

October 19, 2016

Canadian Zinc Corporation
Suite 1710, 650 West Georgia Street
PO Box 11644
Vancouver, BC V6B 4N9

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

Attention: David Harpley
VP Environmental & Permitting Affairs

Subject: Second Round Information Requests, Wildlife and Vegetation 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), the Mackenzie Valley Review Board (MVRB) and other parties submitted a second round of Information Requests (IR's). This letter provides responses from Tetra Tech EBA Inc. (Tetra Tech) to several IR's that pertain to vegetation and wildlife.

2.0 GOVERNMENT OF NORTHWEST TERRITORIES (GNWT) INFORMATION REQUESTS

2.1 IR #1: RARE PLANT SURVEYS

Comment(s):

- Undertaking #11 required CZN to provide a map showing where the road alignment crosses unglaciated areas and describe if and how this information affects predictions of impacts on species at risk and rare plant assemblages. In response to Undertaking #11, CZN stated that "These [rare plant] surveys, including the most recent event conducted in 2016, did not detect any SARA-listed species or species ranked by the GNWT" and "As the surveys conducted to date included assessments of previously unglaciated areas, the predictions of impacts to species at risk and rare plant assemblages, as presented in the DAR and supporting documentation (including the latest field survey results from 2016), have not changed.
- GNWT notes that the surveys referred to in the response to Undertaking #11 include surveys conducted in June 2009 and August 2010. The 2009 rare plant and wildlife survey report states on pages 3-4 that eight rare plant species were found, two ranked by the GNWT as "May be at risk" and six ranked as "Sensitive". This appears to contradict CZN's statement in response to Undertaking #11.
- Section 2.1.3 of the August 2016 Vegetation and Wildlife Baseline Survey report states that "Tetra Tech EBA obtained a list of rare plant species that are known to occur within the Taiga Plain". ENR notes that more than half of the road alignment, an in particular unglaciated areas identified in Undertaking #11, occurs within the Boreal Cordillera ecozone.

- In 2015, Tetra Tech, on behalf of CZN requested data from GNWT-ENR's Virtual Herbarium on rare plants recorded within a 50 km buffer around the road alignment. This data request, and the list of rare plant species contained in the data provided, is not acknowledged in the 2016 vegetation baseline survey report. It is further stated that a list of 217 plants ranged as "At Risk", "May Be At Risk", or "Sensitive" from the GNWT General Status database was compiled, but this list was not provided with the 2016 report. As such it is not possible for reviewers to know which rare plants had the potential to occur in the area and were being searched for during the 2016 surveys.
- Section 2.1.2 states that "Plants that were documented at each ground inspection location were identified to species, where possible. Plants that could not be readily identified in the field were collected for further inspection and subsequent genus or species confirmation. In cases where the plant could have been listed as rare, specimens were only collected if collection did not appear to threaten the immediate population (as per the guidelines presented by the Alberta Native Plant Council [ANPC] 2012)."
- Section 2.1.3 also states that "Plants were identified to species in the field whenever possible. Voucher specimens of suspected rare plants were almost always collected, provided the collection did not appear to threaten the immediate population (as per the guidelines presented by ANPC [2012]). Specimens were also collected (under the same restrictions) if a definitive identification to species in the field was not possible."
- These sections seem to suggest that specimens of suspected rare plants may have been collected in the field, but it is not made clear how many specimens were collected, and whether they were sent to a specialist for identification.

Recommendation(s):

- a) Where are the results of the August 2010 field survey referred to in response to Undertaking #11 reported?
- b) Provide the list of rare plants that had the potential to occur in the areas surveyed in 2016.
- c) Clarify whether any plant specimens were collected in the field for further identification and whether any had to be sent to a specialist for identification.
- d) Clarify if any of the same areas surveyed in 2009 were resurveyed in 2016.
- e) If any specimens that were collected are later identified as rare plants, CZN is encouraged to share this information with the GNWT so that it may be included in the Virtual Herbarium.

Response:

The response provided in Undertaking #11 refers to results from the 2016 rare plant survey. During the 2009 rare plant survey, Few Flower Meadow Rue (*Thalictrum sparsiflorum*) listed as rare in McJannet et al. (1995) was documented along the Prairie Creek winter road and an adjacent wetland. Currently, 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 hornemannii*) and linear-leaved willowherb (*Epilobium leptophyllum*)]; these species have since 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 also identified adjacent to the Prairie Creek winter road have also now 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 season access road.

Regarding the August 2010 field survey, this involved a rare plant survey of the Polje By-Pass. None of the plant species documented along the proposed Polje By-Pass are listed under SARA, COSEWIC, or as rare in the Infobase, nor are they listed as being rare in McJannet et al. (1995).

In preparation for the July 2016 rare plant survey, the NWT Species Monitoring Infobase was searched and a list of rare plants listed as “Sensitive”, “May Be At Risk”, and “At Risk” was generated, totaling 217 species (Appendix A). According to the ecozone map on the Infobase website, the entire project is shown to occur within the Taiga Plains ecozone. Tetra Tech was recently informed, through correspondence with Suzanne Carriere (Department of Environment and Natural Resources, GNWT), that species rankings have recently been updated since the Infobase was searched in July 2016. However, the Infobase map has yet to be updated with the revised ecozone boundaries.

The western half of the project area falls within the Boreal Cordillera ecozone, however, no species currently listed in the Boreal Cordillera ecozone were observed during the July 2016 field survey. In addition, since the July 2016 survey, species ranks in the Infobase have also been updated, and the number of listed rare species in the Taiga Plains ecozone has dropped to 136 (the updates to the species rankings have also yet to be mentioned on the website). The original list of rare plants considered during the July 2016 survey, as well as the revised rankings, is presented in Appendix A.

Most vascular plants were identified in the field. Select species that were difficult to identify in the field, such as willows, sedges, and grasses, were collected for later identification under more controlled conditions. Identifications were confirmed through the use of magnification and taxonomic guides. No specimens collected were identified as rare plants and none required confirmation by specialists.

The 2016 rare plant survey had little overlap with previous surveys in order to provide more coverage along the proposed road corridor. Some survey overlap occurred between KP 11 and KP 44 (alpine), between KP 54 and KP 59 (Poljie By-Pass), and between KP 86 and KP 87. However, survey methodology varied between surveys and the all season road alignment differs from the winter alignment in places. No rare plants were observed during the 2016 surveys, however, should future surveys proposed for the pre-construction period result in the identification of rare plants, CZN would be pleased to share this information with the GNWT for inclusion in the Virtual Herbarium.

2.2 IR #3: BLACK BEARS

Comment(s):

- Section 5.2 of the August 2016 Vegetation and Wildlife Baseline Survey report states that “There is the potential to move the Liard Camp to Borrow Source BP159a (KP 158), which is located in an area predicted to be low Black Bear feeding habitat.”
- Section 5.1.3 of the updated Wildlife Mitigation and Monitoring Plan (WMMP) states that “CZN’s current winter road permit does not include a requirement for a bear den survey or monitoring, nor was it considered during the EA or permitting process for that permit. For the all-season road, the first part of the development will include construction of a winter road within the all-season road alignment. That road alignment and borrow sources will be accurately surveyed in the field, likely in the summer. As part of that process, survey crews, together with local and environmental monitors, will be tasked to identify previously used Black Bear dens proximal to road sections that will deviate from the winter road originally constructed in the 1980s. Old dens

that are located during this ground-based reconnaissance will help focus the search area for a more thorough survey in the late fall, prior to denning, as bears are commonly known to re-den in the same general area (Clarkson 1993).” and “The survey will encompass an area within 800 m of Project related footprints that significantly diverge from the current winter road alignment and 1.5 km from borrow sources planned for blasting during the winter period”.

- “The bear den monitoring surveys are to be conducted in areas of high and moderate predicted denning habitat, within 800 m of the Project footprint where it deviates from the current winter road alignment, and within 1.5 km of borrow sites requiring blasting. The Black Bear hibernating model (Tetra Tech 2016) has identified high, moderate, and low predicted denning habitat and will be used to determine the survey area.”
- These sections of the WMMP appear to imply that CZN is assuming that no bear dens will occur along the current winter road alignment. CZN should be aware that the permit for the existing winter road does not constitute a permit to disturb or destroy bear dens that may occur along it.
- Figures 5a – 5j in the August 2016 Vegetation and Wildlife Baseline Survey report suggest there is ‘High’ potential black bear hibernating habitat along many sections of the current winter road alignment and new alignment areas.
- Much of the proposed road alignment dated 160422 (which includes portions of the original winter road alignment) and preferred alignment option 160405 pass do not appear as currently disturbed habitat on maps of habitat disturbance produced by Environment and Climate Change Canada (~2010) and the Dehcho Land Use Planning Commission (~2002) (See Figure 1-3 – Appendix A attached). This suggests that portions of the existing permitted winter road alignment may be revegetated to a point where it is no longer visible on satellite imagery and will likely require vegetation clearing to accommodate the winter road and upgrade to an all-weather road. Given that most of the existing alignment has not been used since the 1980’s, it is possible that bears could den along or adjacent to the existing winter road alignment in areas where vegetation along the alignment has recovered.

Recommendation(s):

- a) Please clarify which sections (by providing kilometre posts or a map) of new road alignment CZN currently intends to survey for bear dens ahead of construction.
- b) Please clarify whether CZN will conduct pre-construction bear den surveys along portions of the current winter road alignment that fall in areas ranked as High potential black bear denning habitat in the August 2016 Vegetation and Wildlife Baseline Survey report.

Response:

Survey crews, together with local and environmental monitors, will conduct ground-based reconnaissance den surveys from KP 174 (Nahanni Access Road) to KP 36 (modelled extent of high Black Bear hibernating habitat potential). These ground-based surveys will cover the entire 138 km (KP 36 to 174) along the proposed all-season road, including areas overlapping with the previously developed winter road.

An aerial den survey will focus on the area along the proposed all-season road (KP 36 to 174) with: 1) moderate and high denning potential, 2) known den(s) identified during the ground-based surveys, and 3) proposed winter clearing (after October 1). This includes areas overlapping with the previously developed winter road. The aerial survey will consist of flying evenly spaced transects, with a higher survey intensity in areas of previously identified dens (irrespective of the previously developed winter road).

This clarification will be included in an updated draft WMMP.

2.3 IR #4: BOREAL CARIBOU HABITAT DISTURBANCE CALCULATIONS

Comment(s):

- In response to IR #16.1 – Boreal Caribou, CZN estimated that the project would contribute approximately 1,700 ha of new buffered disturbance to the overall disturbance footprint within the NT1 boreal caribou population range.
- It is unclear how CZN arrived at this number, which of the alignment options (160405 or 160422) this figure was based on, and whether it included 500 m buffers around borrow pits and borrow pit access roads.
- Based on the shapefiles provided by CZN ENR has calculated that new buffered disturbance from the project would be about 5,515 ha for the 160422 alignment + borrow sources, and about 5,590 ha for the 160405 alignment + borrow sources (including the portion of alignment 160422 + borrow sources from ~KP124 onwards). The new buffered footprint from the two alignment options is shown in Figure 4 (Appendix A attached). These calculations exclude areas of overlap with the existing buffered anthropogenic disturbance mapped by Environment and Climate Change Canada based on 2008-2010 Landsat imagery and fires = 40 years old (1975-2015).

Recommendation(s):

- a) Please clarify how CZN arrived at the estimate of 1,700 ha of new buffered disturbance from the project within boreal caribou range.
- b) Please clarify which of the two alignment options west of Grainger Gap is the currently the preferred option.
- c) Please clarify, for the entire length of the proposed all-season road, how many kilometers of the all-season road alignment differ from the currently permitted winter road alignment, and how many kilometers of the all-season road differ from the original winter road.

Response:

Within boreal caribou range, a permitted winter road right-of-way will be cleared prior to all-season road construction. The winter road alignment will be the same as the preferred alignment of the all-season road; therefore, there will be clearing of a **single alignment for both winter and all-season roads**.

Tetra Tech previously estimated that the proposed Project will directly affect 53.3 ha of boreal caribou habitat (includes camps, borrow sources and access roads), or 1,700 ha using a 500 m buffer surrounding the Project-related footprints (those not part of the permitted winter road). This calculation did not incorporate fire and other anthropogenic disturbances in the area, and is therefore considered a conservative estimate of habitat disturbance.

At the time of calculating the 1,700 ha disturbance area, the new alignment west of the Grainger Gap (Alignment Option 160405) was thought to diverge from the permitted winter road. Tetra Tech now understands that Alignment Option 160405 is the preferred alignment for the all-season road, and the winter road will also be constructed along this route. Therefore, the 1,700 ha calculation over-estimates boreal caribou habitat loss.

The GNWT's calculation of 5,590 ha for the 160405 alignment and borrow sources/access roads estimates the permitted winter road and the proposed all-season road disturbances together within boreal caribou range (following the Recovery Strategy methods). However, the winter road disturbance has already been assessed by the Review Board in EA0809-002, and therefore this disturbance should be subtracted from the calculation.

To specifically respond to the question regarding the difference between the all-season road and the original winter road, the majority of the proposed all-season road alignment (160405 option) within boreal caribou range differs from the original winter road. The original winter road, within boreal caribou range, has primarily re-vegetated and the all-season road will not disturb this regrowth.

3.0 GOVERNMENT OF CANADA – ENVIRONMENT AND CLIMATE CHANGE CANADA (ECCC) INFORMATION REQUESTS

3.1 IR #1: BOREAL CARIBOU

Comment:

In their response to IR#16, the Proponent estimated 1,700 ha of new disturbance within the NT1 boreal caribou range. Consistent with the Boreal Caribou Recovery Strategy, the proponent also states in Table 1 that considerations were given to minimize the footprint of development by including disturbed habitat where possible. Based on location of the proposed all-season road alignment, preferred alignment option, possible borrow sources and access roads, the majority of the proposed footprint within NT1 is considered new disturbance by Environment and Climate Change Canada (ECCC) and the disturbance estimate should be greater. It is unclear which alignment scenario the Proponent used to estimate habitat disturbance, and what the areal difference is between the alignment options. ECCC also notes an area where the preferred alignment option closely parallels, but does not overlap, existing disturbance (kms 111-120). No rationale, in the context of minimizing boreal caribou habitat disturbance where possible, is provided for this particular alignment choice. To aid the Proponent with their response, the ECCC disturbance layers used to inform the boreal caribou recovery strategy are available here: <http://open.canada.ca/en/open-data>.

Recommendation(s):

ECCC requests that the Proponent provide:

- a) A revised boreal caribou habitat disturbance estimate for:
 - the proposed all-season road alignment; and
 - preferred alignment option. Estimates should include areas currently proposed as borrow sources and access roads and the methods should be consistent with those outlined in the Recovery Strategy.
- b) A map focused on the NT1 portion of the proposed project showing the proposed and preferred alignment options, the new NT1 habitat disturbance created by the proposed project and the existing anthropogenic and fire disturbance layers used to inform the Recovery Strategy.
- c) A rationale for the selection of preferred alignment option, near kms 111-120, instead of using existing disturbance.

Response:

Please refer to the response to GNWT IR#4 above.

The GNWT estimated and mapped boreal caribou habitat disturbances following the Recovery Strategy methods for the all-season road (alignment Option 160405 is the preferred; refer to Appendix A – GNWT – ENR Wildlife Division maps). GNWT's estimated calculation of 5,590 ha combines the habitat disturbances from both the permitted winter road and all-season road.

The preferred alignment option 160405, near KP 111-120 was selected rather than the re-vegetated original winter road alignment (1980's) because the latter traverses the centre of the valley and crosses wetlands, and the Nahanni Butte Dene Band requested that CZN adopt an alignment on the valley sides. This request was made during the permitted winter road environmental assessment.

3.2 IR #2: MIGRATORY BIRDS

Comment(s):

- In their response to undertaking #14, the Proponent confirmed that during EA 0809-002 the effects from habitat loss and fragmentation for migratory birds and avian species at risk were not assessed for the winter road alignment. The Proponent further states that as the winter road is permitted, it is appropriate to only consider potential effects from those sections of the proposed all-season road alignment that “diverge significantly” from the winter road.
- The effects assessment underestimates the direct and indirect loss of habitat and fragmentation for migratory birds, including avian species at risk for several reasons. The updated route maps (Appendix G; All North Response to IRs) show little spatial overlap between the permitted winter road alignment and the proposed all-season road alignment, particularly in the eastern portion. It is unclear which areas of the footprint were assessed for habitat loss and fragmentation, how the Proponent defines “diverge significantly” and whether the use of the term has an ecological basis (e.g. home ranges) or is a measurement of distance. The permanent loss of habitat and the indirect effects on migratory bird habitat from an all-season road are not comparable to those of a winter road. Although a winter road may change the avian species assemblage and abundance, usually sufficient substrate and vegetation remains available as habitat for nesting birds. In addition, the current status of vegetation along portions of the permitted winter road alignment is described as having naturally regenerated due to the winter road not being used since the early 1980's. Regardless of which baseline condition (i.e. early successional or mature forest) the Proponent uses in its effects assessment, the habitat along the entire alignment of the road represents valuable habitat for migratory birds, including species at risk. Direct and indirect alteration of habitat including direct road footprint impact on wildlife and wildlife habitat is also included in the Terms of Reference Section 7.3.8.2 as an effect to be evaluated in the DAR.

Recommendation(s):

ECCC requests that the Proponent provide:

- a) Clarification on the definition and use of “diverge significantly” and the basis for which it is appropriate in the effects assessment.
- b) A revised effects assessment of habitat loss and fragmentation for the entire proposed all-season road alignment and preferred alignment options for migratory birds including avian species at risk.

Response:

The permitted winter road alignment depicted in the referenced Appendix G (Allnorth Response to IRs) has yet to be developed, although portions overlap the original winter road. Should the all-season road be approved, a winter road will be developed along the all-season road alignment to create a single road corridor, except in two locations as described below.

The two locations where the winter road and the proposed all-season road will diverge in geographic extent are:

1. Sundog Creek (4 km section from approximately KP 24.5-28.5 to avoid steep slopes); and,

2. Tetcela River to Fishtrap Creek area (4 km section from approximately KP 90.5-94.5 to avoid wet areas appropriate for a winter road but not for an all-season road).

An effects assessment for migratory birds for the two road sections of divergence noted above was provided in the DAR Addendum, Appendix E. Additional information was provided in our replies to Round One IR's, EC #1 and Parks #30-31, 34-36 and 40-44 for the assessment of migratory birds and avian species at risk including:

- Forest Birds;
- Trumpeter Swans;
- Forest Raptors;
- Barn and Bank Swallows;
- Short-eared Owls;
- Common Nighthawks;
- Olive-sided Flycatchers; and
- Harlequin Ducks.

Regarding a revised effects assessment of habitat loss and fragmentation for the entire proposed all-season road alignment, the proposed all-season road route would fragment migratory bird habitat along an 8-km long corridor within areas that diverge in geographical extent from the permitted winter road. Combined, the permitted winter road and proposed all-season roads would fragment migratory bird habitat along a 145-km long corridor (calculation does not include portions of the road from KP 0-23 and 29-33 that already exist in all-season quality (see EA TOR Reasons for Decision)). Habitat fragmentation and its associated edge effects increase forest bird nest predation. This is found to be true in highly disturbed landscapes, but may not be applicable to landscapes present in the project area. In a forested landscape (such as the project area), predation on birds as a result of habitat fragmentation and increasing edge habitat is less of a concern than habitat loss (Schmiegelow and Mönkkönen 2002)¹.

Together, the permitted winter road and the all-season road (including camps, borrow sources and access roads) result in the direct loss of approximately 358 ha of boreal forest and cordillera habitat (based on a 20 m road right-of-way width) available for migratory birds and avian species at risk (calculation does not include the KP 0-23 and KP 29-33 road portions). Of this, the all-season road alignment directly disturbs approximately 32.3 ha (including camps and borrow sources and their roads) in the areas that diverge in geographic extent from the permitted winter road alignment.

The winter road will primarily change forested habitat to graminoid/sedge habitat, which alters available habitat for existing forested species. However, it is acknowledged that the winter road would provide, after initial clearing, some level of migratory bird nesting habitat for select ground-nesting species.

Direct loss of nesting habitat associated with the all-season road (areas that diverge in geographical extent from the permitted winter road) was estimated previously. However, the all-season road (including camps, borrow sources, and access roads) and permitted winter road combined result in the following direct nesting habitat loss:

- Harlequin Duck = 1.4 km of Sundog Creek undergoing re-alignment, and therefore, not a total loss of habitat.
- Olive-sided Flycatcher = 326 ha (includes all-season and permitted winter roads within boreal forest);
- Common Nighthawk = 326 ha (includes all-season and permitted winter roads within boreal forest);
- Barn and Bank Swallow = 0 ha (includes habitat loss within the all-season and permitted winter roads); and
- Peregrine Falcon = 0 ha of cliff nesting habitat directly affected by the all-season and permitted winter roads.

¹ Schmiegelow, F.K. and M. Mönkkönen. 2002. Habitat loss and fragmentation in dynamic landscapes: avian perspectives from the boreal forest. *Ecological Applications*. 12(2): 375-389.

The additional species at risk include those associated with open wetlands and waterbodies within the boreal forest zone (Table 1). Since the design of the proposed all-season road avoids open wetlands and waterbodies to the extent possible, the assessment indicated that direct habitat loss for these species would be negligible. Direct habitat loss to open boreal forest wetlands and waterbodies are restricted to creek crossings, the Liard River crossing, a wetland near KP 44, and wetlands in the Fishtrap Creek area (Table 1). Direct habitat loss at seven locations interact with potential Rusty Blackbird habitat (Table 1). No direct habitat loss for Yellow Rail, Horned Grebe, or Short-eared Owl (Table 1).

Table 1. Wetlands and Waterbodies within 350 m of the Proposed All-Season Road

Type	Habitat Description (based on EOSD Classification)	Nearest KP (approx.)	All-Season Road Within the Alignments		Nearest Proximity to All-Season Road (m; approx.)*	Nesting Potential Within Species Setback Distance*			
			Original Winter Road	Permitted Winter Road		Rusty Blackbird (300 m)	Yellow Rail (350 m)	Horned Grebe (100 m)	Short-eared Owl (200 m)
Creek	Creek crossing	43		✓	0	✓			
Wetland	Shrub wetland with a small herb wetland within. Nearest distance to herb wetland (Yellow Rail and Short-eared Owl habitat) is approx. 125 m.	44	✓	✓	4	✓	✓		✓
Creek	Tall shrub wetland within the drainage channel crossing.	51		✓	0	✓			
Waterbody (Third Polje)	Water	57		✓	330				
Mosquito Lake and drainage channel	Water and Low Shrub (located within recent burn area; some treed and shrub wetlands remain in margins and drainage channel)	63-64	✓	✓	130	✓			✓
Waterbody	Water (located within recent burn area)	65	✓	✓	90	✓		✓	
Waterbody	Water (located within recent burn area)	65	✓	✓	270	✓			
Waterbody	Water (located within recent burn area)	66	✓	✓	120	✓			
Waterbody	Water (located within recent burn area)	66	✓	✓	240	✓			

Table 1. Wetlands and Waterbodies within 350 m of the Proposed All-Season Road

Type	Habitat Description (based on EOSD Classification)	Nearest KP (approx.)	All-Season Road Within the Alignments		Nearest Proximity to All-Season Road (m; approx.)*	Nesting Potential Within Species Setback Distance*			
			Original Winter Road	Permitted Winter Road		Rusty Blackbird (300 m)	Yellow Rail (350 m)	Horned Grebe (100 m)	Short-eared Owl (200 m)
Waterbody	Water (located within recent burn area)	67	✓	✓	180	✓			
Waterbody	Water (located within recent burn area)	67	✓	✓	170	✓			
Waterbody	Water surrounded by treed wetland	74	✓	✓	200	✓			
Creek	Water crossing (mixedwood and coniferous forests surround)	87.5-90	✓	✓	0-350	✓			
Wetland/ waterbody	Treed wetland and Fishtrap Creek water crossing, includes three ponds (80, 90, and 240 m away)	92-97	✓ (from 94.5-97)	✓	0-350	✓	✓	✓	✓
Wetland	Shrub wetland	105		✓	300	✓			
Waterbody	Water	107		✓	200	✓			
Waterbody	Water	107		✓	300	✓			
Waterbody	Water	107		✓	350	✓	✓		
Waterbody	Creek crossing	119 (and Borrow Source)		✓	0	✓			
Waterbody /Wetland	Water and treed wetland	120		✓	250	✓			
Waterbody	Water	134		✓	200	✓			
Waterbody	Water with treed and shrub wetland	141		✓	50	✓		✓	✓
Wetland	Shrub wetland	142		✓	120	✓			✓
Waterbody	Water	142		✓	250	✓			
Waterbody /Wetland	Water and shrub wetland	143		✓	200	✓			
Waterbody	Water	143		✓	200	✓			
Liard River crossing	Water	159		✓	0	✓			
Liard River	Water	163		✓	200	✓			
Wetland	Shrub wetland	165		✓	300	✓			✓

Table 1. Wetlands and Waterbodies within 350 m of the Proposed All-Season Road

Type	Habitat Description (based on EOSD Classification)	Nearest KP (approx.)	All-Season Road Within the Alignments		Nearest Proximity to All-Season Road (m; approx.)*	Nesting Potential Within Species Setback Distance*			
			Original Winter Road	Permitted Winter Road		Rusty Blackbird (300 m)	Yellow Rail (350 m)	Horned Grebe (100 m)	Short-eared Owl (200 m)
Wetland	Treed and shrub wetland	166		✓	160	✓			✓
Liard River	Water	170		✓	300	✓			

Bold indicates areas of direct habitat loss.

The previous assessment (DAR Addendum) discussed indirect habitat loss primarily under the categories of habitat effectiveness (i.e., dust accumulation) and abundance and occurrence (i.e., habitat avoidance). For the purposes of this response, indirect habitat loss was calculated using the recommended setback distances as buffers to the proposed all-season road (including camps, borrows, and access roads). Recommended setback distances follow those outlined in AANDC (2011)² and Environment Canada (2009)³ (Table 2).

Table 2: Recommended Setback Distances to Occupied Species at Risk Nests

Species at Risk	AANDC (2011) Setback Distance (m)	Environment Canada (2009) Setback Distance from Petroleum Industry Roads (m)
Harlequin Duck	250*	
Horned Grebe		100
Peregrine Falcon	1,500**	1,000
Yellow Rail	350	350
Short-eared Owl		200
Common Nighthawk	200	
Olive-sided Flycatcher	300	
Barn and Bank Swallow	250***	
Rusty Blackbird	300	100

* No recommended setback specific to Harlequin Ducks; AANDC (2011) general year round waterfowl nest setback used. COSEWIC (2013)⁴ indicates that Harlequin Ducks are relatively tolerant of moderate levels of human disturbances.

** No recommended setback specific to Peregrine Falcons; AANDC (2011) general raptor setback from Mar 1-Sept 1 is 1,500 m and from Sept 2-Feb 28 is 500 m.

*** No recommended setback specific to Barn and Bank Swallows; AANDC (2011) general bird nest setback used.

² Aboriginal Affairs and Northern Development Canada (AANDC). 2011. Northern Land Use Guidelines – Volume 9a Seismic Operations. Web access: http://publications.gc.ca/collections/collection_2012/aadnc-aandc/R2-226-9-1-2011-eng.pdf

³ Environment Canada. 2009. Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region. Canadian Wildlife Service, Environment Canada, Prairie and Northern Region, Edmonton, Alberta. 64p.

⁴ COSEWIC. 2013. COSEWIC assessment and status report on the Harlequin Duck *Histrionicus* Eastern population in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 38 pp

Combined, the proposed all-season (including camps, borrow sources, and access roads) and permitted winter roads indirectly affect approximately:

- Harlequin Duck nesting habitat = 1,688 ha (includes all habitat within a 250 m buffer along the all-season and permitted winter road along the Sundog, Funeral, Fast, and Prairie creeks);
- Horned Grebe nesting habitat = 130 ha (includes all habitat within a 100 m buffer from the open waterbodies listed in Table 1);
- Peregrine Falcon nesting habitat = 16,533 ha (includes all habitat within a 1,500 m buffer from KP 0-39 and east of the Front Range (KP 121-159));
- Yellow Rail nesting habitat = 554 ha (includes all habitat within a 350 m buffer from the wetlands/waterbodies listed in Table 1);
- Short-eared Owl nesting habitat = 370 ha (includes all habitat within a 200 m buffer from the wetlands/waterbodies listed in Table 1);
- Common Nighthawk nesting habitat = 5,890 ha (includes all habitat within a 200 m buffer from the all-season and permitted winter roads within the boreal forest);
- Olive-sided Flycatcher nesting habitat = 8,502 ha (includes all habitat within a 300 m buffer from the all-season and permitted winter roads within the boreal forest);
- Barn and Bank Swallow nesting habitat = 7,200 ha (includes all habitat within a 250 m buffer from the all-season and permitted winter roads within the boreal forest; considered a conservative estimate using the entire boreal forest road portion); and
- Rusty Blackbird nesting habitat = 1,510 ha (includes all habitat within a 300 m buffer from the creek crossings, wetlands, and waterbodies listed in Table 1).

Predicted effects from the proposed all-season and permitted winter roads on habitat loss and fragmentation after mitigation is applied (refer to the DAR Addendum and replies to Round One IR's), are summarized in Table 3.

Table 3: Migratory Bird and Avian Species at Risk Habitat Loss (Direct and Indirect) and Fragmentation

	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Certainty	Significance
Waterfowl	Adverse	L	M	M	L	M	M	L
Harlequin Duck	Adverse	L	M	M	L	M	M	L
Horned Grebe	Adverse	L	M	M	L	M	M	L
Peregrine Falcon	Adverse	L	M	M	L	M	M	L
Yellow Rail	Adverse	L	M	M	L	M	L	L
Short-eared Owl	Adverse	L	M	M	L	M	L	L
Forest Birds	Adverse	M	M	M	L	M	M	M
Common Nighthawk	Adverse	M	M	M	L	M	M	M
Olive-sided Flycatcher	Adverse	M	M	M	L	M	M	M
Barn and Bank Swallow	Adverse	L	M	M	L	M	M	L
Rusty Blackbird	Adverse	L	M	M	L	M	M	L
Overall Significance								
Adverse Low								

4.0 MVEIRB

4.1 IR #5: COLLARED PIKA – SURVEY AND SITE AVOIDANCE

Comment:

The July 2016 field survey demonstrated that collared pikas are present in or have occupied talus habitat as far east as km 38 along the road route.

Recommendation(s):

- a) Does CanZinc commit to the following?
 - to avoid talus areas with identified collared pika habitat, especially in the Sundog Creek area; and
 - to conduct collared pika surveys in potential habitat within realigned areas and any potential collared pika habitat within borrow sites, including borrow sites 16, 35, and 38.
- b) If there are locations where avoidance/realignment is not possible, what mitigation measures will be in place to minimize impacts to pika or pika habitat?
- c) Please also confirm whether borrow sources 33 and 34 have been removed from the scope of development in order to avoid active collared pika sites.
- d) Please add any agreed upon commitments to the Commitments Table (See IR 2).

Response:

Within collared pika range and where talus is present, CZN commits to avoiding talus to the extent possible, and conducting presence/not detected collared pika surveys in all borrow sources selected for development and along the proposed all-season road alignment that disturbs talus.

As part of this commitment, CZN re-aligned a section of the proposed all-season road that was once on, or adjacent to, talus habitat (KP 34.8 to 39; lower Sundog Creek area). This new re-alignment was shifted to avoid talus habitat, to the extent possible (Allnorth km 34+800 to km 39+000 revision 4, dated August 16). The new proposed re-alignment (the re-alignment to avoid talus) disturbs roughly 0.27 ha of possible talus (including side cuts; talus defined based on non-forested habitat identified from orthophoto image).

CZN commits to conducting pika surveys to determine their presence prior to development (e.g., road alignment, borrow sources) in pika habitat. Should pika's occupy a proposed borrow source or portion thereof, prior to development, a replacement borrow source or an unoccupied portion of the same source (as some sources are large) will be selected for use (after confirming that no pika's occur within a sufficient buffer distance identified by a biologist). Should pikas be determined to be present prior to development at Borrow sources 33 and 34, replacement borrows will be selected unless significant unoccupied portions exist beyond the designated buffer to pikas.

Changes in pika occupancy fluctuate naturally from year to year. In southwest Yukon, Franken and Hiks (2004)⁵, reported a total of 18 talus patch recolonizations and 15 patch extinction events over a six year period (1995-2001). Over-winter survival of adults ranged from 18.9-43% (mean 34.3%) depending on the weather, aspect, and other variables (data from 1995-2001; Franken 2002)⁶, indicating that on average 65% of the adults die over the winter period. The juvenile survival rate is lower (Franken 2002). In Yukon, collared pika average life expectancy was less than 1 year (Franken 2002).

Recolonization and patch persistence were found to be dependent on patch size, connectivity with other patches, aspect (southwest facing slopes more often recolonized than northeast facing), and habitat quality (Franken and Hik 2004).

Additional mitigation, beyond that previously identified in the DAR (e.g., low truck volumes, reduced traffic speeds, dust suppression, response to accidental spills, prohibit littering) specific to collared pika are:

- Prohibit the storage of snow, including along roadside snow banks, on or within 10 m of talus habitat (within pika range);
- Prohibit the disturbance of talus habitat (within pika range) year round unless pre-disturbance presence/not detected surveys have been completed and pikas were determined to be not present; and
- If required, determine a sufficient buffer distance from which borrow construction can occur near active pika habitat, based on guidance from a biologist.

CZN will update the Commitments Table to reflect these commitments.

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 EBA 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 EBA Inc.'s Services Agreement. Tetra Tech's General Conditions are provided in Appendix B of this report.

⁵ Franken, R. J. and D. S. Hik. 2004. Influence of habitat quality, patch size, and connectivity on colonization and extinction dynamics of collared pikas *Ochotona collaris*. *Journal of Animal Ecology*, 73(5): 889-896.

⁶ Franken, R. J. 2002. Demography and Metapopulation Dynamics of Collared Pikas (*Ochotona collaris*) in the Southwest Yukon. M.Sc., thesis submission, University of Alberta, Alberta. 149 pp.

6.0 CLOSURE

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

Respectfully submitted,
Tetra Tech EBA Inc.



Prepared by:
Karla Langlois, B.Sc. P.Biol.
Biologist
Environment Practice
Direct Line: 867.920.2287 x223
Karla.Langlois@tetrattech.com



Prepared by:
Amy McLenaghan, B.Sc., P.Biol., L.A.T.
Biologist
Environment Practice
Direct Line: 780.451.2130 x630
Amy.Mclenaghan@tetrattech.com



Reviewed by:
Tania Perzoff, M.Sc., R.P.Bio
Senior Regulatory Specialist
Mining Practice
Direct Line: 778.945.7517
Tania.Perzoff@tetrattech.com



Reviewed by:
Richard A.W Hoos, M.Sc., R.P.Bio
Principal Consultant
Mining Practice
Direct Line: 604.608.8914
Rick.Hoos@tetrattech.com

/sy

Attachments: Appendix A – Rare Plants with Potential to Occur within the Project Area
Appendix B – Tetra Tech's General Conditions

APPENDIX A

RARE PLANTS WITH POTENTIAL TO OCCUR WITHIN THE PROJECT AREA

Appendix A. Rare Plants with Potential to Occur within the Project Area

COMMON NAME	SCIENTIFIC NAME	NWT GSRANK (July 2016)	NWT GSRANK (October 2016)
Alaska Wild-rhubarb (Alpine Smartweed)	<i>Aconogonum alaskanum</i> (<i>Polygonum alpinum</i> , <i>Polygonum alaskanum</i>)	Sensitive	Delisted
Pale False Dandelion	<i>Agoseris glauca</i>	Sensitive	Sensitive
Spike Bentgrass	<i>Agrostis exarata</i>	Sensitive	Sensitive
Pearly Everlasting	<i>Anaphalis margaritacea</i>	May Be At Risk	Sensitive
Alpine Anemone	<i>Anemone drummondii</i>	Sensitive	Delisted
Seaside Angelica	<i>Angelica lucida</i> (<i>Coelopleurum gmelinii</i>)	May Be At Risk	May Be At Risk
Field Pussytoes	<i>Antennaria neglecta</i> (<i>Antennaria campestris</i>)	Sensitive	Delisted
Indian Hemp	<i>Apocynum cannabinum</i> (<i>Apocynum sibiricum</i>)	May Be At Risk	Delisted
Calder's Rockcress	<i>Arabis calderi</i>	May Be At Risk	May Be At Risk
Drummond Rockcress	<i>Arabis drummondii</i>	Sensitive	Delisted
Arctic Daisy	<i>Arctanthemum arcticum</i> (<i>Chrysanthemum arcticum</i> , <i>Leucanthemum arcticum</i> , <i>Dendranthema arctica</i>)	Sensitive	Delisted
Low-stemmed Sandwort	<i>Arenaria longipedunculata</i>	Sensitive	Sensitive
Egede Cinquefoil	<i>Argentina egedii</i> (<i>Potentilla egedii</i>)	Sensitive	Delisted
Alaska Sagebrush	<i>Artemisia alaskana</i>	May Be At Risk	May Be At Risk
Three-fork Sagebrush	<i>Artemisia furcata</i> (<i>Artemisia hyperborea</i>)	Sensitive	Delisted
White Sagebrush	<i>Artemisia ludoviciana</i>	May Be At Risk	May Be At Risk
Green Spleenwort	<i>Asplenium viride</i> (<i>Asplenium trichomanes-ramosum</i>)	May Be At Risk	May Be At Risk
Meadow Milk-vetch	<i>Astragalus agrestis</i>	Sensitive	Delisted
Canadian Milk-vetch	<i>Astragalus canadensis</i>	Sensitive	Sensitive
Rattle Milk-vetch	<i>Astragalus laxmannii</i> (<i>Astragalus adsurgens</i> , <i>A. adsurgens</i> var. <i>robustior</i> , <i>A. laxmannii</i> var. <i>robustior</i> , <i>A. striatus</i>)	Sensitive	Delisted
Hooker's Alpine Oat Grass	<i>Avenula hookeri</i> (<i>Helictotrichon hookeri</i>)	May Be At Risk	May Be At Risk
Bog Birch	<i>Betula pumila</i> (<i>Betula pumila</i> var. <i>glandulifera</i>)	Sensitive	Delisted
Red Clubrush	<i>Blysmopsis rufus</i> (<i>Blysmus rufus</i> ; <i>Scirpus rufus</i>)	May Be At Risk	Sensitive
Mingan Moonwort	<i>Botrychium minganense</i>	May Be At Risk	May Be At Risk
Leathery Grape-fern	<i>Botrychium multifidum</i>	May Be At Risk	Delisted
Northwestern Moonwort	<i>Botrychium pinnatum</i> (<i>Botrychium boreale</i>)	May Be At Risk	May Be At Risk
Rattlesnake Fern	<i>Botrychium virginianum</i>	Sensitive	Sensitive
Floating Marsh Marigold	<i>Caltha natans</i>	Sensitive	Delisted
Small-leaved Bittercress	<i>Cardamine microphylla</i>	May Be At Risk	May Be At Risk
Few-seeded Bittercress	<i>Cardamine oligosperma</i> (<i>Cardamine oligosperma</i> var. <i>kamtschatica</i> , <i>Cardamine umbellata</i>)	Sensitive	Sensitive
Pennsylvania Bittercress	<i>Cardamine pensylvanica</i>	Sensitive	Sensitive
Lesser Black-scaled Sedge	<i>Carex atosquama</i>	Sensitive	Delisted
Bebb's Sedge	<i>Carex bebbii</i>	Sensitive	Sensitive
Crawford sedge	<i>Carex crawfordii</i>	Sensitive	Sensitive
Needle-leaved Sedge	<i>Carex duriuscula</i> (<i>Carex stenophylla</i>)	May Be At Risk	May Be At Risk
Goosegrass Sedge	<i>Carex eleusinoides</i>	May Be At Risk	Sensitive
Thread-leaved Sedge	<i>Carex filifolia</i> (<i>Carex elyniformis</i>)	Sensitive	Sensitive
Hudson Bay Sedge	<i>Carex heleonastes</i>	Sensitive	Sensitive
Inland Sedge	<i>Carex interior</i>	Sensitive	Delisted
Slender Sedge	<i>Carex lasiocarpa</i>	Sensitive	Sensitive
Weak Sedge	<i>Carex laxa</i>	May Be At Risk	May Be At Risk
Livid Sedge	<i>Carex livida</i>	Sensitive	Sensitive
Rye-grass Sedge	<i>Carex loliacea</i>	Sensitive	Sensitive
Mackenzie Sedge	<i>Carex mackenziei</i> (<i>Carex norvegica</i> Willdenow ex Schkuhr, Besch. Riedgr?)	May Be At Risk	May Be At Risk
Prairie Sedge	<i>Carex prairea</i>	May Be At Risk	May Be At Risk
Northern Meadow Sedge	<i>Carex praticola</i>	Sensitive	Delisted
Retorse Sedge	<i>Carex retrorsa</i>	May Be At Risk	May Be At Risk
Richardson Sedge	<i>Carex richardsonii</i>	Sensitive	Sensitive
Sartwell's Sedge	<i>Carex sartwellii</i>	Sensitive	Delisted
Many-headed Sedge	<i>Carex sychnocephala</i>	Sensitive	Sensitive
Northern Indian Paintbrush	<i>Castilleja hyperborea</i>	Sensitive	Delisted
Yukon Indian Paintbrush	<i>Castilleja yukonis</i>	May Be At Risk	Delisted
Common Hornwort	<i>Ceratophyllum demersum</i>	Sensitive	Sensitive
Rose Chamaerhodos	<i>Chamaerhodos erecta</i> (<i>Chamaerhodos</i> ssp. <i>nuttallii</i>)	May Be At Risk	May Be At Risk
Red Pigweed (Coast-Blite Goosefoot)	<i>Chenopodium rubrum</i>	May Be At Risk	Delisted
Rocky Mountain Goosefoot	<i>Chenopodium salinum</i> (<i>Chenopodium glaucum</i> var. <i>salinum</i>)	Sensitive	Delisted
Wright Golden Saxifrage	<i>Chrysosplenium wrightii</i>	Sensitive	Sensitive
Slender Wood Reed Grass	<i>Cinna latifolia</i>	Sensitive	Delisted
Small Enchanter's Nightshade	<i>Circaea alpina</i>	Sensitive	Delisted
Drummond Thistle	<i>Cirsium drummondii</i>	Sensitive	Sensitive
Moss Grass	<i>Coleanthus subtilis</i>	May Be At Risk	May Be At Risk
Narrow-leaved Collomia	<i>Collomia linearis</i>	Sensitive	Delisted
Hooker's Bugseed	<i>Corispermum hookeri</i> (<i>Corispermum hyssopifolium</i>)	Sensitive	Sensitive
Few-flowered Corydalis	<i>Corydalis pauciflora</i>	Sensitive	Delisted
Slender Rock-brake	<i>Cryptogramma stelleri</i>	May Be At Risk	May Be At Risk
Mountain Bladder-fern	<i>Cystopteris montana</i>	Sensitive	Sensitive
Poverty Wild Oat Grass	<i>Danthonia spicata</i>	Sensitive	Sensitive
Pinate Tansy Mustard	<i>Descurainia pinnata</i>	May Be At Risk	May Be At Risk
Few-flower Shooting-star	<i>Dodecatheon pulchellum</i>	Sensitive	Delisted
Mackenzie River Dwarf Primrose	<i>Douglasia arctica</i>	Sensitive	Delisted
Boreal Whitlow-grass	<i>Draba borealis</i>	Sensitive	Delisted
White Arctic Whitlow-grass	<i>Draba fladnizensis</i>	Sensitive	Delisted
Yellowstone Whitlow-grass	<i>Draba incerta</i>	May Be At Risk	May Be At Risk
Wood Whitlow-grass	<i>Draba nemorosa</i> (<i>D. nemorosa</i> var. <i>leiocarpa</i>)	Sensitive	Delisted
Few-seeded Whitlow-grass	<i>Draba oligosperma</i>	Sensitive	Delisted
Palander's Whitlow-grass	<i>Draba palanderiana</i> (<i>Draba caesia</i> auctt)	Sensitive	Delisted
Slenderleaf Sundew	<i>Drosera linearis</i>	Sensitive	Sensitive
Spinulose Wood-fern	<i>Dryopteris carthusiana</i> (<i>D. spinulosa</i>)	May Be At Risk	May Be At Risk
Slender Spike Rush	<i>Eleocharis elliptica</i> (was misreported as <i>Eleocharis compressa</i> in B003)	May Be At Risk	May Be At Risk

Appendix A. Rare Plants with Potential to Occur within the Project Area

COMMON NAME	SCIENTIFIC NAME	NWT GSRANK (July 2016)	NWT GSRANK (October 2016)
One-Glume Spike Rush	<i>Eleocharis uniglumis (Eleocharis macrostachya)</i>	Sensitive	Sensitive
Canada Nodding Wild Rye	<i>Elymus canadensis</i>	Sensitive	Sensitive
Alpine Willowherb	<i>Epilobium anagallidifolium</i>	Sensitive	Delisted
Arctic Willowherb	<i>Epilobium arcticum</i>	Sensitive	Delisted
Dauria Willowherb	<i>Epilobium davuricum</i>	Sensitive	Delisted
White-flower Willowherb	<i>Epilobium lactiflorum</i>	Sensitive	Sensitive
Linear-leaved Willowherb	<i>Epilobium leptophyllum</i>	Sensitive	Delisted
Denali Fleabane (Mex's Fleabane)	<i>Erigeron denalii (Erigeron mexiae, Erigeron purpuratus var dilatatus)</i>	Sensitive	Sensitive
Yukon Fleabane	<i>Erigeron yukonensis (Erigeron glabellus var yukonensis)</i>	May Be At Risk	May Be At Risk
Showy Forget-me-not	<i>Eritrichium splendens</i>	May Be At Risk	May Be At Risk
Arctic Eyebright	<i>Euphrasia subarctica</i>	Sensitive	Delisted
Grass-leaved Goldenrod	<i>Euthamia graminifolia (Solidago graminifolia)</i>	Sensitive	Delisted
Lobed Fescue	<i>Festuca auriculata (Festuca ovina ssp alaskana ?, Festuca lenensis)</i>	May Be At Risk	May Be At Risk
Alaska Fescue	<i>Festuca brevissima (Festuca ovina spp alaskana)</i>	May Be At Risk	May Be At Risk
Prairie Gentian	<i>Gentiana affinis</i>	Sensitive	Delisted
Pygmy Gentian	<i>Gentiana prostrata</i>	Sensitive	Sensitive
Macoun's Gentian	<i>Gentianopsis macounii (Gentiana macounii)</i>	May Be At Risk	Sensitive
Glacier Avens	<i>Geum glaciale</i>	Sensitive	Sensitive
Prairie-smoke	<i>Geum triflorum</i>	May Be At Risk	May Be At Risk
Sea Milkwort	<i>Glaux maritima</i>	May Be At Risk	May Be At Risk
Small Floating Manna Grass	<i>Glyceria borealis</i>	Sensitive	Delisted
Common Sneezeweed	<i>Helenium autumnale</i>	Sensitive	Delisted
Canadian Needle Grass	<i>Hesperostipa curtisetata (Stipa curtisetata)</i>	Sensitive	Sensitive
Richardson Alumroot	<i>Heuchera richardsonii</i>	May Be At Risk	May Be At Risk
Four-leaved Marestalk	<i>Hippuris tetraphylla</i>	Sensitive	Sensitive
Woolly Beach-heath (Sand Heather)	<i>Hudsonia tomentosa</i>	Sensitive	Sensitive
Lake Quillwort	<i>Isoetes lacustris (Isoetes macrospora)</i>	May Be At Risk	May Be At Risk
Moor Rush	<i>Juncus stygius (Juncus stygius ssp. americanus)</i>	Sensitive	Sensitive
Oriental Koeler's Grass	<i>Koeleria asiatica (Koeleria cairnesiana)</i>	May Be At Risk	May Be At Risk
Prairie Koeler's Grass	<i>Koeleria macrantha (Koeleria cristata; Koeleria yukonensis)</i>	Sensitive	Sensitive
Little Weaselnout	<i>Lagotis minor (Lagotis stelleri)</i>	Sensitive	Delisted
Western Stickseed	<i>Lappula occidentalis (Lappula redowskii)</i>	Sensitive	Delisted
Beach Pea	<i>Lathyrus japonicus</i>	May Be At Risk	May Be At Risk
Calder's Bladderpod	<i>Lesquerella calderi</i>	May Be At Risk	Delisted
Northern Mudwort	<i>Limosella aquatica</i>	May Be At Risk	May Be At Risk
Heart-leaved Twayblade	<i>Listera cordata</i>	Sensitive	Delisted
Segmented Luetkea	<i>Luetkea pectinata</i>	May Be At Risk	May Be At Risk
Rufous Wood Rush	<i>Luzula rufescens</i>	May Be At Risk	May Be At Risk
Tree Clubmoss	<i>Lycopodium dendroideum (Lycopodium obscurum)</i>	Sensitive	Delisted
Bog Adder's-mouth	<i>Malaxis paludosa</i>	May Be At Risk	May Be At Risk
Ostrich Fern	<i>Matteuccia struthiopteris</i>	Sensitive	Sensitive
Sea Bluebell	<i>Mertensia maritima</i>	Sensitive	Sensitive
Common Large Monkey Flower	<i>Mimulus guttatus</i>	May Be At Risk	May Be At Risk
Alpine Stitchwort	<i>Minuartia obtusiloba (Arenaria obtusiloba)</i>	Sensitive	Delisted
Bog Stitchwort	<i>Minuartia stricta (Arenaria stricta, Arenaria uliginosa)</i>	Sensitive	Delisted
Yukon Stitchwort	<i>Minuartia yukonensis (Arenaria laricifolia)</i>	Sensitive	Delisted
Water Blinks	<i>Montia fontana (syn Montia lamprosperma, Claytonia fontana)</i>	Sensitive	Delisted
Spiked Muhly	<i>Muhlenbergia glomerata</i>	Sensitive	Delisted
Matted Muhly	<i>Muhlenbergia richardsonis</i>	Sensitive	Delisted
Alternate-flower Water Milfoil	<i>Myriophyllum alterniflorum</i>	May Be At Risk	Sensitive
Slender Naiad	<i>Najas flexilis</i>	Sensitive	Sensitive
Green Tussock Grass (Feather Grass)	<i>Nassella viridula (Stipa viridula)</i>	May Be At Risk	May Be At Risk
Rocky Mountain Pond Lily	<i>Nuphar polysepala (Nuphar lutea ssp. polysepala)</i>	May Be At Risk	May Be At Risk
Dwarf White Waterlily	<i>Nymphaea leibergii (syn Nymphaea tetragona ssp. leibergii)</i>	May Be At Risk	May Be At Risk
Pygmy White Waterlily (Small White Water-lily)	<i>Nymphaea tetragona</i>	Sensitive	Sensitive
White-grained Mountain Rice Grass	<i>Oryzopsis asperifolia</i>	Sensitive	Delisted
McConnell's Poppy	<i>Papaver mcconnellii</i>	May Be At Risk	Sensitive
Fringed Grass-of-parnassus	<i>Parnassia fimbriata</i>	Sensitive	Delisted
Red-tip Lousewort	<i>Pedicularis flammea</i>	Sensitive	Sensitive
Muskeg Lousewort	<i>Pedicularis macrodonta (syn Pedicularis parviflora var. macrodonta (Richards.))</i>	Sensitive	Delisted
Oeder's Lousewort	<i>Pedicularis oederi</i>	May Be At Risk	May Be At Risk
Whorled Lousewort	<i>Pedicularis verticillata</i>	May Be At Risk	May Be At Risk
Smooth Cliff-brake	<i>Pellaea glabella</i>	May Be At Risk	May Be At Risk
Richardson's Phlox	<i>Phlox richardsonii (incl. spp alaskensis, syn P. alaskensis (P. richardsonii ssp alaskensis), P. sibirica ssp alaskensis)</i>	Sensitive	Delisted
Seaside Plantain	<i>Plantago maritima (Plantago juncooides)</i>	May Be At Risk	Sensitive
Small Round-leaved Bog Orchid	<i>Platanthera orbiculata (Habenaria orbiculata)</i>	Sensitive	Sensitive
Sand Bluegrass	<i>Poa ammophila</i>	May Be At Risk	Sensitive
Porsild's Bluegrass	<i>Poa porsildii</i>	Sensitive	Delisted
Polar Bluegrass	<i>Poa pseudoabbreviata</i>	May Be At Risk	May Be At Risk
Curly Bluegrass	<i>Poa secunda (incl. P. scabrella; P. buckleyana)</i>	Sensitive	Delisted
Macoun's Podistera	<i>Podistera macounii (Ligusticum mutellinoides)</i>	May Be At Risk	May Be At Risk
Showy Jacob's Ladder	<i>Polemonium pulcherrimum</i>	Sensitive	Delisted
Alaska Knotweed	<i>Polygonum humifusum ssp caurianum (Polygonum caurianum)</i>	Sensitive	Delisted
Leafy Pondweed	<i>Potamogeton foliosus</i>	Sensitive	Sensitive
Illinois Pondweed	<i>Potamogeton illinoensis</i>	May Be At Risk	May Be At Risk
Yenisei River Pondweed	<i>Potamogeton subsibiricus (Potamogeton porsildiorum)</i>	Sensitive	Sensitive
Tall Cinquefoil	<i>Potentilla arguta</i>	Sensitive	Delisted
Slender Primrose	<i>Primula borealis</i>	Sensitive	Delisted

Appendix A. Rare Plants with Potential to Occur within the Project Area

COMMON NAME	SCIENTIFIC NAME	NWT GSRANK (July 2016)	NWT GSRANK (October 2016)
Arctic Primrose	<i>Primula eximia</i> (<i>Primula tschuktschorum</i> ssp. <i>cairnesiana</i>)	May Be At Risk	May Be At Risk
Choke Cherry	<i>Prunus virginiana</i>	May Be At Risk	Sensitive
Polar Nuttall's Alkali Grass	<i>Puccinellia nuttalliana</i> (<i>Puccinellia deschampsoides</i> , <i>Puccinellia borealis</i> ?, and incl <i>Puccinellia interior</i>)	Sensitive	Delisted
Kidney-leaved Buttercup	<i>Ranunculus abortivus</i>	Sensitive	Sensitive
Arctic Buttercup	<i>Ranunculus gelidus</i> (<i>Ranunculus karelinii</i>)	Sensitive	Sensitive
Pallas' Buttercup	<i>Ranunculus pallasii</i>	Sensitive	Delisted
Turner's Buttercup	<i>Ranunculus turneri</i>	May Be At Risk	May Be At Risk
Entire-leaved Stonecrop	<i>Rhodiola integrifolium</i>	Sensitive	Delisted
White Beakrush	<i>Rhynchospora alba</i>	May Be At Risk	May Be At Risk
Hoary Yellowcress	<i>Rorippa barbareaifolia</i>	May Be At Risk	May Be At Risk
Tierra del Fuego Dock	<i>Rumex fueginus</i> (<i>Rumex maritimus</i> var <i>fueginus</i>)	Sensitive	Delisted
Lapland Sorrel	<i>Rumex lapponicus</i> (<i>Rumex acetosa</i> ssp <i>alpestris</i> , <i>Rumex alpestris</i> ssp <i>lapponica</i>)	May Be At Risk	May Be At Risk
Wigeon-Grass	<i>Ruppia cirrhosa</i> (<i>Ruppia spiralis</i>)	Sensitive	Delisted
Knotted Pearlwort	<i>Sagina nodosa</i>	Sensitive	Sensitive
Alpine Pearlwort	<i>Sagina saginoides</i> (<i>Sagina linnaei</i>)	Sensitive	Sensitive
Chamisso's willow	<i>Salix chamissonis</i>	Sensitive	Sensitive
Pussy Willow	<i>Salix discolor</i>	Sensitive	Sensitive
Halberd Willow	<i>Salix hastata</i> (syn <i>Salix farriae</i> var. <i>walpolei</i>)	Sensitive	Delisted
Arctic Seashore Willow	<i>Salix ovalifolia</i> (<i>S. ovalifolia</i> var. <i>arctolitoralis</i>)	May Be At Risk	May Be At Risk
Meadow Willow (slender willow)	<i>Salix petiolaris</i> (<i>Salix gracilis</i>)	Sensitive	Delisted
Raup's Willow	<i>Salix raupii</i>	May Be At Risk	May Be At Risk
Tyrrel's Willow	<i>Salix tyrrellii</i>	May Be At Risk	May Be At Risk
Ascending Saxifrage	<i>Saxifraga adscendens</i>	Sensitive	Delisted
Matte Saxifrage	<i>Saxifraga bronchialis</i>	May Be At Risk	Sensitive
Rusty-hair Saxifrage	<i>Saxifraga ferruginea</i>	May Be At Risk	Delisted
Thyme-leaf Saxifrage	<i>Saxifraga serpyllifolia</i>	Sensitive	Sensitive
Three-square Bulrush	<i>Schoenoplectus pungens</i>	May Be At Risk	May Be At Risk
Common River Grass	<i>Scolochloa festucacea</i>	Sensitive	Delisted
Arizona Cinquefoil	<i>Sibbaldia procumbens</i>	Sensitive	Delisted
Menzies Pink Campion	<i>Silene menziesii</i>	Sensitive	Delisted
Creeping Campion	<i>Silene repens</i>	Sensitive	Delisted
Pale Blue-eyed Grass	<i>Sisyrinchium septentrionale</i>	May Be At Risk	Delisted
Alpine Smelowskia	<i>Smelowskia calycina</i> (incl. var. <i>media</i>)	Sensitive	Sensitive
Alkali Cordgrass	<i>Spartina gracilis</i>	Sensitive	Delisted
Umbellate Stitchwort	<i>Stellaria umbellata</i>	May Be At Risk	May Be At Risk
Clasping Twisted Stalk	<i>Streptopus amplexifolius</i>	Sensitive	Sensitive
Sago Pondweed	<i>Stuckenia pectinata</i> (<i>Potamogeton pectinatus</i>)	Sensitive	Delisted
Horned Sea-blite	<i>Suaeda calceoliformis</i>	Sensitive	Delisted
Water Awlwort	<i>Subularia aquatica</i>	Sensitive	Delisted
Alkali Aster	<i>Symphyotrichum ciliatum</i> (<i>Aster brachyactis</i>)	Sensitive	Delisted
Western Mountain Aster	<i>Symphyotrichum spathulatum</i> (<i>Aster spathulatus</i>)	Sensitive	Delisted
Yukon Aster	<i>Symphyotrichum yukonense</i> (<i>Aster yukonensis</i>)	May Be At Risk	May Be At Risk
Alaska Kitten-tail	<i>Synthyris borealis</i>	May Be At Risk	May Be At Risk
Floccose Tansy	<i>Tanacetum bipinnatum</i> (<i>T. huronense</i>)	May Be At Risk	May Be At Risk
Kjellman's Groundsel	<i>Tephrosieris kjellmanii</i> (<i>Senecio kjellmanii</i>)	Sensitive	Sensitive
Twice-hairy Groundsel	<i>Tephrosieris lindstroemii</i> (<i>Senecio lindstroemii</i>)	Sensitive	Sensitive
Rolland's Bulrush	<i>Trichophorum pumilum</i> (<i>Scirpus pumilus</i> , <i>Scirpus rollandii</i>)	May Be At Risk	Delisted
Arctic Starflower	<i>Trientalis europaea</i>	Sensitive	Delisted
Lesser Bladderwort	<i>Utricularia minor</i>	Sensitive	Delisted
Northern Bladderwort	<i>Utricularia ochroleuca</i>	Sensitive	Sensitive
Wood Valerian	<i>Valeriana dioica</i> (<i>Valeriana eptentrionalis</i>)	Sensitive	Sensitive
American False Hellebore	<i>Veratrum viride</i> (<i>Veratrum eschscholtzii</i>)	Sensitive	Delisted
American Speedwell	<i>Veronica americana</i>	Sensitive	Sensitive
Purslane Speedwell	<i>Veronica peregrina</i>	May Be At Risk	Delisted
Marsh Speedwell	<i>Veronica scutellata</i>	Sensitive	Delisted
Northern Marsh Violet	<i>Viola epipsila</i>	Sensitive	Delisted
Smooth White Violet	<i>Viola macloskeyi</i> (<i>Viola pallens</i>)	Sensitive	Delisted
Northern Bog Violet	<i>Viola nephrophylla</i>	Sensitive	Delisted
Alpine Cliff-fern (Northern Woodsia)	<i>Woodsia alpina</i>	Sensitive	Delisted
Horned pondweed	<i>Zannichellia palustris</i>	May Be At Risk	Sensitive

APPENDIX B

TETRA TECH'S GENERAL CONDITIONS

GENERAL CONDITIONS

NATURAL SCIENCES

This report incorporates and is subject to these “General Conditions”.

1.1 USE OF REPORTS AND OWNERSHIP

This report pertains to a specific site, a specific development or activity, and/or a specific scope of work. The report may include plans, drawings, profiles and other supporting documents that collectively constitute the report (the “Report”).

The Report is intended for the sole use of TETRA TECH's Client (the “Client”) as specifically identified in the TETRA TECH Services Agreement or other Contract entered into with the Client (either of which is termed the “Services Agreement” herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Report when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Report is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, in fact, caused by the unauthorized use of the Report.

Where TETRA TECH has expressly authorized the use of the Report by a third party (an “Authorized Party”), consideration for such authorization is the Authorized Party's acceptance of these General Conditions as well as any limitations on liability contained in the Services Agreement with the Client (all of which is collectively termed the “Limitations on Liability”). The Authorized Party should carefully review both these General Conditions and the Services Agreement prior to making any use of the Report. Any use made of the Report by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Report and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH 's professional work product and shall remain the copyright property of TETRA TECH.

The Report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Report, if required, may be obtained upon request.

1.2 ALTERNATIVE REPORT FORMAT

Where TETRA TECH submits both electronic file and hard copy versions of the Report or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH 's “Instruments of Professional Service”), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive the original signed and/or sealed version for a maximum period of 10 years.

Both electronic file and hard copy versions of TETRA TECH 's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH 's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Report have been conducted in accordance with the Services Agreement, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Report.

TETRA TECH professionals are bound by their ethical commitments to act within the bounds of all pertinent regulations. In certain instances, observations by TETRA TECH of regulatory contravention may require that regulatory agencies and other persons be informed. The client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 ENVIRONMENTAL ISSUES

The ability to rely upon and generalize from environmental baseline data is dependent on data collection activities occurring within biologically relevant survey windows.

1.5 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Services Agreement, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.6 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Report, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.7 GENERAL LIMITATIONS OF REPORT

This Report is based solely on the conditions present and the data available to TETRA TECH at the time the data were collected in the field or gathered from publically available databases.

The Client, and any Authorized Party, acknowledges that the Report is based on limited data and that the conclusions, opinions, and recommendations contained in the Report are the result of the application of professional judgment to such limited data.

The Report is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present at or the development proposed as of the date of the Report requires a supplementary investigation and assessment.

It is incumbent upon the Client and any Authorized Party, to be knowledgeable of the level of risk that has been incorporated into the project design or scope, in consideration of the level of the environmental baseline information that was reasonably acquired to facilitate completion of the scope.

The Client acknowledges that TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of property, the decisions on which are the sole responsibility of the Client.

1.8 JOB SITE SAFETY

TETRA TECH is only responsible for the activities of its employees on the job site and was not and will not be responsible for the supervision of any other persons whatsoever. The presence of TETRA TECH personnel on site shall not be construed in any way to relieve the Client or any other persons on site from their responsibility for job site safety.