

October 23, 2017

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*Via Email*  
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**Re: Technical Report for Boreal Caribou – EA1617-01: Tłı̄cho All-Season Road**

Mr. Toogood:

As per the requirements for the Mackenzie Valley Environmental Impact Review Board's EA1617-01: Tłı̄cho All-Season Road (TASR), please find attached the Wek'èezhì Renewable Resources Board's technical report submission specific to the Board's scientific concerns, comments and recommendations related to boreal caribou prior to the November 2017 public hearing.

The WRRB is looks forward to continued opportunities to provide meaningful input for the TASR. If you have any questions, please contact our office at (867) 873-5740 or [jpellissey@wrrb.ca](mailto:jpellissey@wrrb.ca).

Sincerely,



J. Grant Pryznyk  
Chair

Cc Michael Conway, Superintendent, Infrastructure, GNWT  
Jessica, Manager, Culture and Lands Protection, Tłı̄chų Government

# **Wek'èezhì Renewable Resources Board**

## **Technical Report (Boreal Caribou)**

Submission to the  
Mackenzie Valley Environmental Impact  
Review Board  
for the Public Hearings on the  
Tłıchǫ All-Season Road Project  
EA-1617-01

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23 October 2017

## Technical Report Summary for Ṯɔdzı (Boreal Caribou)

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The Wek'èezhì Renewable Resource Board (WRRB) finds there is not enough certainty in the Developer's evidence to suggest that incremental and cumulative effects of the Ṯıcẖ All-Season Road (TASR) will not have a significant influence on the ability of ṯɔdzı (boreal caribou) to be self-sustaining and ecologically effective. The WRRB finds that this conclusion holds at the Wek'èezhì/North Slave regional scale, NWT South range/sub-population scale, and the NWT ṯɔdzı population scale (NT1).

The WRRB found shortcomings in the Developer's approach to the environmental assessment (EA), with the assessment endpoint, temporal and spatial boundaries, and measurement indicators having limitations. In addition, the WRRB identified uncertainties about potential effects, adaptive mitigation, and mitigation effectiveness. The combined weight of the limitations and uncertainties prevents the WRRB from reaching clear conclusions about the effects of the TASR; however, literature suggests a combination of limited habitat and addition of permanent linear features is typically not beneficial for ṯɔdzı populations.

The WRRB has provided recommendations that would enable the Developer to strengthen their approach to the EA and reduce uncertainty in the evidence provided. The WRRB's reasoning for a strengthened assessment, especially regarding adaptive mitigation, is that the ṯɔdzı are already at or below the threshold for significant risk that local populations are not self-sustaining - and that recovery and restoration of critical habitat is required. Ṯɔdzı ranges in the NWT have relatively high rates of forest fire, which, together with the additive effect of the human footprint, have reduced the amount of undisturbed critical habitat available at multiple scales.

The WRRB's confidence in the effectiveness of its recommendations is contingent on whether ongoing delays in recovery planning will persist. The Adequacy Statement Report (ASR) made minimal reference to the specific requirements for mitigating effects on ṯɔdzı and critical habitat, though information on recovery planning, the legal context for describing and mitigating effects for a Threatened species, and critical habitat assessments have been available since 2011. The WRRB also notes that discussion of specific recovery planning at the scale of ranges in the NWT (e.g. Wek'èezhì/North Slave) occurred in 2014, and despite a federal requirement for range plans by early October 2017, no plans are yet available. This is unfortunate, as clarity provided by a Wek'èezhì/North Slave-specific Range Plan would have been extremely useful during review of information, and in determining the best approaches for adaptive mitigation, including critical habitat recovery. The WRRB believes that the completion of range plans, and specifically a Wek'èezhì/North Slave Range Plan is essential for assessment of the TASR.

The WRRB suggests its recommendations in the Technical Report can be implemented as a Mackenzie Valley Environmental Impact Review Board (MVEIRB) Measure, and that the TASR assessment's shortcomings can be remedied if MVEIRB sends the operations phase back to the Parties for: (i) further review to collaboratively revise the Wildlife Management and Monitoring

Plan (WMMP), (ii) development of specific management plans, such as for access and traffic management, and (iii) the establishment of an Independent Oversight Committee to ensure that the road's monitoring and mitigation is highly protective of the Threatened t̄qdzı, their critical habitat, people and the environment. Guidance would be provided through expertise of T̄ıchq̄ members, and expertise provided by technical experts in the NWT and provinces, including academic and industry partners.

## 1. Introduction

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### 1.1 Organization of the Technical Report

This Technical Report on t̄qdzı is provided in addition to information in the Technical Report provided to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) on October 11, 2017 (PR #215). The previous Technical Report focussed on ɤekw̄ (barren-ground caribou), łıwe (fish), and traditional knowledge (TK), and included T̄ıchq̄ elders' information on t̄qdzı habitat. This report provides additional information relevant to t̄qdzı (see comments section 4.1 T̄qdzı (Boreal Caribou) in PR#215).

The WRRB's Technical Report is organized following MVEIRB's guidance (PR#182). Further, for t̄qdzı, the WRRB has relied on the context set by national<sup>1</sup> and territorial<sup>2</sup> recovery planning. T̄qdzı were listed as Threatened under the *Species at Risk Act* (SARA) in 2003. In 2011, Environment Canada (2011<sup>3</sup>; PR#33) described critical habitat through assessing natural (fire) and human (industrial) disturbance to ranges, and the likelihood of supporting self-sustaining t̄qdzı populations (Figure 11; PR#33).

## 2. Background Information on WRRB

This was provided in the previous Technical Report (PR #215).

## 3. WRRB Technical Issues Raised Prior To This Technical Report

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During comments on the Terms of Reference, the Government of the Northwest Territories (GNWT) commented that they could not establish population trends for t̄qdzı due to lack of information (GNWT – DOT, ID#22; PR #76). The MVEIRB recommended that the GNWT consult with

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<sup>1</sup> Recovery Strategy for the Woodland Caribou, Boreal Population (*Rangifer tarandus caribou*), in Canada (National Recovery Strategy; Environment Canada 2012).

<sup>2</sup> Conference of Management Authorities. 2017. Recovery Strategy for the Boreal Caribou (*Rangifer tarandus caribou*) in the Northwest Territories. *Species at Risk (NWT) Act* Management Plan and Recovery Strategy Series. Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT. 57 + x pp.

<sup>3</sup> Environment Canada. 2011. Scientific Assessment to Inform the Identification of Critical Habitat for Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada: 2011 update. Ottawa, Ontario, Canada. 102 pp. plus appendices.

the WRRB and Environment and Climate Change Canada (ECCC) regarding t̄odzı ranges to see if the parties can agree that trends could only be applied to the entire NT range, which led to a meeting in November 2016 (PR #94, #99, and #100). The WRRB’s focus was the need for data at the Wek’èezhìi scale, and that lack of information prevented assessment at both the Wek’èezhìi and NT1 scales. The WRRB supported the use of habitat suitability models when population information was not available, and mentioned the need for cooperation and coordination via a t̄odzı monitoring program, and the need to clarify concepts related to habitat modelling and offsets (PR#100). A follow-up meeting in January 2017 to discuss the WRRB’s and ECCC’s responses (PR#107) clarified that WRRB concerns still stood. During the Information Request (IR) phase, the WRRB raised questions about the assessment endpoint, measuring indicators and spatial boundaries, habitat and other issues (see Table 1 for summary of IR topics raised by the WRRB). Although some useful responses were received, the WRRB continued to have outstanding concerns, with additional information requested during the Technical Session in Behchok̄ò (PR#158, #159 and #162); the WRRB concerns continue to be covered in this Technical Report.

**Table 1.** WRRB's issues raised before the Technical Report for boreal and barren-ground caribou

<b>Information Requests / responses regarding t̄odzı</b>	<b>Public Registry #:</b>
1. Application of Assessment Endpoint and Measurement Indicators	#142 & #149
2. Measurement Indicators	#142
5. Access (increased potential for harvest)	#145
7. Habitat Availability (quantification of)	#142
8. Habitat Availability (thresholds at NT1 and Wek’èezhìi scale)	#134
9. Habitat Availability (connectivity / fragmentation)	#142
10. Increased Traffic Collisions	#142
11. Predation-related Impacts (influence of moose and bison)	#142
13. Mitigation Measures (reclamation)	#142

#### 4. WRRB Issues Raised For This Technical Report

The WRRB reviewed the Developer’s Project Description Report (PDR; PR#7), the Adequacy Statement Response (ASR; PR#110), IRs and their responses (see Table 1), reports of meetings including the Technical Session, and the Wildlife Monitoring and Management Plan (WMMP). In addition, the WRRB considered recovery planning reports at the national and territorial scales, given t̄odzı are listed as Threatened in Canada and the NWT. The WRRB has organized its concerns and comments for this Technical Report along the structure of the ASR to emphasise how the concerns align with the components within the EA.

## 1. Assessment endpoint

### 1i) WRRB's concern

An Assessment Endpoint is a key concept related to each Valued Component that should be protected, given the importance of “self-sustaining and ecologically effective populations” (PR#110). The Developer-defined endpoint is not appropriate for ṫdzı, as the WRRB believes there is uncertainty regarding the prediction that they are self-sustaining.

### 1ii) Developer's conclusion

The Developer defined the Assessment Endpoint: *“At Base Case, ṫdzı are predicted to be self-sustaining and ecologically effective with a low risk, but are near their resilience limits”* (p.4.53; PR#110).

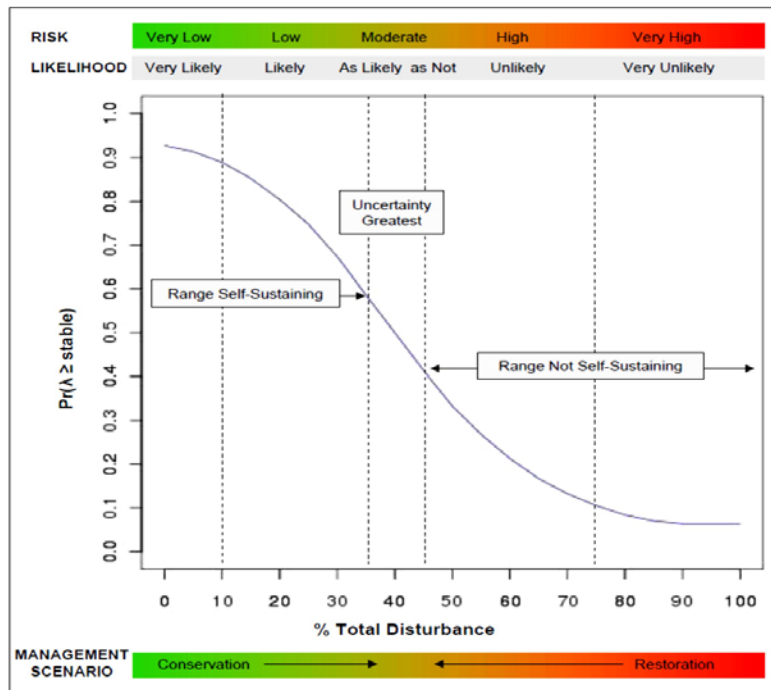
### 1iii) Rationale for WRRB's concern

The Developer stated that ṫdzı in the NT1 range may be approaching the limit for a self-sustaining population as the amount of undisturbed habitat in the NT1 range was estimated at 66.8%. The WRRB has three concerns:

Firstly, the WRRB is concerned that the threshold of 65% of undisturbed habitat for a self-sustaining population is not an appropriate endpoint for an EA. At that threshold, there is only a 60% probability for the population to be self-sustaining. To clarify, ECCC's complete definition of the threshold is:

This recovery strategy identifies 65% undisturbed habitat in a range as the disturbance management threshold, which provides a measurable probability (60%) for a local population to be self-sustaining. This threshold is considered a minimum threshold because at 65% undisturbed habitat there remains a significant risk (40%) that local populations will not be self-sustaining” (emphasis added).

Secondly, the WRRB is concerned that the habitat threshold is not a fixed numerical target, but is a point along a gradient of risk related to the probability that current range conditions will support a self-sustaining population. Figure 11 from Environment Canada’s (2011) assessment of critical habitat (PR#33) illustrates how the certainty of outcome, ecological risk, and management scenarios varies along a continuum of habitat conditions. The graph projects the rate of change in caribou recruitment plotted against the percentage of undisturbed range.



**Figure 11.** Probability of observing stable or positive growth ( $\lambda \geq \text{stable}$ ) of caribou populations over a 20-year period at varying levels of total range disturbance (fires  $\leq 40$  years + anthropogenic disturbances buffered by 500 m). (Note: figure copied from PR #33).

Thirdly, the WRRB continues to have concerns about the Developer’s focus in using the entire NWT t̄odzı range (NT1). As explained in this report, Section 4 – Spatial Boundaries, ECCC (PR#33) identified a local population range (NT South) that, through an integrated risk assessment, was rated *as likely as not* to maintain a self-sustaining population over time (see Table 11; PR#33). The WRRB has repeatedly highlighted the appropriateness of the Wek’èezhii/North Slave scale (e.g. PR#100), the same scale at which the yet-to-be developed regional range plan is required.

**1iv) WRRB’s recommendations**

The WRRB recommends that the Assessment Endpoint should be revised to use a definition that recognizes uncertainty, and is applicable to the current state of t̄odzı habitat and population trend. The WRRB notes that the revised definition should be based on the 2011 integrated risk assessment (PR#33) that NT South was “*as likely as not*” to maintain a self-sustaining population over time.

Alternatively, the Assessment Endpoint could be based on the amount of habitat to improve the likelihood of the range being self-sustaining. In the 2011 Critical Habitat Assessment Appendix 2, the NWT South range needed 3% (731,964 ha) as a minimum amount of functional habitat to be restored over 50 years, to improve the likelihood of the range being self-sustaining.

## **2. Measurement Indicators**

### **2i) WRRB's concern**

Measurement Indicators are how changes to the Assessment Endpoint are described. The WRRB is concerned that the Developer did not adequately explain measurement sensitivity for the selected indicators. The sensitivity may limit the size of the effect that can be detected, which increases uncertainty about the Developer's conclusions about the impacts of the TASR.

### **2ii) Developer's conclusion**

The Developer described habitat availability, habitat distribution, and survival and reproduction as the measurement endpoints to measure the TASR effects (PR#110).

### **2iii) Rationale for WRRB's concern**

While the Developer clarified how Measurement Indicators were measured through the responses to the WRRB's IRs (WRRB IR#2; PR #142) and the ASR (Section 4.1.2; PR#110), the sensitivity related to detection of effects was not described.

Habitat availability as a Measurement Indicator records quantity and quality of habitat. However, the Developer equated habitat with vegetation classes without describing any implications of this assumption. The Developer stated they used similar approaches for mapping the vegetation classes as for the National Recovery Strategy (p. 4-26; PR#110; PR#38). The PDR (Table 6-9; PR#7) refers to the biophysical attributes for year-round, calving, post-calving, rutting, winter and travel. These six classes summarize the habitat needed for t̄dzı to survive and reproduce, and were applied in the context of Critical Habitat (PR#33). In contrast, the Developer in the ASR (PR#110) assigned the land cover classes (essentially vegetation) into only either moderate to high suitability, or low to nil suitability.

The WRRB finds the use of just two classes weakens the use of the Measurement Indicator, as the indicator will not be sensitive to detecting habitat changes relevant to t̄dzı ecology. Use of information provided by T̄ch̄ elders and NWT studies on habitat use (e.g. PR# 7, #177 and #178) would have allowed the Developer to increase the value of the Measurement Indicator and apply the biophysical attributes used by ECCC (Appendix H; PR#38). This information is required as one of the mitigation actions listed in the National Recovery Strategy to avoid destruction of biophysical attributes (Appendix I; PR#38).

The Developer lists the footprint of linear developments as an area, but as a baseline measure it would have been useful to have the different types of linear structures (TASR, winter roads and trails) provided as linear km/km<sup>2</sup>. While ECCC reported that splitting anthropogenic disturbance



into linear and polygonal features did little to improve the predictive power of ECCC's recruitment model, ECCC found that the negative effect of linear disturbance was greater than the negative effect of polygonal disturbances (Appendix 7.5; PR#38). Line density (km/km<sup>2</sup>) is a habitat attribute used to examine correlations with ṫdzı calf survival in, for example, northeast BC (Demars *et al.* 2017<sup>4</sup>).

Part of the WRRB's concern about the Measurement Indicators is that in 2016, the use of similar indicators for ECCC's Critical Habitat Assessment and the 2012 National Recovery Strategy led to the recognition of regional differences in caribou responses and the characteristics of disturbances (ECCC 2016<sup>5</sup>). ECCC is focused on re-examining the 500m buffering of disturbance and its relationship to calf recruitment and adult survivorship. The WRRB notes that the model describing the relationship between caribou recruitment and buffered development (Figure 7; PR#33), though statistically significant, is relatively imprecise as it only explains 69% of the variation for a buffer 500 to 2000m, though the explanatory power was improved from a model used in 2008. ECCC is also undertaking updated population analysis and a sensitivity analysis to examine variation in recruitment and adult survival.

The second Measurement Indicator is Habitat Distribution, which is the arrangement and connectivity of habitats, and the spatial distribution and movement of animals. The Developer in responses to IRs provided a qualitative analysis of vegetation classes (IR#2; PR#140; PR#142) using information on patch size, spatial arrangement and connectivity. The WRRB notes the need for explaining the accuracy and precision of estimating habitat characteristics for Measurement Indicators. For example, Blyth *et al.* (2016<sup>6</sup>) measured that the percentage of habitat patches >500 km<sup>2</sup> is 83% of the undisturbed area in the Dehcho but Nagy (2011<sup>7</sup>) using different data sources and parameters estimated 15.2%, 46% and 13.8% secure unburned habitat for the South Slave, Dehcho-north and Dehcho-south.

The range of natural variation in the Measurement Indicator for survival and reproduction is available including estimates of the range of natural variation (Species at Risk Committee. 2012; PR#33 and 128). For example, in the Dehcho from 2004-2017, Larter and Allaire (2017<sup>8</sup>) report that for 2005-2017, pregnancy rates of caribou in the Dehcho were high (93%) but adult survival low and annually variable, and the population rate of increase over the past 12 years remains < 1 ( $\lambda = 0.96$ ). As Larter and Allaire (2017) mention, "*...a combination of both low adult female survival and low recruitment, or conversely, high adult female survival and high recruitment, can have a major impact on annual population rates of increase. For 2016/17, the*

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<sup>4</sup> Demars, Craig & Boutin, Stan. (2017). Nowhere to hide: effects of linear features on predator-prey dynamics in a large mammal system. *Journal of Animal Ecology*. 10.1111/1365-2656.12760.

<sup>5</sup> Enhanced Analysis to Support Regional Caribou Range Planning and Action Planning [http://www.registrellep-sararegistry.gc.ca/document/default\\_e.cfm?documentID=2933](http://www.registrellep-sararegistry.gc.ca/document/default_e.cfm?documentID=2933)

<sup>6</sup> Blyth, C.A., D. Daust, B. Armitage, D. Cichowski, S. Alexander and K. Price. 2016. Landscape projections on ṫdzı habitat in NWT. Prepared for Government of Northwest Territories, Yellowknife, NWT.

<sup>7</sup> Nagy, J.A. 2011. Use of Space by Caribou in Northern Canada. Ph.D. Thesis, University of Alberta.

<sup>8</sup> Larter, N.C. and D.G. Allaire. 2017. Dehcho Ṫdzı Study Progress Report, April 2017. Environment and Natural Resources Government of the Northwest Territories

*combination of average calf recruitment with below average adult survival, resulted in an estimated annual  $\lambda < 1$  (0.92)". Late winter calf:cow ratios are also annually variable and did not correlate with late winter snow depth. The WRRB notes that it would have been useful for the Developer to have provided more information on the Measurement Indicators to clarify sensitivity in detecting changes.*

#### **2iv) WRRB's recommendations and suggested mitigation**

The WRRB recommends that to reduce uncertainty in detecting and measuring effects of the TASR, the Developer should clarify the likely effect sizes, and the sensitivity of the indicators to detecting the effects for all three Measurement Indicators.

### **3) Temporal boundaries**

#### **3i) WRRB's concern**

The WRRB's concern is that as recovery planning is implemented, the ecological and recovery planning context for monitoring and mitigation will change during the TASR's indefinite life.

#### **3ii) Developer's conclusion**

The Developer stated the TASR operational life was indefinite. Though monitoring would be reviewed five years after construction, only collaring was likely to continue after five years.

#### **3iii) Rationale for WRRB's concern**

The WRRB is concerned that there are no criteria for how monitoring and mitigation will remain in place to detect longer term effects. The WRRB notes that for example, ECCC's (2011) indicators used to assess self-sustainability refer to a 20-year time period. The WRRB is also concerned about a changing climate and trends for changes in habitat and fires, and the changes in alternative prey and the associated predation risk to tōdzı (e.g. 10-30 year time frame; NWT response to WRRB IR#11; PR#142).

#### **3iv) WRRB's recommendations**

The WRRB recommends that the Developer revise the temporal boundaries to clarify their adaptive mitigation for longer-term effects and ecological trends which may require changes in monitoring and adaptive mitigation.

### **4) Spatial boundaries (Regional Study Area)**

#### **4i) WRRB's concern**

The WRRB remains concerned about how use of the overall NT1 range is appropriate for the Regional Study Area (RSA) boundaries, and how it influences conclusions about the effects of the TASR.

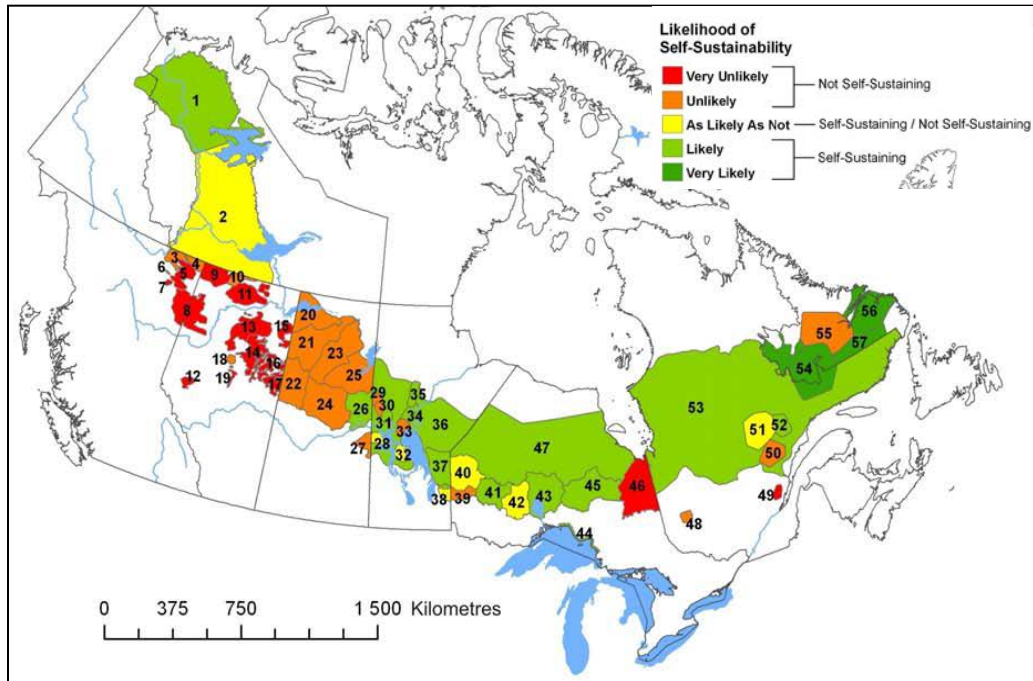
#### **4ii) Developer's conclusion about the issue**

The Developer defined the RSA for t̥dzı based on the extent of its range in the NWT (NT1; PR#38) and, after discussions, some habitat changes were assessed for Wek'èezhìi (PR#107; see also previous comments re: Assessment Endpoints).

#### **4iii) Rationale for WRRB's concern**

The Developer followed the National Recovery Strategy (PR#38) in using the entire NWT range (NT1) and, in response to the WRRB (PR #100 and 110), habitat changes within Wek'èezhìi. The WRRB acknowledges difficulty in determining the most appropriate spatial boundaries; information is incomplete in the NWT, and the reasons for determining the boundaries can influence outcomes.

At the scale of the overall NT1 range, t̥dzı are considered likely self-sustaining, but this is not the case at a more local population scale. The WRRB notes that Objective #1 in the NWT Recovery Strategy (PR#106) is to ensure "there is adequate habitat across the NWT range to maintain a healthy and sustainable population of t̥dzı." This leads the WRRB to recommend that the RSA should be based on the need for maintaining adequate habitat. In the NWT, habitat and satellite-collared caribou grouping indicated two ranges (PR#7 and #178). This division is recognized in ECCC's assessment (PR#33), for which the range delineation described two local population ranges: NWT North and NWT South (see Table 11, and Figure 14, PR#33; Figure 14 provided). Based on the amount of fire and human disturbance (38%; Table 2), NWT South was classified "*as likely as not*" to maintain a self-sustaining/not-self-sustaining population over time. The uncertainty of the classification leads the WRRB to recommend a conservative approach, especially as the amount of area burnt has been of concern for some time (PR#177 and #178), with fires in 2014 (PR#106) leading to a situation where there is now need for critical habitat restoration vs. conservation (Figure 11, PR#33).



**Figure 14.** Integrated risk assessment for t̄d̄z̄i ranges in Canada (note: modified slightly, legend removed for clarity; PR#33)

**Table 2.** Summary of areas for natural disturbance (fire), buffered human disturbance (500m) and undisturbed habitat at three different scales: NT1, NWT South and Wek’èezhìi/North Slave (PR#110).

	NT1		NWT South		Wek’èezhìi/North Slave	
	ha	%	ha	%	ha	%
fire	10,159,286	24.4		29.0	1,813,041	39.1
Buffered disturbance	3,697,637	8.9		10.0	40,840	0.9
undisturbed	27,861,774	66.8	15,127,250	62.0	277,883	60.0
total	55,575,620		24,398,791		2,131,764	

The WRRB also notes that the 2012 NWT SARC assessment,<sup>9</sup> and the 2017 NWT Recovery Strategy (PR#106) recognize that the NWT has regional variation in whether t̄d̄z̄i are declining, stable or increasing. The NWT Recovery Strategy (PR#106) reported that: “There is concern that caribou may be declining in Wek’èezhìi and the North Slave region overall.” The WRRB

<sup>9</sup> Species at Risk Committee. 2012. Species Status Report for T̄d̄z̄i (*Rangifer tarandus caribou*) in the Northwest Territories. Species at Risk Committee, Yellowknife, NT Available online: [http://www.nwt-species-at-risk.ca/sites/default/files/boreal\\_caribou\\_nwt\\_status\\_report\\_dec\\_2012\\_3.pdf](http://www.nwt-species-at-risk.ca/sites/default/files/boreal_caribou_nwt_status_report_dec_2012_3.pdf).

maintains that Wek'èezhì/North Slave region is the appropriate scale for range planning. The development of range plans is required under the national Recovery Strategy for Woodland Caribou, Boreal Population (PR#38), with region-specific range plans described as one of the approaches to achieve conservation and recovery objectives NWT Recovery Strategy (see Approach 1.1; PR#106). However, the WRRB notes that range plans for t̄qdzı in the NWT are not available, although as stated in the federal Action Plan (PR#153) they are required by October 2017. There is no indication of when a Range Plan may be produced given that a framework for the range plans was expected in early October (see Day 1 and Day 2 Technical Session transcripts; PR#158 and PR#159, respectively) and has not yet been received.

The WRRB is also concerned about the uncertainty of the eastern spatial boundary for either NT1 or NWT South. Both the Species at Risk Committee (2012) and WRRB's t̄qdzı report (PR#178) describe t̄qdzı distribution extending into the Taiga Shield. Community observations, habitat and traditional harvesting areas largely coincide with the Taiga Plains ecozone but northeast of Gamètì, an area of 15,000 km<sup>2</sup> of the Taiga Shield has small groups of t̄qdzı (Table 2; PR#178).

#### **4iv) WRRB's recommendations**

The WRRB recommends that the spatial boundaries for the RSA to be revised to refer to the NWT South (not NT1), as well as the Wek'èezhì/North Slave region.

### **5) Base Case Conditions**

#### **5i) WRRB's concerns**

The WRRB's concern is that information used to describe Base Case is incomplete, and criteria for the Developer's conclusions are inadequately described.

#### **5ii) Developer's conclusion**

The Developer concluded that: *"t̄qdzı in the NT1 range appear to be within the limits of adaptive capacity and resilience at Base Case"* (Section 4.2.3.1; PR#110).

#### **5iii) Rationale for WRRB's concerns**

##### **(a) Criteria for adaptation and resilience**

In the ASR's Section 4.2.1 (PR #110), adaptability and resilience are defined in general terms. The criteria for the limits to adaptability and resilience for t̄qdzı are not explained, even though those limits could be related to the current knowledge for t̄qdzı and their habitat. The available evidence points towards a possible decline in t̄qdzı in Wek'èezhì and a high proportion of fire-modified habitat (PR#79 and 178). It is serious gap that the Developer did not examine whether the thresholds used in recovery planning based on Integrated Risk Assessment (PR#33) are relevant for defining the limits to adaptability and resilience.

##### **(b) Missing information**

The Base Case is the current conditions which are the outcome of past and present developments and environmental changes and which influence how t̄qdzı will be able to cope

with additional changes. The WRRB finds it confusing that although the PDR (PR#7) uses knowledge for Wek'èezhì and neighbouring regions compiled for NWT status assessment (Species at Risk Committee. 2012; PR#79 and 178), the ASR (PR#110) does not include the information. The Base Case leaves a gap in all the available NWT-specific information on habitat use, diet and behavior in comparison with the more generalized information used by the Developer, which included references for ɬekwò rather than ɬòdzì.

The WRRB is concerned that the Base Case does not refer to critical habitat even though identification of adverse effects for ɬòdzì includes critical habitat (section 79(2) of the *Species at Risk Act*). The PDR (p.6-26; PR#7) refers to critical habitat but the ASR does not include it in the Base Case for ɬòdzì.

The WRRB found that the ecology of ɬòdzì was not well-represented. For example, the implications of home ranges relative to current habitat conditions are missing. In northern Alberta, Dalerum et al (2007<sup>10</sup>) found that the home range size was not affected by fire (up to 76%) possibly because the home ranges were relatively large. Even although 14 – 26% of their home ranges were burnt, adult survival and late winter calf productivity were not affected, which suggests a high degree of adaptability. However, the annually variable adult survival and high pregnancy rates for ɬòdzì in the NWT South range (Dehcho) suggest limits to adaptability when human disturbance is additional to habitat loss from fires.

The Developer describes the ɬòdzì use of the vegetation classes and, in responses to IRs, provided a qualitative description of the patch size, spatial arrangement and connectivity for the vegetation classes (PR#140; PR#142). The Developer clarified that patches >500 km<sup>2</sup> on either side of the Project would be maintained after application of the project and Reasonably Foreseeable Developments (RFD). The WRRB believes that barrier effects and the potential for increased probability of encounter rates with predators in patches east of the TASR remain unknown, leading to uncertainty on potential impacts to the boreal population.

The WRRB notes that the Base Case has gaps in the current conditions. The Developer does refer to ecozones (broad classifications of climate, terrain and vegetation) and that ɬòdzì in the NWT occur within the Taiga Plains and, to a lesser extent, Taiga Shield. However, the Developer does not use the information available on trends in the ecozones (ESTR Secretariat 2013<sup>11</sup>). For example, the annual mean temperature has increased over 2°C and winter temperatures have risen about 5°C since 1950. This warming has translated into changes to permafrost landscapes and increases in terrestrial primary productivity. Climate-related changes in the treeline zone at the north of the ecozone include increased shrub growth, a small net increase in tree cover resulting from increased conifer cover at the northern part of the treeline zone. Other trends include increased temperatures of permafrost, changes in active layer depth, and decreases in

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<sup>10</sup> Dalerum, F., S. Boutin, and J.S. Dunford. (2007). "Wildfire effects on home range size and fidelity of ɬòdzì in Alberta, Canada." *Canadian Journal of Zoology* **85**: 26-32.

<sup>11</sup> ESTR Secretariat. 2013. Taiga Plains Ecozone+ evidence for key findings summary. Canadian Biodiversity: Ecosystem Status and Trends 2010, Evidence for Key Findings Summary Report No. 13. Canadian Councils of Resource Ministers. Ottawa, ON. vii + 109 p. <http://www.biodivcanada.ca/default.asp?lang=En&n=137E1147-1>

permafrost leading to loss of frozen peat plateaus, which is especially relevant for t̥d̥z̥i ecology. Rain and icing events also have energetic impacts to caribou with regards to movement and access to winter forage.

Trends in forest fires are particularly important for t̥d̥z̥i. While annual variability is high, there are long-term trends: the area burned increased from the 1960s until the 1990s and then fell sharply in the 2000s, which may be related to changes in large atmospheric oscillations. In comparison with other ecozones, the average annual area burned in the Taiga Plains is high (0.71% of the forested ecozone area, second only to the Taiga Shield), despite the frequency of very low fire years (ESTR Secretariat 2013). The high proportion of areas burnt also means a high proportion of younger vegetation types, which favour moose, bison and deer with incidental predation for t̥d̥z̥i.

The WRRB is aware that the application of the 65% recovery threshold of habitat loss has been questioned for northern Saskatchewan because the rate of fire is high, and the human footprint is low (PR#154). Critical habitat designation for northern Saskatchewan and any adjustment to the threshold is not expected until 2018, and is currently not formalized. The draft NT Recovery Strategy (PR#79) states that: *“The NWT does not currently have strong evidence to support changing the threshold, and the minimum threshold of 65% disturbance applies to the NWT range”* (see also PR#134). The National Recovery Strategy (PR#38) identifies a need for range plans, which will outline how range-specific land and/or resource activities will be managed over space and time to ensure that critical habitat for t̥d̥z̥i is protected from destruction. However, the NWT has not yet completed range plans.

The Developer’s comparisons to the SK1 range in Saskatchewan (PR#142; PR#159) focussed on the similarities regarding the high degree of disturbance due to fire, the low amount of anthropogenic disturbance, and low prey density. However, the comparisons omit the fact that while harvest is extremely low in SK1 (PR#154), harvest occurs in Wek’èezhìi (PR#177 and #178), with details on the harvested number, location and sex largely unknown (PR#145). Also in addition to moose, bison are present in the RSA, with both species expected to increase their abundance and distribution due to changes in vegetation post-fire and movements related to range expansion. Information from collaring surveys provided in response to ECCC (PR#128) clearly shows there is already overlap with bison, with the possibility that the TASR will further facilitate movements. The WRRB questions the Developer’s speculation about current conditions for moose and deer, as the Developer suggests that the absence of high numbers of deer and moose may reduce the amount of undisturbed habitat needed for t̥d̥z̥i (p. 4-41; PR#110). Given the regional variation in fire, and its likely relationship with home range size (Dalerum *et al.* 2007), the WRRB suggests that a more detailed assessment of the evidence is needed before questioning how ECCC’s recovery thresholds are applicable.

The Developer provides almost no information by which to measure future changes in survival and reproduction, as the section has a generalized narrative on habitat and predation. Considerably more and specific information is available for the NWT, including estimates of the range of natural variation (Species at Risk Committee. 2012; PR#33 and 128). For example, in

the Dehcho from 2004-2017, a total of 158 collars have been deployed (Larter and Allaire 2010; 2017). Larter and Allaire (2017) report that for 2005-2017, pregnancy rates of caribou in the Dehcho are high (93%) but adult female survival estimated for 2016/17 was 74.2% lower than the best conservative estimate (geometric mean) over the past 12 years of 78.6%; survival was also annually variable. Late winter calf:cow ratios are also annually variable, and did not correlate with late winter snow depth. The importance of disturbed habitat is apparent from the high proportion of wolf-related mortalities (suspected) within 400 m of a seismic line. The Dehcho information is useful for the ASR as it provides information on the precision for measurements of survival and reproduction that could be used to describe the sensitivity of these Measurement Indicators.

The WRRB notices that in contrast to other projects subject to EA, that there was no requirement for baseline studies. The Department of Environment & Natural Resources, GNWT did provide the results of their aerial reconnaissance prior to deploying collars, but there was comparable baseline information collected for Fortune Minerals Ltd. NICO Mine, which included aerial and track surveys. However, the Fortune NICO surveys did not differentiate between t̄q̄dzı and Ɂekw̄, a difficulty which is mentioned in the WMMP; the WRRB believes this difficulty can be addressed using knowledgeable observers.

#### **5iv) WRRB recommendations**

The WRRB recommends that the Base Case be revised to include updated and additional information, specifically:

- a) Analyses of habitat including reporting on habitat availability and distribution relative to biophysical attributes; and,
- b) A complete account of the range of natural variation in the survival and reproduction information as well as a more complete account of harvest levels using T̄łch̄q̄ knowledge.

### **6) Mitigation**

#### **6i) WRRB's concern**

The WRRB is concerned about gaps in mitigation especially the lack of an adaptive mitigation framework and no evidence for the effectiveness of mitigation. The WRRB is also concerned about how the proposed mitigation relates to protecting critical habitat relative to SARA<sup>12</sup>.

#### **6ii) Developer's conclusion**

The Developer's conclusions about mitigation is included in Section 7 – Residual Effects Analysis.

#### **6iii) Rationale for WRRB's concern**

In the Technical Report for Ɂekw̄ (PR#215), the WRRB has drawn attention to the lack of description of the effectiveness of mitigation and the mitigation hierarchy, and similar

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<sup>12</sup> *Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada*  
([http://www.sararegistry.gc.ca/virtual\\_sara/files/policies/EA%20Best%20Practices%202004.pdf](http://www.sararegistry.gc.ca/virtual_sara/files/policies/EA%20Best%20Practices%202004.pdf))



shortcomings are applicable for t̄odzı. A particular gap for t̄odzı is how proposed mitigation for TASR construction and operation relate to mitigating the root causes of t̄odzı's Threatened status and on protecting critical habitat (Appendix 1; PR#79; Table I.1; PR#38). The WRRB notes that the National Recovery Strategy (PR#38) classifies graded or paved roads as a permanent alteration to t̄odzı habitat, and the Developer has minimized this effect by proposing a minimal footprint during construction of the TASR (PR#110).

The gaps include the third tier of the mitigation hierarchy, which is rehabilitation/restoration and includes offsetting (see PR# 215 for comments about offsetting for Ɂekw̄). The Developer answered ECCC's question about restoring the winter road habitat (IR#8; PR#140) that it was the T̄ı̄ch̄q̄ Government's responsibility with no suggestion of methodology or timing. This is slightly different than earlier assertions that portions of the winter road could be reclaimed to reduce the impacts of habitat fragmentation (PR# 110).

Additionally, the WRRB identifies a second gap for habitat restoration. Use of NWT South for the RSA is more consistent with the evidence than use of the overall NWT t̄odzı range (NT1). The NWT South has a large area of burnt habitat, which means the threshold for self-sustaining caribou is already exceeded by 3% (731,964 ha in 2010; Table 11; Appendix F-2<sup>13</sup>; PR#33). For NWT South, there is already a need for restoration, without taking into account the TASR footprint and fires vs. natural recovery since 2011.

Some approaches for restoring habitat for t̄odzı are available<sup>14</sup> as well as practical experience<sup>15</sup>. The WRRB is aware of the on-going mitigation for t̄odzı in the Taiga Plains of northeastern British Columbia (BC) where the BC T̄odzı Research and Effectiveness Monitoring Board (REMB) was established in 2011 as a partnership between government and industry<sup>16</sup>. REMB supports achieving recovery objectives including operating practices, restoring t̄odzı habitat, and managing predators and their primary prey. Admittedly, the scale of the oil and gas development differs from an all-season road, but roads typically precede opening up areas for development and so the BC experience is applicable and anticipatory. The BC experience also provides examples of reconciling mitigation actions for multiple species, which is not clearly discussed in the ASR (PR#110). Examples of research collaboration and coordination can also be found in Alberta, with oil, and gas and forestry partners cooperating with universities on many t̄odzı research questions for over 20 years (e.g. earlier examples include the T̄odzı Research Program, and Integrated Landscape Management initiatives).

The draft WMMP has few details for how mitigation will avoid or minimize increased harvesting, increased predation resulting from changes in moose and bison, increased road-induced mortality, and barrier effects to caribou. The draft WMMP acknowledges that there is

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<sup>13</sup> rs\_appendix\_2\_eng non sustaining incl NWT.pdf

[http://www.registelep-sararegistry.gc.ca/virtual\\_sara/files/plans/rs\\_appendix\\_2\\_eng.pdf](http://www.registelep-sararegistry.gc.ca/virtual_sara/files/plans/rs_appendix_2_eng.pdf)

<sup>14</sup> [Defining Habitat Restoration for T̄odzı in the Context of National Recovery: A Discussion Paper](#) (2016)

<sup>15</sup> <http://www.bcogris.ca/boreal-caribou-home>

<sup>16</sup> <http://www.bcogris.ca/boreal-caribou-home>

experience elsewhere for road-induced mortality and examples are mentioned in the brief summarised literature review for road impacts and mitigation (Appendix G). However, the identified mitigations only emphasise fencing or crossing structures. The mitigation for collisions during operation of the road is a 70kmph speed limit but evidence that this is effective is not included. The mitigation for incidental predation is through reducing habitat change by limiting the TAsR's direct footprint, but the effectiveness is uncertain.

What is missing from the draft WMMP is a clear indication of how monitoring will trigger increases or decreases in mitigation and how mitigation can be modified. This is despite the description of how the t̄dzı collars will be used to monitor caribou during construction (Appendix E; PR#192), and the description of operating procedures during the geotechnical investigations (PR#181). The sample size for collars is low, and statistical power analyses were not provided. Initial results suggest a low encounter rate which will limit use of collars for monitoring. During review of the Wildlife Management Proposal application for the collaring program, the WRRB expressed concern over the lack of consultation with T̄chq̄ communities prior to the deployment of collars, and lack of other techniques (e.g. snow track surveys, remote cameras, fecal pellet surveys to measure stress, dust levels and local densities). Alternative techniques would bring a greater incorporation of TK and expertise, and techniques could be cross-calibrated and supplement the information provided by collars. The monitoring also does not clarify how individual mitigation actions, such as speed, can be increased or decreased with sequences of mitigation actions then implemented. For example, lower speeds can be implemented, followed by daily closures or convoys to reduce the likelihood of collisions, and increase the predictability of traffic gaps so the caribou can cross the road.

In comparing the ASR and draft WMMP with mitigation for critical habitat (Table I.1; PR#38), the WRRB noticed that although there was concurrence, there are gaps. Mitigation to reduce loss for biophysical attributes is not addressed; the use of time-specific windows (except for calving) is not specified and mitigating inter-species relations is not described although their probability is likely in a longer-term project. For example, the WMMP (Section 2.8; PR#192) lists species relative to their conservation status. The WMMP notes it is consistent with the proposed Recovery Strategy for the Wood Bison in Canada in mitigating and documenting traffic collisions. However, it does not explain the sequence of monitoring and mitigation if moose and bison numbers increase incidental predation on t̄dzı (see Table I.1; PR#38); in this instance, the experience in northeast BC would be a useful reference.

The WRRB notes uncertainties in the WMMP's sensitive seasons (Table 3, draft WMMP); they only include calving and winter, and only appear to relate to construction. The dates for calving 5 April to 5 June actually includes pre-calving (Table 6; SARC PR#7). In the Taiga Plains, (Dehcho), calves were born from 7-23 May with 62% born by 15 May (Larter and Allaire 2017). This suggests that to include a month of post-calving, the season should be extended to 25 June. It is not clear why the late winter season is short (16 March – 4 April) as a sensitive season.

The Developer does not provide evidence for the assertion that (Appendix E; PR#192) t̓d̓z̓ı are “less sensitive to sensory disturbance at other times of the year, as they are moving greater distances on a daily basis and will likely avoid active construction areas or move away from them quickly if and when they encounter them”. The WRRB is doubtful that displacement should be considered as mitigation.

#### **6iv) WRRB’s recommendations**

The WRRB recommends:

- a) Monitoring techniques and mitigation actions should be expanded to use the experience from elsewhere for avoiding, minimizing and recovery effects. Revisions to mitigation should specify criteria to measure effectiveness of mitigation and how thresholds are specifically applied to changes in mitigation and monitoring;
- b) An access management plan for wildlife harvesting with recommendations based on community-based monitoring and adaptive mitigation to manage access and harvest monitoring. The plan should describe criteria for temporary closure related to wildlife or weather;
- c) A collaborative oversight committee should refine and revise the adaptive mitigation thresholds for incremental and cumulative effects and ensure that they are consistent with the NWT and national recovery planning; the committee (working group) would also serve as a forum for continued development and refinement of collaborative t̓d̓z̓ı research in Wek’èezhì; and,
- d) Building on (iii), consideration of use of establishment of conservation agreements (as mentioned in federal Action Plan) to provide a framework to achieving population and distribution objectives for t̓d̓z̓ı.

### **7) Residual Effects Analysis**

#### **7i) WRRB’s concern**

The WRRB is concerned that the residual, incremental and cumulative effects, especially regarding critical habitat, are under-estimated. This increases uncertainty about the risks for t̓d̓z̓ı.

#### **7ii) Developer’s conclusion**

*“Overall, the weight of evidence from the analysis of the primary pathways predicts that incremental and cumulative changes to measurement indicators from the Project and other developments should have no significant adverse effect on self-sustaining and ecologically effective t̓d̓z̓ı populations. The confidence in this prediction is higher for the Application Case than the RFD Case” (p. 4-213; PR#110).*

#### **7iii) Rationale for WRRB’s concerns**

The Developer describes the three primary pathways with strong interactions for t̓d̓z̓ı (direct habitat loss, sensory disturbance and increase in public access: Table 4.3.2; PR#110) and a fourth primary pathway, “Use of linear corridors by bison may lead to range expansion and affect moose and caribou habitat” was listed as a weak interaction.

The WRRB is concerned that the Developer has under-estimated indirect habitat loss. The Developer stated that (p.4-171; PR#110); *“vehicular activity, noise and other sensory disturbances under existing conditions (PR#7; PR#28) and therefore, measurable losses in local habitat use from indirect effects from the Project during construction and operation are predicted to be small and confined to 1,780 ha of undisturbed habitat (Table 4.4-1)”*. This includes areas modified by forest fires and so there is uncertainty about when the habitat would recover. The Developer used a 500m buffer for indirect habitat loss as a result of sensory disturbance, based on the National Recovery Strategy (PR#38), which noted that the *“effect of anthropogenic disturbance varies for individual ranges (i.e. in some ranges extending up to 14 km)”* and referenced the sensitivity analysis undertaken for critical habitat (PR#33). The analysis (Figure 7; PR#33) does also support an effect on recruitment for some disturbances for 500 to 2000 m which is consistent with the literature<sup>17</sup> (PR#124).

The WRRB suggests that the evidence supports applying a 2500 m buffer to measure indirect habitat loss relative to sensory disturbance from traffic and human activity. The indirect habitat loss (TASR buffered by 2500 m based on possible behavioral avoidance) is 55,572 ha, which is additional to the change in habitat availability (p. 4-170; PR#110) as the direct habitat loss from TASR footprint is 3,414.3 ha. The scale of effect size depends on which RSA is applied (NT1, NWT South or Wek'èezhì).

For the incremental effects, the Developer predicts that changes to survival are predicted to be small relative to the Base Case. However, without analysis, the WRRB notes uncertainty about the implications of 'small' effects. The effect of dust on forage, vehicle collisions and use of linear corridors and converted habitat (i.e., younger, more productive forest) by prey and predators are considered to have a negligible residual effect. However, the WRRB remains concerned that vehicle collisions, even at a low frequency, may act together with increased incidental predation on t̄dzı (PR#38 and 79). The draft WMMP's literature search (PR#124) describes how t̄dzı avoid habitats within one kilometer of active roads, and are sensitive to between 10 and 60 vehicles/day. This contrasts with the characterization of the TASR's average of 40 vehicles/day, which the Developer did not expect to permanently affect movement.

The WRRB is concerned that the incremental effects on critical habitat are not clearly addressed especially at the scale of NWT South local population (PR#33), which in 2011 was identified as highly uncertain as to whether it was self-sustaining or not (i.e. “as likely as not”).

The National Recovery Strategy (Appendix I; PR#38) describes that new access roads in previously undisturbed areas may induce further disturbance by opening territory to more development, recreational users, etc. However, the Developer only added the footprint (buffered by 500 m) of RFDs (Fortune Minerals Ltd. NICO Mine, Nailii Hydroelectric Project, T̄ichq̄/Whatì Park Area, Prairie Creek Mine Project and Mackenzie Valley Highway) (p. 4-193; PR#110) for considering the overall t̄dzı range (NT1), which seems an under-estimate given

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<sup>17</sup> A list of references is available from WRRB

possible mining development (PDR PR#69). Discussion of inclusion of Fortune NICO as part of the t̄odzı study area occurred at the Technical sessions, with a commitment outlining possible collaboration regarding cumulative effects (PR#171). However, the WRRB is disappointed that the Developer did not take the opportunity to speak more to possibilities regarding coordination and cooperation among parties in the WMMP, given the WMMP is the appropriate place (see also PR#100).

The WRRB notes that mitigation is uncertain and is not related to recovery planning or critical habitat. The Developer states (p. 4-193; PR#110) *“that RFDs are future developments that are not present on the landscape, there is uncertainty about mitigation detail that will be used to avoid, minimize rehabilitate or off-set effects to t̄odzı habitat availability”*. Although the Developer mentions climate change, there is no analysis or use of published literature to integrate possible effects with trends in fire and industrial developments.

#### **7iv) WRRB’s recommendations**

The WRRB recommends that:

- a) The Residual Effects analysis be revised to more comprehensively assess incremental and cumulative effects to reduce current uncertainty;
- b) The range plan for Wek’èezhì/North Slave be completed by the end of April 2018, with interim thresholds provided for development in Wek’èezhì/North Slave in time for the November 15-17, 2017 Public Hearing; and,
- c) The conclusions for ‘small’ effects which are not expected to exceed the resilience or adaptability limits of t̄odzı be examined in the context of recovery planning and critical habitat. The context is the draft NWT Recovery Plan (p. 25; PR#33), as Approach 1.4 states: *“Where the cumulative habitat disturbance surpasses the threshold for a self-sustaining population, management authorities may need to recommend to regulatory agencies and land use planning boards that development activities be scaled back or not approved in a particular area, until sufficient habitat regenerates to offset the new disturbance.”*