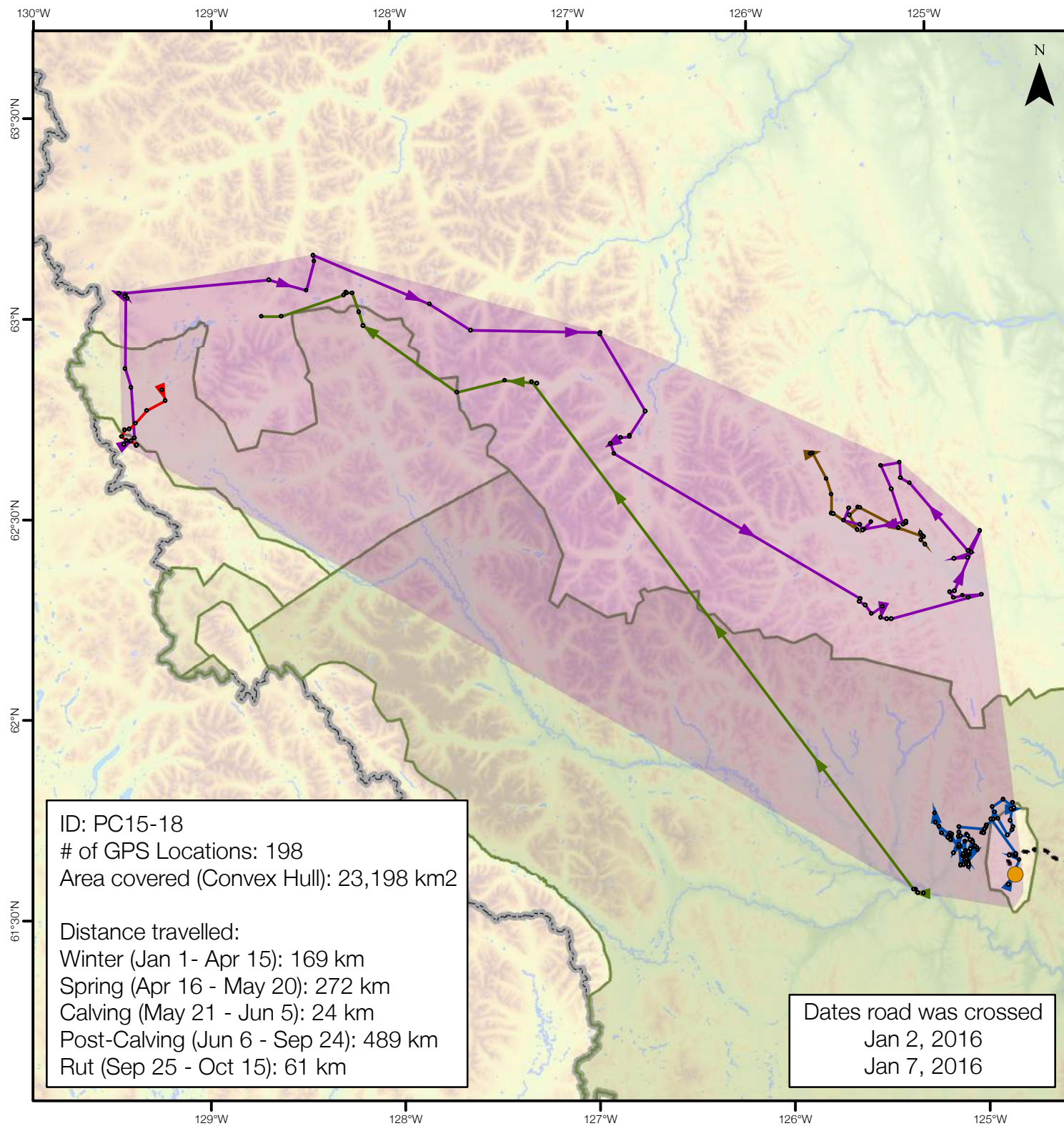
Spring (Apr 16 - May 20): 358 km

Calving (May 21 - Jun 5): 62 km

Post-Calving (Jun 6 - Sep 24): 470 km

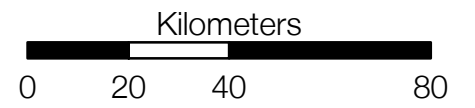
Rut (Sep 25 - Oct 15): 76 km





Nahanni
National Park Reserve

Prairie Creek Collar Study PC15-18

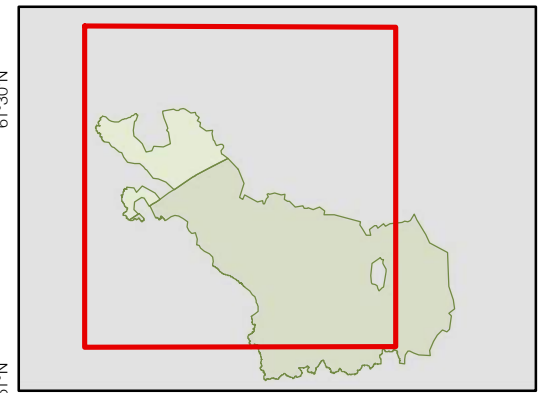


- Winter Movement
- Spring Movement
- Calving Movement
- Post-Calving Movement
- Rut Movement
- Minimum Bounded Area
- GPS Point
- Prairie Creek Mine
- Proposed Access Road
- Nááts'ihch'oh NPR
- Nahanni NPR

ID: PC15-18
of GPS Locations: 198
Area covered (Convex Hull): 23,198 km²

Distance travelled:
Winter (Jan 1 - Apr 15): 169 km
Spring (Apr 16 - May 20): 272 km
Calving (May 21 - Jun 5): 24 km
Post-Calving (Jun 6 - Sep 24): 489 km
Rut (Sep 25 - Oct 15): 61 km

Dates road was crossed
Jan 2, 2016
Jan 7, 2016



ADDENDUM 6

Date: April 5, 2017
From: John Wilcockson
To: David Harpley, Canadian Zinc Corp
Subject: Response to technical report (Parks Canada): 19 to 21

HCP Ref No.: CZN7932-600

INTRODUCTION

This memo provides replies to the Parks Canada (PC) Technical Report (the report), dated March 10, 2017. In their report, PC issues directives with respect to required and ongoing assessment and monitoring of potential aquatic impacts that may result from the proposed all-season road. These are overly prescriptive and unusual for a federal agency. Current practice typically relies on qualified professionals to develop and implement environmental studies on behalf of proponents.

Many of the items highlighted, below, are generally contained within construction-related management plans, which are typically developed once the Environmental Assessment phase has concluded.

PC #19

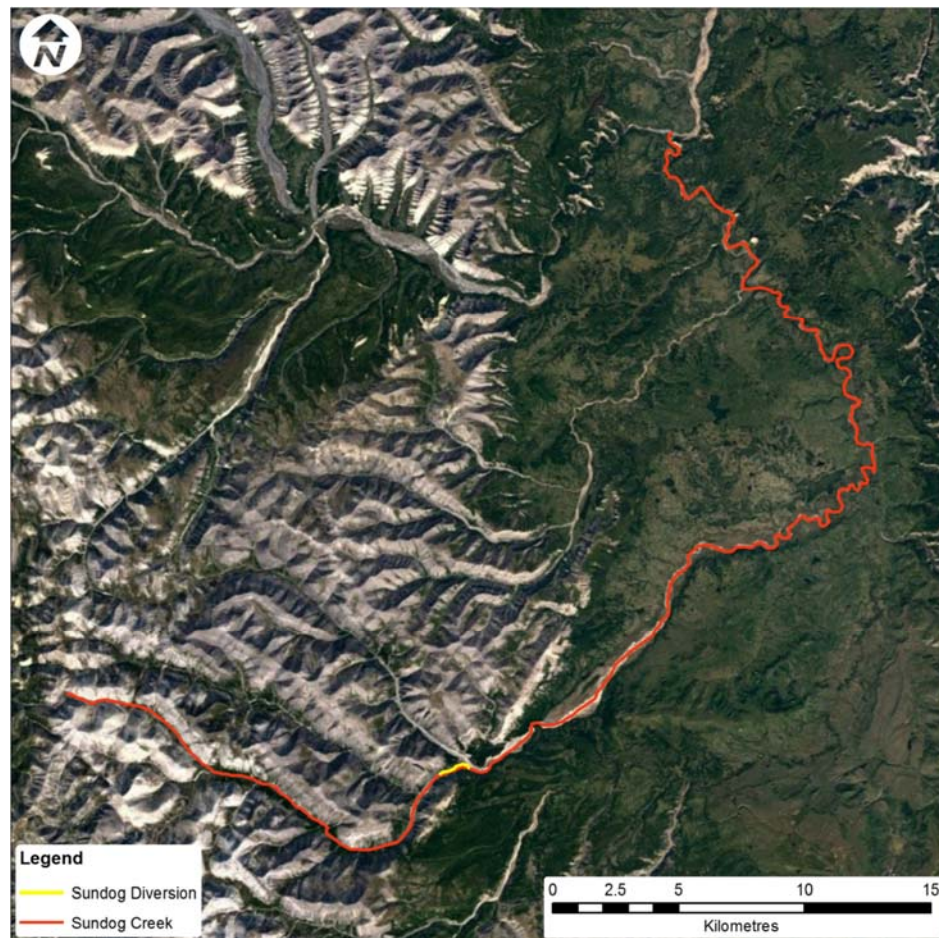
CZN shall develop and deploy a program to monitor the duration of reductions in the ecological performance of the realigned section of Sundog Creek using benthic macroinvertebrates as a biological indicator. Benthic macroinvertebrate samples shall be collected in the fall at the sites established for monitoring the water quality of Sundog Creek as outlined in [Request] 15 and shall follow the rapid bioassessment protocols described by Canadian Aquatic Biomonitoring Network (CABIN). Comparisons of the benthic macroinvertebrate communities upstream of the realignment, within the realignment, and downstream can be assessed using the existing reference condition approach model derived for the South Nahanni watershed by Scrimgeour et. al., 2012.

Response – Hatfield believes that the utility of the study as proposed above is low, while the cost is unreasonably high. Our opinion is based on a number of empirical factors:

1. Anticipated low abundance of benthic invertebrates within the diversion area – the diversion is within the headwaters of Sundog Creek, the habitat is oligotrophic and substrates are generally cobble and unstable. Portions of the channel in the area of the diversion also naturally dry up in the summer and stay dry throughout the winter. Ice within Nahanni National Park Reserve is often 1m thick, and therefore ice will form well into substrates. Due to the above reasons, habitat for benthic invertebrates is poor and indicates that resident assemblages will be low and commonly in a state of stress and recovery. In our opinion, the colonization of the newly diverted channel (within the active floodplain) will likely occur at a similar rate as the existing channel from the natural seasonal disruptions it often experiences. Downstream of the diversion, gradients decrease and the stream is flanked by forests. We would anticipate that the downstream areas of Sundog support much higher relative benthic invertebrate densities¹;

2. The small relative area - the diversion represents a very small portion of Sundog Creek (see Figure 1), therefore the contribution of benthic invertebrates from this section of Sundog Creek is likely a small fraction of drift insects available to downstream fish; and
3. The low importance of benthic drift to downstream fish populations - In Alaskan streams, drifting benthic invertebrates contribute relatively little biomass to the diet of downstream resident fish (12.4%¹). Sundog Creek is likely to have lower productivity in proximity to the realignment because it is nutrient poor. Any shift in benthic invertebrate community is not likely to have a significant influence on the food supply of downstream fish.

Figure 1 Proposed diversion compared to Sundog Creek from headwaters to confluence with Ram River.



PC #20

CZN shall develop an adaptive management plan for benthic macroinvertebrates to address potential impacts from the all season road. The plan is subject to review and approval by Parks Canada during the regulatory phase, should the project proceed to that phase. The baseline information outlined in the [Request] 17 can be used to inform the extent and design of the required plan. Until notified otherwise by

¹ Wipfli MS, Gregovich DP. 2002. Export invertebrates and detritus from fishless headwater streams in southeastern Alaska: implications for downstream salmonid production. *Freshwater Biology* 47:957–969.

Parks Canada, CZN shall provide annual monitoring updates to Parks Canada to ensure that appropriate management responses/mitigation adjustments can be implemented. These responses/mitigation adjustments must be approved by Parks Canada.

Response – As discussed above, Hatfield believes that residual effects to benthic macroinvertebrates will be low and that monitoring is not necessary. There is nominal benefit in the study proposed.

PC #21

CZN shall offset or compensate for the short-term habitat losses and reductions in fish habitat incurred by the rerouting of a portion of Sundog Creek. Any offsetting or compensation plans must be approved by Parks Canada.

Response – CZN will continue to engage with respect to changes in fish habitat and offsetting related to the project. We believe offset requirements are the jurisdiction of DFO.

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John Wilcockson, MSc RPBio
Environmental Specialist
HATFIELD CONSULTANTS

ADDENDUM 7

Date: April 5, 2017 HCP Ref No.: CZN7932-600
From: John Wilcockson
To: David Harpley, Canadian Zinc Corp
Subject: Response to technical report supplement (DFO), Recommendations 1, 7-16

1. Side channel between Kp35.5 and 37.77.

1 Ref. 3.1.1 DFO-FPP recommends that the Developer submit a Request for Review and/or apply for a Fisheries Act Authorization for their Project.

Response – An Application Form for Paragraph 35(2)(b) Fisheries Act Authorization (Normal Circumstances) will be submitted that will include the side channel.

3. Summary of losses, alterations, and gains

7 Ref. 3.3.1. DFO-FPP recommends that the Developer include in Table A1.9 all impacts to fish and fish habitat that may cause serious harm to fish, including but not limited to water crossings.

Response – The information requested is already provided in Table A1.9, however, the language and organization of the information will be re-arranged and re-submitted as part of the Application Form for Paragraph 35(2)(b) Fisheries Act Authorization (Normal Circumstances).

4. Offsetting options

8 Ref. 3.4.1. DFO-FPP recommends that the Developer continue working with the Program and Aboriginal groups to identify suitable offsetting opportunities.

Response – CZN concurs and will continue to work with DFO and aboriginal groups to identify suitable offsetting opportunities.

9 Ref. 3.4.2. The Program recommends that the Developer submit a Request for Review and/or apply for a Fisheries Act Authorization.

Response – CZN will apply for a Fisheries Act Authorization as part of the Application Form for Paragraph 35(2)(b) Fisheries Act Authorization (Normal Circumstances)

10 Ref. 3.4.3. If a Fisheries Act authorization is required, DFO-FPP recommends that the proponent submits an offsetting plan, and a monitoring plan, which are requirements under the Fisheries Act.

Response – CZN intends to submit an offsetting plan along with an effectiveness monitoring plan as per discussions with DFO as part of Undertaking 7. These plans will be submitted as part of the Application Form for Paragraph 35(2)(b) Fisheries Act Authorization (Normal Circumstances).

5. Habitat delineation for water crossings

11 Ref. 3.5.1. DFO-FPP recommends that the Developer clarify which return year was used to calculate anticipated *serious harm to fish* that may result from the construction, operation, maintenance and decommissioning of all water crossings.

Response – For crossings the high water mark was conservatively approximated using the bank shape and presence of vegetation, which is considered to be greater than the 1:2-year return period..

6. Partial dewatering

12 Ref. 3.6.1. DFO-FPP recommends that the Developer utilizes terminology provided in the Fisheries Protection Policy Statement for example, *serious harm*, *permanent alteration*, and *destruction*.

Response – CZN will apply the terminology suggested as part of the Application Form for Paragraph 35(2)(b) Fisheries Act Authorization (Normal Circumstances) application submission.

13 Ref. 3.6.2. If the Developer intends to dewater (pump) while constricting the Sundog Creek diversion channel, DFO-FPP recommends that the Developer submit a dewatering plan to the Program. DFO-FPP recommends, that all best management practices be incorporated in the dewatering plan, including but not limited to the use of appropriately-sized fish screens as per DFO's *Freshwater Intake End-of-Pipe Fish Screen Guideline* (1995).

Response – There is some confusion in DFO's characterization of this issue. The "partial dewatering" refers to the existing channel once the diversion is implemented. Prior to the diversion, the new channel will be deepened, and in that process, subsurface water may be encountered. This water will not be connected to the active channel and therefore will not be habitat to fish. In addition, CZN does not anticipate pumping this water. Before the new channel is activated, CZN has proposed to wash surface substrates with water as a mitigation for potential sediment suspension during new channel activation; however this water will come from a pit dug outside of the active floodplain. CZN does not intend to pump water from any fish bearing water during the project.

14 Ref. 3.6.3. DFO-FPP recommends that the Developer submit a Request for Review and/or apply for a *Fisheries Act Authorization* to DFO-FPP.

Response – Since water will not be pumped from any fish bearing waters during the project, the Application Form for Paragraph 35(2)(b) Fisheries Act Authorization (Normal Circumstances) to be submitted will not include this project activity. .

6(7). Improvements to existing road between Kp 0 and 17

15 Ref. 3.7.1. DFO-FPP recommends that the Developer confirm that the riparian vegetation to be removed between km 0 and km 17 is above the High Water Mark.

Response – This is correct, any vegetation to be removed will be on the upslope side of the existing road and therefore above the High Water Mark.

16 Ref. 3.7.2. The Program recommends that the Developer incorporate standard best management practices for the removal of riparian vegetation, including but not limited to: minimize the removal of riparian vegetation where practical; install and maintain sediment and erosion controls, and re-stabilize the site immediately.

Response – CZN will follow standard best management practices for the removal of riparian vegetation, where practical and feasible. It is the goal of CZN to minimize the overall project footprint.

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John Wilcockson, MSc RPBio
Environmental Specialist
HATFIELD CONSULTANTS