



Via Email

Government of Northwest Territories / Gouvernement des Territoires du Nord-Ouest

Ms. Jody Pellissey
Executive Director
Wek'èezhì Renewable Resources Board
102A 4504 49 AVENUE
YELLOWKNIFE NT X1A 1A7

JUL 16 2021

Dear Ms. Pellissey:

Submission of the Final Caribou Habitat Offset Plan for the Tłı̨ch̨o All-Season Road

The Government of the Northwest Territories' Department of Infrastructure (GNWT-INF) is pleased to submit the Final Caribou Habitat Offset Plan (Final Plan) to the Wek'èezhì Renewable Resources Board (WRRB) for review and approval for the Tłı̨ch̨o All-Season Road (TASR) under section 12.5.1 of the Tłı̨ch̨o Agreement. The Final Plan is being submitted in compliance with the Mackenzie Valley Environmental Impact Review Board's (MVEIRB) Report of Environmental Assessment Measure 6-3 (EA-1617-01), as well as satisfying Part C, Condition 55 of TASR Land Use Permit (W2016E0004) and directives in the Wek'èezhì Land and Water Board's May 30, 2019 Reasons for Decision Letter.

As part of Measure 6-3 requirements, GNWT-INF submitted a draft Caribou Habitat Offset Plan (draft Plan) to the WRRB prior to commencement of construction. The Draft Plan was completed in collaboration with the Government of the Northwest Territories Department of Environment and Natural Resources (GNWT-ENR), the Tłı̨ch̨o Government, the WRRB, and in consultation with Environment and Climate Change Canada, the Yellowknives Dene First Nation, and the North Slave Métis Alliance.

The Final Plan, not only improved and finalized the Draft Plan, but it also provided a framework for the next phase of the habitat offsetting program. However, caribou habitat offsetting is a new concept to the Northwest Territories with associated unknowns and considerable financial cost to the GNWT. Therefore, the Final Plan may be revised and adaptively managed, if necessary, in collaboration with the WRRB, GNWT-ENR, and other stakeholders to ensure the offsetting program is successful and cost effective.

Substantial completion of the TASR is scheduled for November 30, 2021 and opening of the road to public use is contingent on approval of the Final Plan. The GNWT-INF looks forward to working with all stakeholders on the next phase of the caribou habitat offsetting program. Should you have any questions or concerns please contact me at (867) 767-9086 ext. 31117 or by email at Ziaur_Rahman@gov.nt.ca at your earliest convenience.

Sincerely,

Ziaur Rahman
Manager, Surface Design and Construction
Department of Infrastructure

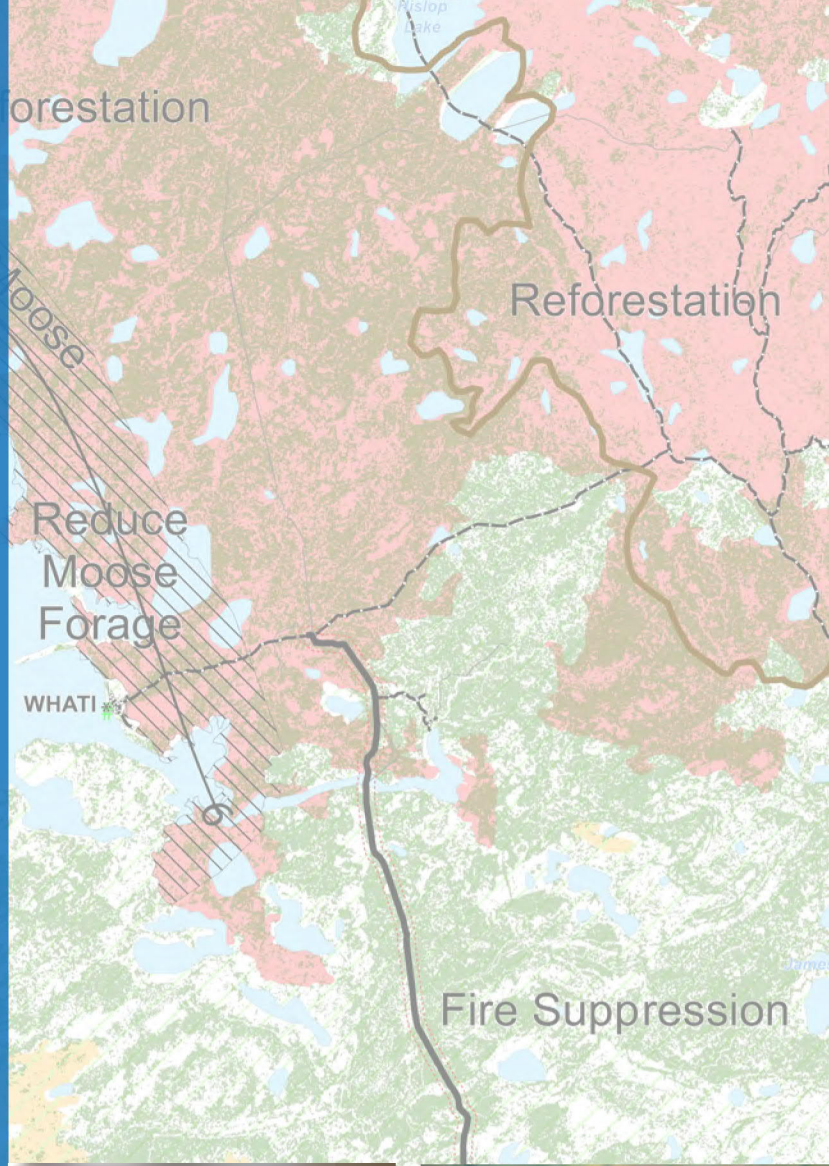
c. Ms. Laura Duncan, Tłı̨ch̨o Executive Officer
Tłı̨ch̨o Government



Government of
Northwest Territories

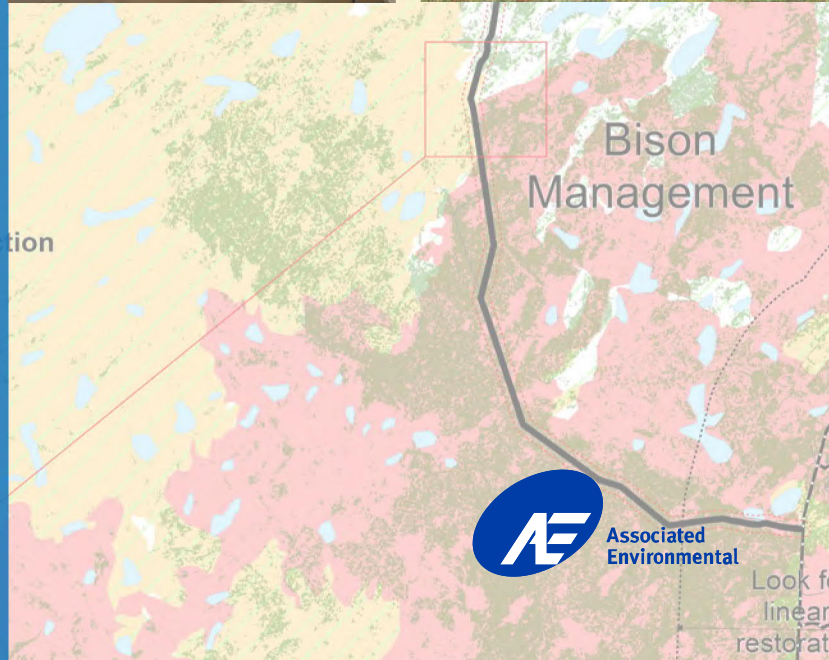
Department of Infrastructure

Tłichǫ All-Season Road Caribou (tǫdzi) Final Habitat Offset Plan



- Study:
- Water
 - Plants
 - Todzi health
 - wolf collars
 - survival and reproduction

Fire Suppression



Associated Environmental Consultants Inc.



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June 22, 2021
File: 2018-2330

Benjamin Bey
Environmental Analyst
Design & Technical Services - Department of Infrastructure
5015 - 49th Street
Yellowknife, NT
X1A 2L9
Via email: Benjamin_Bey@gov.nt.ca

Re: Tłıchq All-Season Road Final Boreal Caribou Habitat Offset Plan

Dear Dr. Bey:

Associated Environmental Consultants Inc. is pleased to present this Final Caribou Habitat Offset Plan for the Tłıchq All Season Road. The Mackenzie Valley Environmental Impact Review Board (MVEIRB; EA1617-01), with Measure 6-3, requires a plan to offset any residual effects on effective boreal caribou (tqdzı) habitat caused by building and operating the road.

This document is the Final Caribou Habitat Offset Plan and has been developed in collaboration with the Government of Northwest Territories – Department of Infrastructure and Department of Environment and Natural Resources and with input from the Tłıchq Government, North Slave Métis Alliance, Yellowknives Dene First Nation, Wek'èezhì Renewable Resources Board, and Environment and Climate Change Canada. This Final Caribou Habitat Offset Plan includes Appendix D, which is a supplemental framework for implementing this Plan. This Plan will be submitted to the Wek'èezhì Renewable Resources Board as required in Measure 6-3 of the MVEIRB's Report of Environmental Assessment and Reasons for Decision, as modified by responsible ministers.

Please direct any comments or questions to Keenan Rudichuk, R.P.Bio. at rudichukk@ae.ca.

Yours truly,

Sean Sharpe, M.Sc., R.P.Bio.
Project Biologist

Keenan Rudichuk, R.P.Bio.
Project Biologist

Corinna Hoodicoff, M.Sc., R.P.Bio.
Manager, BC/Northern Division

DISCLAIMER

Development of the Final Boreal Caribou (ṯdzı) Habitat Offset Plan for the Ṯchq̱ All-Season Road (ASR) revealed several major uncertainties that may require the Government of Northwest Territories (GNWT) to adapt and modify the Plan as more information and experience are gained through implementation, and may limit the GNWT's ability to achieve the full offset area proposed in the Plan. Uncertainties related to the Plan are as follows:

- This is the first habitat offset plan required for boreal caribou (ṯdzı) in the Northwest Territories (NWT).
- Much of the research on restoration-based offsets for boreal caribou is recent and ongoing, and the effectiveness of restoration treatments applied elsewhere in Canada is only beginning to be evaluated.
- Restoration treatments that have been tested in Alberta and BC have never been attempted in the NWT, and there are important differences in climate and soil conditions (e.g., permafrost) that may affect their feasibility and efficacy.
- Residual effects of the Ṯchq̱ ASR cannot be accurately quantified at this time and the final offset area required for the Ṯchq̱ ASR project will not be known until construction of the road is completed.
- The amount of existing human disturbance within the Wek'èezhì portion of the boreal caribou range where restoration-based offsets might be applied is very limited.
- Not all of the candidate offset areas identified may require restoration, and some of these areas may be ruled out as candidates due to ongoing use for commercial or subsistence activities.
- New technologies, techniques, or approaches to offsetting may emerge as superior options to those initially considered in this Plan, so implementation of the Plan must be flexible enough to allow opportunities for adaptive management.
- Once reclamation of borrow sources is complete and decisions are finalized for which borrow sources will be needed for ongoing maintenance of the Ṯchq̱ ASR, a significant amount of residual effects of the Ṯchq̱ ASR can be reduced from GNWT's commitment for offsetting.
- Implementation is subject to appropriations and budgetary constraints of the GNWT.

Due to these uncertainties, GNWT is proposing to implement this Plan in a phased approach by piloting implementation of different restoration approaches within a subset of the total required offset area. This will be coupled with robust monitoring to determine which habitat restoration treatments are most feasible and effective before scaling them up to the full offset area.

While this Plan may inform the development of future offset plans for development projects in the NWT, where such plans are required, it should not be considered as setting GNWT policy or standards for offset plan requirements in the NWT.

EXECUTIVE SUMMARY

The Tłıchq All-Season Road (Tłıchq ASR) Project is a proposed 97-km all-season road that will connect the community of Whatı to Highway 3, approximately 30 km southwest of Behchokq located in the Wek'èezhı Management Area of the Northwest Territories (the Project). The Project involves building and operating the new road through a portion of the NT1 boreal caribou (tqdzı) range. Boreal caribou (tqdzı) is a species at risk and vital to survival of Indigenous peoples in the area where the Project is proposed. Since the Project was determined to likely cause direct (i.e., the Project footprint) and indirect (e.g., noise, light, vibration, or smell) adverse effects on boreal caribou (tqdzı), the developer, the Government of Northwest Territories - Department of Infrastructure (GNWT-INF), is required to submit a habitat offset plan for boreal (tqdzı) caribou habitat lost because of disturbance from the Project (Measure 6-3; Section 3.2).

The objective of habitat offsets is to compensate for residual effects on boreal caribou (tqdzı), or those effects that remain following the implementation of the mitigation measures proposed for the Tłıchq ASR. Habitat offset plans are based on quantified impacts and make recommendations for measurable goals (e.g., total area to be restored, habitat quality targets following restoration). Habitat offsetting is separate from mitigating for Project effects and is intended to compensate for residual Project effects on caribou, including habitat loss, sensory disturbance, and barriers to movement and habitat fragmentation. Ideally, offset recommendations are quantifiable, although some qualitative measures are sometimes recommended.

This **Final Caribou Habitat Offset Plan** draws on Traditional Knowledge from Tłıchq citizens, scientific experience, case studies from outside of the region, and information shared during consultation with Indigenous groups. Traditionally, offsets are recommended to reduce the anthropogenic effects on a species, specifically in response to direct habitat impacts, usually the footprint of development, and the disturbance effects on physically disturbed adjacent habitat (i.e., zone of influence; ZOI). Offsets for caribou have not generally been applied to ZOIs outside of Project physical footprints, although this Plan proposes some offsets that will account for potential indirect disturbance effects within a 500-m ZOI of the footprint.

In the Wek'èezhı Management Area, 98% of the identified disturbances to boreal caribou (tqdzı) habitat are due to wildfires, and restoring only the relatively few anthropogenic disturbances may not adequately offset for residual effects of the Tłıchq ASR. Therefore, offsets proposed in this Plan focus on restoration of linear features and some areas of boreal caribou (tqdzı) habitat affected by wildfire. By adopting an integrated approach to improve habitat for boreal caribou (tqdzı), this Plan will aim to restore existing habitat for boreal caribou (tqdzı) in the Wek'èezhı Management Area, while including monitoring and adaptive management plans with the goal to ensure that offsetting is effective.

This Final Caribou Habitat Offset Plan proposes three primary offset options with integrated support measures to improve efficacy, provide permanency, and monitor long-term success of offsets.

Offset Options	Offset Support Measures
<ol style="list-style-type: none"> 1. Restoration of existing linear features within the Wek'èezhì Management Area. 2. Restoration of existing polygonal disturbance within the Wek'èezhì Management Area. 3. Reforestation of fire-disturbed areas to accelerate reforestation from natural regeneration timelines. 	<ol style="list-style-type: none"> 1. Effectiveness monitoring incorporated into each Offset Option. 2. Consider enhancement of protected areas as potential offsetting options once all other options are exhausted.

This Final Caribou Habitat Offset Plan provides guidelines towards implementation of the offsets, including steps necessary to develop an Implementation Plan that will require further consultation and collaboration with GNWT-ENR, Tłı̨chq̓ Government, Wek'èezhì Renewable Resource Board, Yellowknives Dene First Nation, and North Slave Métis Alliance. Additional consultation with Environment and Climate Change Canada may also benefit the implementation of this Plan.

An Implementation Plan for this Final Caribou Habitat Offset Plan is required. A framework to develop the Implementation Plan is provided in Appendix D. The Implementation Plan should, at a minimum, include the following activities:

- Identify suitable linear features for restoration. This may require new digitization of candidate linear features that are not already mapped in government datasets and ground-truthing of possible restoration sites. Consultation with affected Indigenous land users will be important to ensure that traditional trails are not blocked or otherwise disturbed by restoration activities. Priority locations for linear feature restoration should first investigate protected areas that have existing linear disturbance to provide permanency of the offset.
- Work with GNWT - Department of Environment and Natural Resources to review and implement the offset actions and monitoring needed to evaluate efficacy of restoration in the proposed candidate areas, including site assessments, or any necessary consultation to finalize an Implementation Plan for restoration of the linear feature and reforestation of burned areas.
- Continue to collaborate with the Tłı̨chq̓ Government and Wek'èezhì Renewable Resource Board, and consult with Environment and Climate Change Canada, North Slave Métis Alliance, Yellowknives Dene First Nation, and any other affected Indigenous organizations during the planning and development of an Implementation Plan.

Ongoing monitoring of caribou response to mitigation and offset measures will provide feedback to inform adaptation of measures to protect caribou. Developing an inventory of candidate linear features suitable for restoration will benefit future projects by reducing costs due to mapping and Indigenous consultation if specific areas can be identified as priorities for restoration. Monitoring of the effectiveness of reforestation to accelerate the recovery of caribou habitat following wildfire will inform efficacy and future use of this approach as an offset over the long term for other projects in NWT.

ACKNOWLEDGEMENTS

The preparation of this Final Caribou Habitat Offset Plan would not have been possible without the coordination and collaboration among key staff members from the Tłıchq Government, Wek'èezhì Renewable Resource Board (WRRB), North Slave Métis Alliance (NSMA), Yellowknives Dene First Nation (YKDFN), Environment and Climate Change Canada (ECCC), Government of Northwest Territories - Department of Environment and Natural Resources (GNWT-ENR), and GNWT - Department of Infrastructure (GNWT-INF). We would also like to recognize the support provided from Damian Panayi, Paula Bentham, Michelle Bacon, and Dan Coulton of Golder Associates Ltd. (Golder). Many individuals from these organizations contributed to the success of the collaboration.

In particular, we recognize Michael Birlea, Georgina Chocolate, Tammy Steinwand, Terrell Knapton-Pain, Tyanna Steinwand, and Albertine Eyakfwo from the Tłıchq Government for their excellent coordination, communication, guidance, and effort in bringing Elders and Harvesters from Whatì and Behchokq together for this Plan. From the WRRB, we thank Jody Pellissey, Laura Meinert, and Aimee Guile for their input into the Plan and their coordination among themselves to ensure the WRRB was involved in every step of the consultation and planning. We thank the staff from the NSMA and YKDFN for making time to attend our workshop in Yellowknife, and we appreciate their input into planning this document. We recognize from GNWT-ENR, James Hodson for his thought-provoking contributions at each workshop and his work to prepare and share information that was invaluable in developing this Plan, and Andrea Patenaude and Rachel Turnquist for their input during the engagement. GNWT-INF was instrumental in helping bring all participants together by helping to coordinate resources and fund travel and food for all three workshops. We also thank the people of Behchokq for welcoming us into their community, preparing delicious meals for our working group, and sharing sensitive information that will benefit the long-term survival of caribou (tòdzi).

Finally, and most importantly, we recognize the following Elders, Harvesters, and translators who took time away from their communities to share their valuable stories with us: Charlie Apples, Michel-Louis Rabesca, Noel Drybones, Harry Rabesca, Leo Williah, Ernest Wedawin, Jimmy P. Mantla (Behchokq) and Jimmy Nitsiza, Francis Simpson, Joe Champlain, Louis Wedawin, Archie Nitsiza, Richard John Williah, Bobby Nitsiza, Jimmy B. Rabesca, Michael Romie (Whatì), Jonas Lafferty, James Rabesca, and Peter Huskey. This Plan was developed using their stories and knowledge of the land as guidance, and their willingness to share Traditional Knowledge helped us to understand some of the greatest concerns to tòdzi, from the people's perspective.

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1 INTRODUCTION

1.1 Project Background

The Tłıchq All-Season Road (Tłıchq ASR) Project is an all-season road that will connect the community of Whatı to Highway 3 (the Project), approximately 30 km southwest of Behchokò located in the Wek'èezhì Management Area of the Northwest Territories. The Project involves building and operating a new 97-km all-season gravel road through a portion of the NT1 boreal caribou (tòdzı) range. Boreal caribou (tòdzı) is a species at risk and vital to survival of Indigenous peoples in the area where the Project is proposed. The Project was assessed as likely to cause direct and indirect adverse effects on boreal caribou (tòdzı) (MVEIRB 2018a).

The Government of Northwest Territories - Department of Infrastructure (GNWT-INF), in partnership with the Tłıchq Government, has advanced permitting of the Tłıchq ASR through the Wek'èezhì Land and Water Board (WLWB) and Mackenzie Valley Environmental Impact Review Board (MVEIRB; EA1617-01). The MVEIRB issued its Report of Environmental Assessment and Reasons for Decision (REA) (MVEIRB 2018a), which recommends that the Project be approved subject to the measures outlined in the REA. The responsible ministers issued their decision on the environmental assessment to adopt the MVEIRB's recommendations with modifications (MVEIRB 2018b), allowing GNWT-INF to proceed with the permitting process to obtain a Water Licence and Land Use Permit from the WLWB.

In the REA, the MVEIRB recommends that GNWT-INF use a regional approach in determining effects on boreal caribou (tòdzı) (MVEIRB 2018a). The Recovery Strategy for the Boreal Caribou in the NWT also indicates that a regional approach is appropriate (CMA 2017). The Tłıchq Government, Wek'èezhì Renewable Resource Board (WRRB), and Government of Northwest Territories - Department of Environment and Natural Resources (GNWT-ENR) (i.e., the Collaborators Working Group) recommends that offsetting occur in the Wek'èezhì Management Area; therefore, offsetting for the Tłıchq ASR is focused predominantly in the Wek'èezhì administrative region for boreal caribou (tòdzı).

The MVEIRB requires a plan to offset any loss of effective boreal caribou (tòdzı) habitat caused by building and operating the Tłıchq ASR. Specifically, Measure 6-3 of the REA requires GNWT-INF (the developer) to submit a Final Habitat Offset Plan for boreal caribou (tòdzı) habitat lost because of disturbance from the Project (Section 3.2). The measure states:

The developer, with the involvement of GNWT-ENR, will prepare and implement a habitat offset plan. This plan will describe how the required habitat offset area will be determined and how it will be achieved. In preparing the plan, the developer will collaborate with Tłıchq Government and the Wek'èezhì Renewable Resources Board, and consult with the following participants to this environmental assessment:

- *Environment and Climate Change Canada;*
- *Yellowknives Dene First Nation; and*
- *North Slave Métis Alliance.*

This document is the **Final Boreal Caribou (tòdzı) Habitat Offset Plan** (the Final Habitat Offset Plan) for the WRRB, which the developer (GNWT-INF) is required to submit to the WRRB for review, under section 12.5.1 of the Tłıchq Agreement, no later than 90 days prior to public use of the Tłıchq ASR. The Tłıchq ASR is under construction and substantial completion is anticipated in November 2021.

This Final Habitat Offset Plan draws on Traditional Knowledge from Tłıchq citizens, scientific experience, and case studies¹ from outside of the region. GNWT intends to develop caribou offset guidance for the Territory, and components of this Final Habitat Offset Plan will be useful as an offsetting guide for other projects in NWT with similar constraints to the Tłıchq ASR, such as access to land available for offsetting, identifying suitable locations available for offsetting, or selecting offsetting options that are economically feasible.

1.2 Implementation Plan

This Final Habitat Offset Plan will require the development of an Implementation Plan before physical work can begin to restore boreal caribou (tqdzı) habitat. The Final Habitat Offset Plan focuses on restoring linear corridors as an offset measure, and through the development of the Final Habitat Offset Plan it is clear that linear corridors provide an important service (e.g., for hunting, travel, harvesting) to Indigenous people in the region. The Implementation Plan will be an extension of this Final Habitat Offset Plan and will use the Traditional Knowledge shared to prepare this plan and will identify further Indigenous collaboration that will be required to help identify specific linear corridors to focus offset measures on. The Implementation Plan will require a staged approach because some aspects of offsetting in NWT are unknown. Uncertainties related to implementing this Final Habitat Offset Plan include the following:

- This is the first habitat offset plan required for boreal caribou (tqdzı) in the NWT.
- Much of the research on restoration-based offsets for boreal caribou is recent and ongoing, and the effectiveness of restoration treatments applied elsewhere in Canada is only beginning to be evaluated.
- Restoration treatments that have been tested in Alberta and BC have never been attempted in the NWT, and there are important differences in climate and soil conditions (e.g., permafrost) that may affect their feasibility and efficacy.
- The final offset area required for the Tłıchq ASR project will not be known until construction of the road is completed.
- The amount of existing human disturbance within the Wek'èezhıı portion of the boreal caribou range where restoration-based offsets might be applied is very limited.
- Not all of the candidate offset areas identified may require restoration, and some of these areas may be ruled out as candidates due to ongoing use for commercial or subsistence activities.
- New technologies, techniques, or approaches to offsetting may emerge as superior options to those initially considered in this Plan, so implementation of the Plan must be flexible enough to allow opportunities for adaptive management.
- Once reclamation of borrow sources is complete and decisions are finalized for which borrow sources will be needed for ongoing maintenance of the Tłıchq ASR, a significant amount residual effects of the Tłıchq ASR can be reduced from GNWT's commitment for offsetting.
- Implementation is subject to appropriations and budgetary constraints of the GNWT.

Due to these uncertainties, GNWT is proposing to implement the Final Habitat Offset Plan in a phased approach by piloting implementation of different restoration approaches within a subset of the total required offset area. This will be coupled with robust monitoring to determine which habitat restoration treatments are most feasible and effective before scaling them up to the full offset area.

¹ A list of Traditional Knowledge and how it was incorporated is provided in Appendix A and documents reviewed for the Final Habitat Offset Plan is provided in Appendix B and the list of References at the end of this document.

While this Final Habitat Offset Plan may inform the development of future offset plans for development projects in the NWT, where such plans are required, this Plan should not be considered as setting GNWT policy or standards for offset plan requirements in the NWT.

Because some options have not been tested in NWT (e.g., reforestation) and not all offsetting will occur immediately, the Implementation Plan will focus on:

- where (i.e., which linear corridors or burned areas specifically) the offsetting work should be completed;
- the procurement process and decision criteria for who will implement the offsetting work;
- the development of a site-specific restoration treatment plan (e.g., mounding with seedling planting) to confirm habitat offset amount, budget, and schedule; and
- an effectiveness monitoring and adaptive management plan to monitor the success of the offsetting work.

Appendix D is a framework that provides guidance for developing the Implementation Plan. Appendix D identifies the purpose and goals of the Implementation Plan, proposed timelines to complete important milestones, challenges related to implementing habitat offsetting in NWT (e.g., logistical considerations, selecting candidate restoration areas and refining to final restoration areas), next steps to develop the Implementation Plan, and an example outline of an implementation plan that could be used as a template for the Tłıchq ASR.

1.3 Project Description

The Project will be a 97-km gravel road that connects Whatı to Highway 3, approximately 30 km southwest of Behchokq (Figure 1-1). The road will start at kilometre 196 on Highway 3 and extend to the Community Government of Whatı boundary, following a winter road alignment (i.e., the Old Airport Road). Approximately 17 km (18%) of the alignment is located on Tłıchq lands, and the remaining 77 km (82%) of the route is located on territorial lands.

The new two-lane gravel road (8.5 m road surface) consists of a maximum 60 m right-of-way (ROW; including the 8.5 m road surface) and includes 12 culverts and four bridges at major crossings (i.e., Duport River, an unnamed tributary, James River, and La Martre River). In addition, up to nine borrow source locations have been identified to provide appropriate fill for the road construction (NSI 2019a); to date, the final as-built design of the road and borrow sources is unknown. The Zone of Influence² (ZOI) is the area extending 500 m beyond the direct footprint of the Tłıchq ASR (e.g., the road surface and ROW) in which caribou may experience indirect effects (e.g., loss of habitat suitability due to noise disturbance³, increased mortality due to increased line-of-sight for predators) (Environment Canada 2011).

A figure inset in Figure 1-1 illustrates the conceptual Project description for the Tłıchq ASR. The following direct and indirect effects of the Tłıchq ASR on boreal caribou (tqdzı) were identified (Golder 2017):

- Site preparation, construction, and operation activities can result in the loss or alteration of vegetation and topography that may change habitat availability, use, and connectivity and influence wildlife abundance and distribution.

² The ZOI is a 500 m conceptual buffer on the road surface and ROW. Habitat within the ZOI will not be physically disturbed; however, the sensory disturbance originating from the construction and operation of the Tłıchq ASR may result in reduced habitat use within the ZOI.

³ Noise disturbance is usually considered an indirect impact as it affects wildlife differently and is a gradient decreasing with the log of distance during a traffic event.

- Sensory disturbance (e.g., noise, light, vibration, or smell) can change wildlife habitat availability, use, and connectivity (e.g., movement and behaviour), which can lead to changes in wildlife abundance and distribution.
- Increase in public access can affect wildlife survival and reproduction through vehicle strikes and/or legal and illegal hunting.

The Tłı̄chq̄ ASR (Figure 1-1) will have a direct physical disturbance on habitats used by boreal caribou (t̄q̄dzı). The road surface and ROW will be permanent changes to the environment. Borrow sources will be restored following construction, and restoration of borrow sources will need to be enhanced from permit requirements that are currently insufficient to reduce residual effects of the Project.

The ROW is a 60-m wide corridor that includes the road surface. The ROW (not including the road surface) will likely be revegetated following construction, but it is unlikely it will return to the same habitat as it was pre-disturbance. It is assumed that the ROW will be regularly brushed or mowed, providing limited habitat value for boreal caribou (t̄q̄dzı); therefore, the cleared ROW is treated as permanent habitat loss in this Final Habitat Offset Plan.

The 500-m ZOI is an approximation of the spatial extent of the effects of linear features on boreal caribou (t̄q̄dzı). The ZOI is a 500-m buffer applied outside of the area of physical disturbance (i.e., the ROW) and will remain in the condition that currently exists (i.e., no direct disturbance of habitat is expected). Effects such as avoidance due to sensory disturbance may occur within this area, with this effect decreasing away from the road towards the outer margins. The level of projected road use is considered relatively low in intensity and, including the 500-m ZOI for offsetting, is considered a conservative management approach (Golder 2017).

The Old Airport Road is an existing cleared area of road and, because it is currently used by vehicles and wildlife, including predators (Golder 2019), the Old Airport Road has an existing 500-m ZOI. Areas where the Old Airport Road and the Tłı̄chq̄ ASR overlap (including their ZOIs) are removed from the calculation of residual effects because it is understood that those effects are already existing on the landscape at baseline. The principle of conducting offsets using linear features is to restore existing corridors by reducing use by predators and people. This project is unique as it included ZOIs for calculation of offsets; therefore, it is appropriate to remove the 500-m buffer in the accounting once restoration is complete.

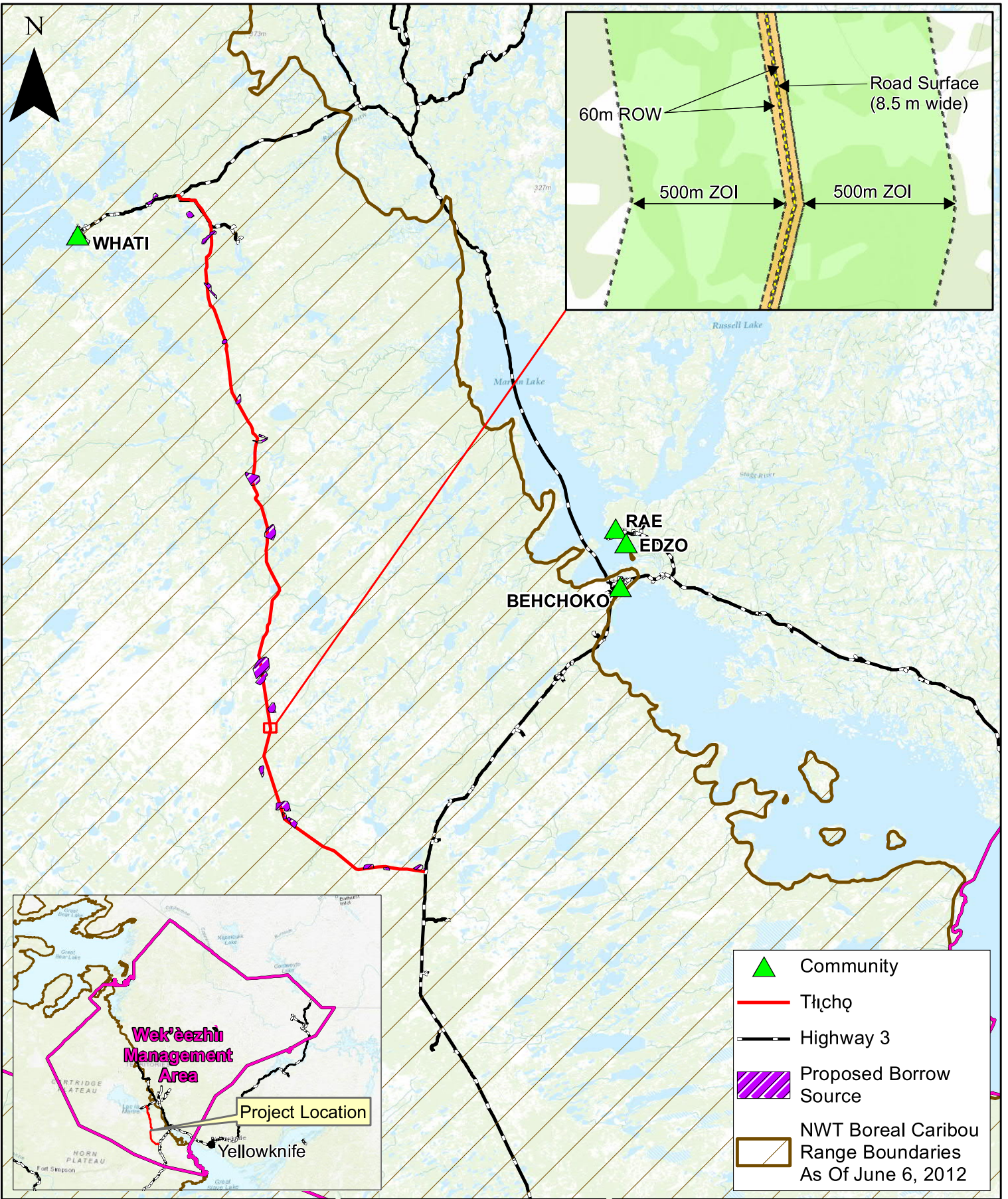


Figure 1 NWT.mxd / 7/11/2019 / 3:30:45 PM

- ▲ Community
- Tłı̄chǫ
- Highway 3
- Proposed Borrow Source
- NWT Boreal Caribou Range Boundaries As Of June 6, 2012



PROJECT NO.: 2018-2330.010.000
 DATE: July 2019
 DRAWN BY: DA

0 5 10
 Kilometers

FIGURE 1-1: PROJECT LOCATION

Government of Northwest Territories
 Department of Infrastructure

Tłı̄chǫ All-Season Road

1.3 Offset Planning

The objective of the **Final Habitat Offset Plan** is to compensate for residual effects of the Tłıchq ASR on boreal caribou (tòdzı) habitat, and related effects on boreal caribou (tòdzı) that remain following the implementation of the mitigation measures outlined in the approved Wildlife Management and Monitoring Plan (WMMP) (GNWT 2019) for the Tłıchq ASR. Offsetting is the last step of the mitigation hierarchy and for the Tłıchq ASR, mitigation measures to reduce potential adverse effects on boreal caribou include, but are not limited to:

- **avoiding** unnecessary Project footprint by following an existing trail alignment (i.e., the Old Airport Road) where possible;
- **minimizing impacts by minimal** clearing in the ROW, reducing sensory disturbance during construction, enforcing speed limits on the road etc.; and
- **restoring** temporary disturbance and borrow sources created during construction.

Once all mitigation and construction restoration are completed, residual effects may still exist that affect boreal caribou. **Residual effects** of the Tłıchq ASR include (Golder 2017):

- Changes in **habitat availability** and potential changes in habitat use (e.g., avoidance due to sensory disturbance);
- Changes in **habitat distribution**, including the effects on wildlife movement and habitat connectivity (e.g., habitat patches and barriers to movement); and
- Changes in **survival and reproduction**.

Residual effects can be offset by undertaking additional conservation actions with the objectives of achieving ‘no net loss’ or ‘net positive impact’ (Figure 1-2, Poulton 2014). ‘No net loss’ refers to the end condition of available habitat following application of all mitigations, including offsetting, where the goal is to “prescribe no significant disturbance without an acceptable equivalent of offset being arranged” (Poulton 2014). ‘Net positive impact’ is a scenario where more habitat is restored both on and off site than was initially disturbed due to the project. Habitat offset plans typically use offset multipliers, or offset ratios between damaged (residual effects) and compensated amounts (restoration areas) to manage the risks associated with variable effectiveness, time lags, and uncertainty, to ultimately achieve a goal of ‘no net loss’ or a ‘net positive impact’ to habitat. For example, for 1 unit of habitat disturbed, the offset may need to be 2-4 times greater if offsetting is anticipated to be ½ to ¼ as effective. This Final Habitat Offset Plan for the Tłıchq ASR will aim to achieve ‘no net loss’ for boreal caribou (tòdzı).

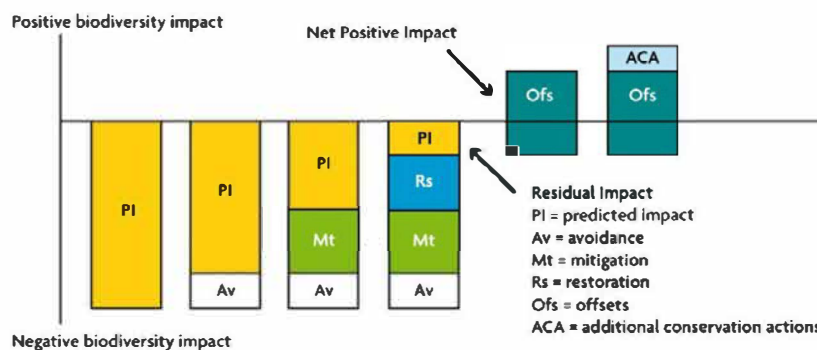


Figure 1-2
 Mitigation Hierarchy and Offsets (borrowed from Poulton 2014)

Habitat Offsetting

“**Measurable** conservation outcomes resulting from actions designed to **compensate** for significant residual adverse... impacts arising from a project **after appropriate prevention and mitigation measures have been taken.**”

-*Business and Biodiversity Offsets Programme* (IUCN 2014)

Habitat offset plans make recommendations for clearly defined, measurable goals to compensate for quantified effects (e.g., habitat area disturbed). Examples of measurable goals include quantifying the amount of habitat area restored and determining the value of habitat quality improved off site. In this case, offsetting may include any activity that might compensate for a new disturbance (e.g., a new project) by restoring habitat within existing disturbance (i.e., disturbance present before the residual effects of a project may occur). Restoration of human-caused disturbance located off site such

as old roads or trails is a common off-setting practice in other jurisdictions; however, in the case of the Tłıchq ASR, potential limitations in the amount of human disturbance in the region eligible for restoration available has led to the consideration of restoration in areas of disturbance caused by wildfire. Direct habitat offsets are usually the preferred approach for offsetting, as one can quantitatively measure the amount of habitat that is restored such as hectares of land restored to support caribou.

Woodland caribou offset plans in Canada have focused primarily on the application of restoration measures to existing linear disturbances in areas with high levels of disturbance within the same caribou range as the project impact. Offsetting for caribou is relatively new, and because of this few studies have documented the results of follow-up monitoring. Information used in this Final Habitat Offset Plan is based on those projects where offsetting results are available, and where positive effects from offsetting have been observed (e.g., where a reduction of predator movement efficiency has been observed following the installation of visual and physical movement barriers). Specific examples of projects in western Canada that have focused the implementation of offset programs on habitat restoration of previously disturbed anthropogenic disturbance include (but are not limited to)⁴:

- NOVA Gas Transmission Ltd. (NGTL) Final Caribou Habitat Restoration Plan for the Leismer to Kettle River Crossover Project (NGTL 2014).
- Caribou Habitat Restoration and Offset Measures Monitoring Program – Leismer to Kettle River Crossover (NGTL 2015).
- North Montney Mainline Project Preliminary Caribou Habitat Offset Measures Plan (NGTL 2019).
- Smoky River Lateral Loop Final Caribou Habitat Restoration and Offset Measures Plan (NGTL 2020b).
- Cenovus LiDea Project (Cody 2017).

The hypothesized benefits of restoration are to expedite vegetation recovery, reduce human access to improve long-term vegetation recovery, and reduce predator movement efficiency. In the Wek'èezhì Management Area, few linear features have been mapped in the vicinity of the proposed Project area, and some of these are not suitable for restoration due to Traditional Use and other Indigenous values precluding their restoration. During the development of this Final Habitat Offset Plan, existing linear and polygonal disturbance has been mapped within 10 km of the Tłıchq ASR and Highway 3. Although extensive mapping has been completed to date, high resolution satellite imagery shows more disturbance that has not been mapped (Section 5.2).

Through the consultation process (Section 4), Indigenous participants identified wildfire as being particularly disruptive to boreal caribou (tqdzı). As a result, a secondary priority for offsetting (identified during the draft Offset Plan development) is reforestation of burned habitat to accelerate habitat recovery, thereby providing increased security

⁴ Complete references to each document available in the Reference section of this report

cover for caribou and reduced predator movement efficiency more quickly than would be observed if natural regeneration was to occur.

In addition to direct habitat offsets, other qualitative measures may need to be considered to support habitat offsets for boreal caribou (t̄qdzı). For example, habitat areas may be established as conservation areas, research can be completed to help address knowledge gaps, and other wildlife species populations can be managed (Section 3.3.4). This Final Habitat Offset Plan proposes novel approaches to habitat offsetting because offsetting has not occurred in NWT and some treatments have not been tested, and due to the relatively undisturbed boreal caribou (t̄qdzı) habitat in the Wek'èezhìi Management Area, and relatively few (in comparison to other jurisdictions) legacy linear features available for restoring as offsets in the Wek'èezhìi Management Area.

2 BOREAL CARIBOU (TQDZI) IN NWT

Boreal caribou (tqdzı; *Rangifer tarandus caribou*) in NWT are considered a distinct population that is differentiated from barren ground caribou and northern mountain caribou by their large body size, large antlers, seasonal behaviour, and habitat preference. Boreal caribou (tqdzı) in NWT do not migrate as barren ground and northern mountain caribou do and are found primarily in forested environments east of the Mackenzie Mountains (CMA 2017).

The Tłı̄chų ASR is proposed within habitat occupied by boreal caribou (tqdzı), which is listed as Threatened under Schedule 1 of the federal *Species at Risk Act* (SARA) and the NWT *Species at Risk Act* (NWT SARA). They are naturally found at low densities (individuals or small groups) and are considered one continuous population in NWT (Environment Canada 2012). Boreal caribou (tqdzı) require large, undisturbed tracts of boreal forest with abundant lichens. They are non-migratory and therefore sensitive to habitat degradation, including habitat loss and fragmentation from forest fires and human land use (Gagos 2019). Density of linear features (e.g., roads or trails) is a key concern to the long-term survival of caribou in Canada, because linear features improve predator hunting success, improve hunter access, and fragment habitat where linear features occur at high densities (Environment Canada 2012).

Forage abundance/availability and predator avoidance are driving factors that determine habitat selection by boreal caribou (tqdzı). Areas forested with jack pine (*Pinus banksiana*), black spruce (*Picea mariana*), lichen (*Cladina* spp.), and muskeg/peatland matrices connected to drier upland ecosystems provide suitable habitat for living, growing, and security. Pregnant female boreal caribou (tqdzı) select relatively isolated, low-density predator habitats where food is abundant for calving (Environment Canada 2012, Gagos 2019). The federal Recovery Strategy for the Boreal Caribou describes disturbed habitat as areas that have burned within the past 40 years and areas that are within 500 m of human disturbance footprints (e.g., roads, seismic lines, cutblocks) visible on 1:50,000 scale Landsat imagery (Environment Canada 2011, CMA 2017). In contrast, a recent Resource Selection Function (RSF) model developed by GNWT-ENR demonstrated that boreal caribou (tqdzı) select some recent burns more than random choice during some seasons, suggesting that habitat selection by boreal caribou (tqdzı) happens on a finer scale than simply burned versus non-burned areas (DeMars et al. 2020). As such, this Final Habitat Offset Plan relies on results of the RSF model to determine relative habitat importance (based on selected versus non-selected habitat) to boreal caribou (tqdzı). It is hypothesized that this may reflect the intensity of burns and actual patterns of retention and regeneration of new vegetation, as well as established caribou behaviour patterns in using specific areas.

The range of boreal caribou (tqdzı) in NWT (named the NT1 population) is extensive and continuous throughout the forested region of NWT (CMA 2017). The range of the NT1 population had greater than 65% undisturbed habitat in 2012, which is the established threshold for providing conditions for “likely self-sustaining” populations. “Likely self-sustaining” is based on a determination that the population, on average, “demonstrates stable or positive population growth over the short-term (≤ 20 years) and is large enough to withstand stochastic events and persist over the long term (≥ 50 years), without the need for ongoing active management intervention” (Environment Canada 2012). However, more recent evaluations indicate that habitat disturbance is increasing, and caribou numbers are reported to be declining in the southern NT1 range (Environment Canada 2012, GNWT-ENR 2018). Regional range plans to maintain at least 65% undisturbed range within the NT1 are in development, including a Wek’èezhìi Range Plan, and restoration measures identified will be consistent with measures recommended in this Final Habitat Offset Plan for the Tłı̄chų ASR.

The Wek’èezhìi Management Area is a relatively intact region of NWT, considering the limited amount of existing human disturbance, particularly linear disturbance features. Habitat change for boreal caribou (tqdzı) in the Wek’èezhìi

Management Area is predominantly caused by wildfire (Environment Canada 2012, Gagos 2019). The portion of the NT1 range that is within the Wek'èezhì Management Area is approximately 4,950,506 ha (pers comm GNWT 2020). Based on Environment and Climate Change Canada (ECCC) definitions of disturbed and undisturbed habitat, 65.9% of the Wek'èezhì Management Area provides undisturbed habitat for boreal caribou (tòdzì) as of fall 2017 (GNWT-ENR 2018, CMA 2017). Fire disturbance accounts for the largest area of disturbance, amounting to approximately 1,668,320 ha, and anthropogenic disturbance amounts to approximately 39,711 ha (33.7% and 0.8%, respectively). The Adequacy Statement Response submitted for the Project estimates that the Project will affect 0.1% of undisturbed habitat (i.e., habitat not recently affected by wildfire) in the Wek'èezhì Management Area (Golder 2017).

The proposed two-lane gravel Tłjchq ASR may be considered a relatively low impact road (i.e., projected use of 20 to 40 vehicles per day and speed limits of 70 km/hr) compared to other highway corridors, is anticipated to have minimal disturbance to boreal caribou (tòdzì), and is not expected to be a barrier to caribou movement (GNWT-INF 2016).

Table 2-1 presents the potential effects of the Project on boreal caribou (tòdzì) and their relationship to the residual effects of the Project as identified in the Adequacy Statement Response submitted for the Project (Golder 2017).

Table 2-1
Potential Project Effects and Their Relationship to Residual Effects

Project Effect	Residual Effects		
	Habitat Availability	Habitat Distribution	Survival and Reproduction
Direct habitat loss including the road and right-of-way footprint	●	●	●
Sensory disturbance and behavioural impacts such as avoidance of habitats near the Tłjchq ASR by caribou	●	●	●
Barriers to movement and habitat fragmentation	●	●	●
Increased hunting pressure due to increased access			●

Notes: Habitat Availability, Habitat Distribution, and Survival and Reproduction are the residual effects of the Project (Golder 2017).

3 SCOPE OF THE PLAN

3.1 Goals and Objectives

The **goal** of the Final Habitat Offset Plan is to articulate a collaboratively developed approach to compensate for the residual impacts of the Tłıchq ASR that ultimately restores, improves, or protects effective, functional caribou habitat and meets the final terms of Measure 6-3 (see below; MVEIRB 2018b). The **objectives** of the Plan are to: a) identify specific offset measures, b) identify total areas required for offsetting, and identify key limitations so that when the offsetting is ultimately implemented it will provide the highest likelihood of success and is supported by all participants in the development of the Plan.

3.2 Measure 6-3

The following final approved wording for Measure 6-3, as prepared by the MVEIRB and modified by responsible ministers, is the scope of work for the Final Habitat Offset Plan (MVEIRB 2018b):

The developer will offset effective boreal caribou (tɔdzı) habitat lost because of disturbance from the Project. The developer, with the involvement of GNWT-ENR, will prepare and implement a habitat offset plan. This plan will describe how the required habitat offset area will be determined and how it will be achieved.

In preparing the plan, the developer will collaborate with Tłıchq Government and the Wek'èezhì Renewable Resources Board, and consult with the following participants to this environmental assessment:

- Environment and Climate Change Canada;
- Yellowknives Dene First Nation; and,
- North Slave Métis Alliance.

The developer will make funding available to the parties to support this consultation and collaboration.

The developer will submit a draft and a final plan as described below. Once approved, the developer will operate in accordance with the plan.

The developer will submit a draft plan to the Wek'èezhì Renewable Resources Board a minimum of 30 days prior to commencement of construction. The developer will submit the final habitat offset plan to the Wek'èezhì Renewable Resources Board for review under section 12.5.1 of the Tłıchq Agreement, as soon as possible, and no later than 90 days prior to public use of the road. This final plan will include, at a minimum the elements below (Table 3-1, taken from Measure 6-3). We have included in Table 3-1 our assumptions made for this document.

Table 3-1
Requirements for the Final Habitat Offset Plan

Measure 6-3 Requirement ¹	Habitat Offset Plan Response
The goals and objectives of the plan	Section 3.1
A discussion on the expected effectiveness of mitigations and offsets	Section 6 The Final Habitat Offset Plan recognizes that some uncertainty lies in the proposed offsets. Uncertainty is reduced by applying offset ratios to restore more habitat than will be disturbed by the Project. Detailed planning and development of an evidence-based Implementation Plan will reduce the uncertainty.
A decision framework to prioritize restoration areas, mitigations, and offsets, including references to the research on which the decision framework was based	Sections 5.4 and 5.5
A discussion of how any proposed mitigations or offsets align with the Recovery Strategy for the Boreal Caribou in the NWT and range plans	Sections 1.3 and 3.3
Details of proposed ways to offset habitat disturbance including restoration sites, mitigation measures, offsets, forest firefighting policies, or habitat management approaches	Sections 5 and 6
A description of the spatial scale of the proposed offset, the habitat quality and type, site-specific restoration activities, and any challenges	Section 5.2 and Appendix D
A timeline for offsetting	Sections 5.5 and 6, and Appendix D The Final Habitat Offset Plan recognizes that more detailed timelines will become clearer once an Implementation Plan is developed. Appendix D provides timelines to complete critical path activities.
A quantitative and qualitative assessment of the total area of boreal caribou habitat proposed for restoration and the timeframe required for restoration	Sections 5.1, 5.2, 5.4, and 6
A summary of consultation feedback that was integrated into the draft and final plans	Section 4 and Appendices A, B, C and D. The Final Habitat Offset Plan was largely driven by the consultation process. Details are incorporated throughout the Plan.
A description of any Traditional Knowledge that was considered in the development of the plan, and how it was incorporated	Section 3.3 and Appendices A and C. Traditional Knowledge and comments, our responses, and how the information was

Measure 6-3 Requirement ¹	Habitat Offset Plan Response
A description of any resources provided to Indigenous groups to support their involvement in the drafting of the final plan, and for any involvement in the implementation of the plan	incorporated into the Final Habitat Offset Plan is presented. Appendices B and C

¹ Requirements taken directly from Measure 6-3 Final Wording (MVEIRB 2018b).

3.3 Methods

The Final Habitat Offset Plan follows a Draft Boreal Caribou (ṯɔdzı) Habitat Offset Plan (the “Draft Plan”) that was developed following consultation with the Wek’èezhì Renewable Resources Board, Indigenous, territorial, and federal governments. The Draft Plan was largely conceptual, and residual effects of the Ṯıchq̱ ASR were not well understood, as boreal caribou habitat mapping, existing disturbance mapping, and predator use information were not available. In addition, there was no established framework for offsetting boreal caribou (ṯɔdzı) habitat in NWT that could be used for guidance. Work completed since the Draft Plan has helped to better understand the residual effects of the Ṯıchq̱ ASR on boreal caribou (ṯɔdzı), and to establish the approach to habitat offsetting for the Project. Consultation has continued since the Draft Plan, and all comments on the Final Habitat Offset Plan that were not editorial in nature were discussed with the Indigenous or government organization to ensure the comments were being correctly interpreted. Concordance tables that document those comments and the response are provided in Appendix C.

The methods followed to develop this Final Habitat Offset Plan were:

1. **Collaborate and consult** (during the draft planning phase of this Final Habitat Offset Plan) with governments, resource managers, Elders, Harvesters, and community members to determine scope and approach for habitat offsetting (Section 3.3.1);
2. **Quantify residual effects** so that offset targets can be developed (Section 3.3.2);
3. **Determine offset options** to identify the most effective offsetting options for boreal caribou in relation to the Ṯıchq̱ ASR (Section 3.3.3); and
4. **Refine the approach** so that decisions reflect the best course of action using the best available information (Section 3.3.4).

3.3.1 Collaborate and Consult

Consistent with provisions in Measure 6-3, the GNWT-INF and GNWT-ENR have closely collaborated with the Ṯıchq̱ Government and Wek’èezhì Renewable Resources Board as the **Collaborators Working Group** to establish the scope and approach of the Final Habitat Offset Plan.

In addition, the GNWT-INF (as the developer) is required to consult with ECCC, Yellowknives Dene First Nation (YKDFN), and North Slave Métis Alliance (NSMA) (collectively with the Collaborators Working Group, “the **Participants**”). The collaboration and consultation helped to prioritize offsetting options and identified general locations to address residual effects of the Ṯıchq̱ ASR (Section 4).

The Collaborators Working Group began with a meeting to understand the best approach to engage all Participants in the process. The initial collaboration was held during a 1-day workshop in Yellowknife (Workshop #1) and an

engagement process with all Participants was developed, roles and responsibilities were identified, and a tentative schedule was set for future workshops and deliverables (e.g., draft report delivery and information responses).

At the conclusion of the first workshop, the Collaborators Working Group determined that the following process would be an appropriate engagement strategy for all Participants:

- Complete a focused background review of existing information;
- Hold a 2-day workshop with Elders and Harvesters from Whatì and Behchokq (Workshop #2);
- Compile the information and prepare for a third workshop (Workshop #3);
- Reconcile all of the information gathered, deliver-and-revise a Draft Plan; and
- Continue consultation and data gathering and prepare the Final Habitat Offset Plan (this document).

Section 4 describes the feedback gathered from the Indigenous consultation and how Traditional Knowledge was incorporated into the Plan.

3.3.2 Quantify Residual Effects

Measure 6-3 requires a description of the spatial scale of the proposed offset, the habitat quality and type, the site-specific restoration activities, and any challenges associated with the offset. To meet these criteria, the following approach was followed:

1. Map existing disturbance within the ZOI.
2. Determine habitat value for boreal caribou (tòdzì).
3. Verify existing human and predator activity along the Old Airport Road.
4. Quantify residual effects of the Tłı̨chq ASR.
5. Apply offset ratios and finalize Habitat Balance Table.

1 - Map existing disturbance within the ZOI

Following ECCC's description of effects of linear disturbance on caribou, potential effects of sensory disturbance (e.g., noise, light, vibration or odour) and increased predation that may occur within 500 m of the Project, this distance is therefore considered the Project ZOI (Environment Canada 2012). A 500-m ZOI has been included in the calculations of potential residual effects of the Tłı̨chq ASR, although no direct, physical habitat loss is anticipated in this zone.

Existing disturbances such as linear features (e.g., the Old Airport Road) and polygonal features (e.g., existing borrow sources) occur along the entire length of the Tłı̨chq ASR corridor. Disturbance was mapped along the Tłı̨chq ASR corridor within the 500-m ZOI to gain an understanding of the degree of pre-existing disturbance within the Tłı̨chq ASR ZOI (RIC 1998). Existing linear and polygon features were mapped at a scale of 1:5,000 using high resolution satellite imagery and ESRI ArcMap 10.6.1 software. The direct physical footprint of existing disturbance that occurs within the Tłı̨chq ASR was then removed from the total area calculation of the Tłı̨chq ASR new disturbance (see Step 4 below).

2 - Determine habitat value for boreal caribou (tòdzì)

Determining habitat value for boreal caribou (tòdzì) that would be affected by the Tłı̨chq ASR was an important step in quantifying the residual effects of the Project. Habitat value for boreal caribou (tòdzì) was modelled throughout the Wek'èezhì Resource Area using the RSF model that was developed by GNWT-ENR (DeMars et al. 2020). The RSF model was generated by correlating 'all-year' satellite collar data to EOSD⁵ landcover classification to determine

⁵ Earth Observation for Sustainable Development.

relative habitat preference by boreal caribou. The model considered fire age classes in different EOSD landcover classes and the influence of the density and distance to human disturbance features. The model assumed that relative habitat preference is based on duration of occupancy (i.e., the RSF model assumes that if boreal caribou spend more time in a certain habitat type, then that habitat provides more value to caribou than habitats they spend less time in). Habitat preference was ranked from 1 to 10, with classes 7-10 representing habitats that were consistently selected by boreal caribou (t̄qdzı) for use (DeMars et al. 2020).

The RSF model was used in this Final Habitat Offset Plan to represent overall habitat value, assuming that habitat classes that ranked 7-10 represent habitat preferred by caribou (i.e., selected), and habitat classes ranked 1-6 represent habitat not preferred by caribou (i.e., not selected).

3 - Verify existing human access and predator activity along the Old Airport Road

The T̄jch̄q ASR was designed to reduce impacts on caribou by minimizing the amount of new linear disturbance by intersecting the existing Old Airport Road route. Following a similar approach to other projects that affect caribou, the existing Old Airport Road was considered as existing disturbance with an existing ZOI at baseline conditions (Northern Resource Analyst 2014). To verify the baseline conditions, a review of images captured from wildlife game cameras was conducted to confirm that the existing Old Airport Road was being used by humans and wildlife as a travel corridor. Images reviewed show vehicles (e.g., ATVs and trucks) and predators (e.g., wolverine, gray wolf, and black bear) traveling along the Old Airport Road before land was cleared for the T̄jch̄q ASR ROW, confirming the road's existing use (Golder 2019). Caribou were also identified as using the existing road (Golder 2019). Offsets are applied to new project disturbance remaining after mitigation and on-site reclamation. Existing disturbance such as the Old Airport Road (where it does not overlap with the T̄jch̄q ASR ROW) is considered as a candidate area for off-site restoration that could be credited towards the required offset.

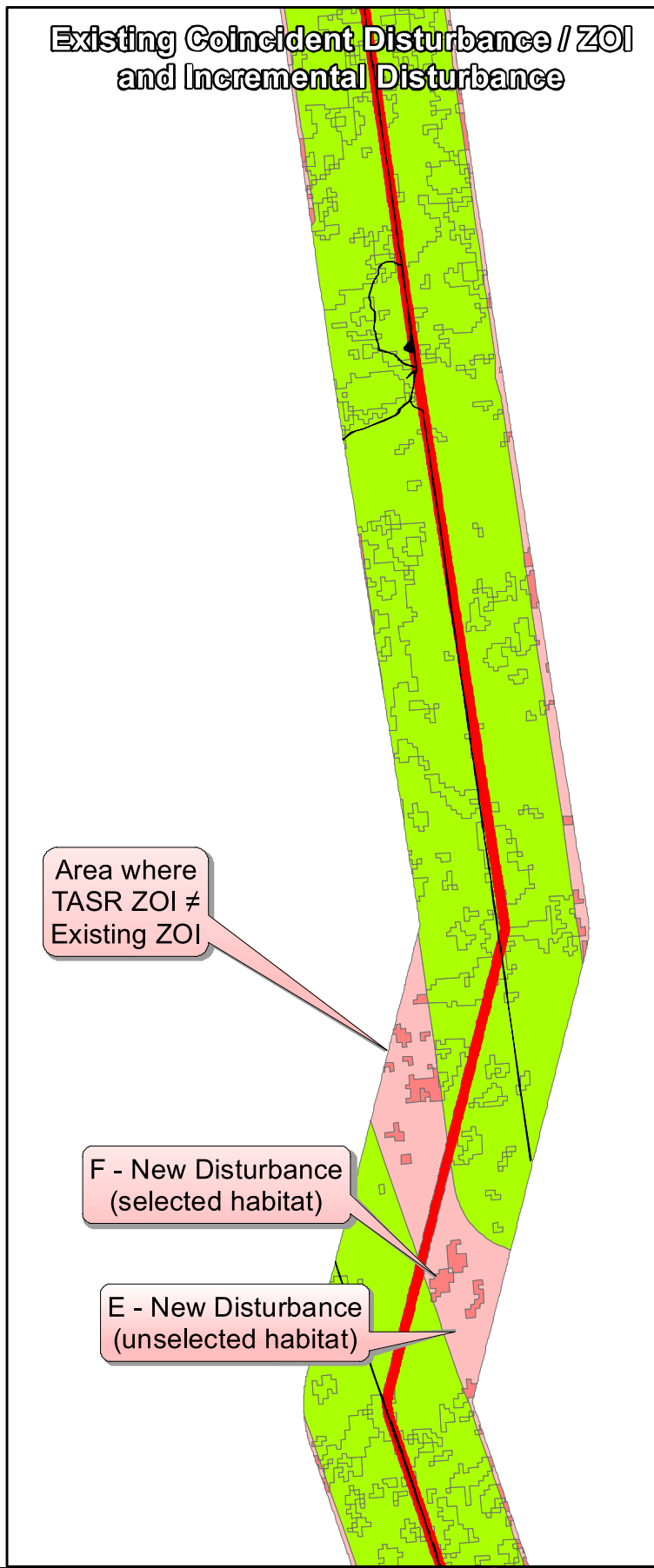
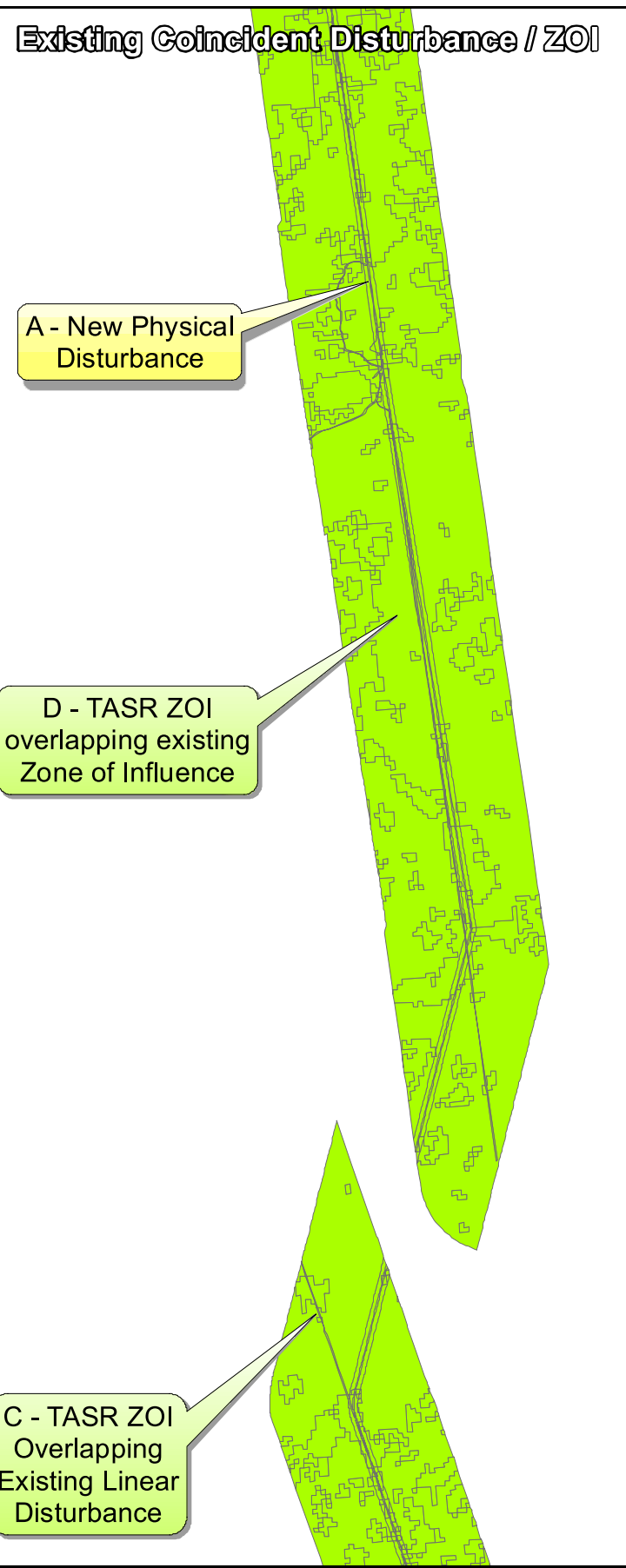
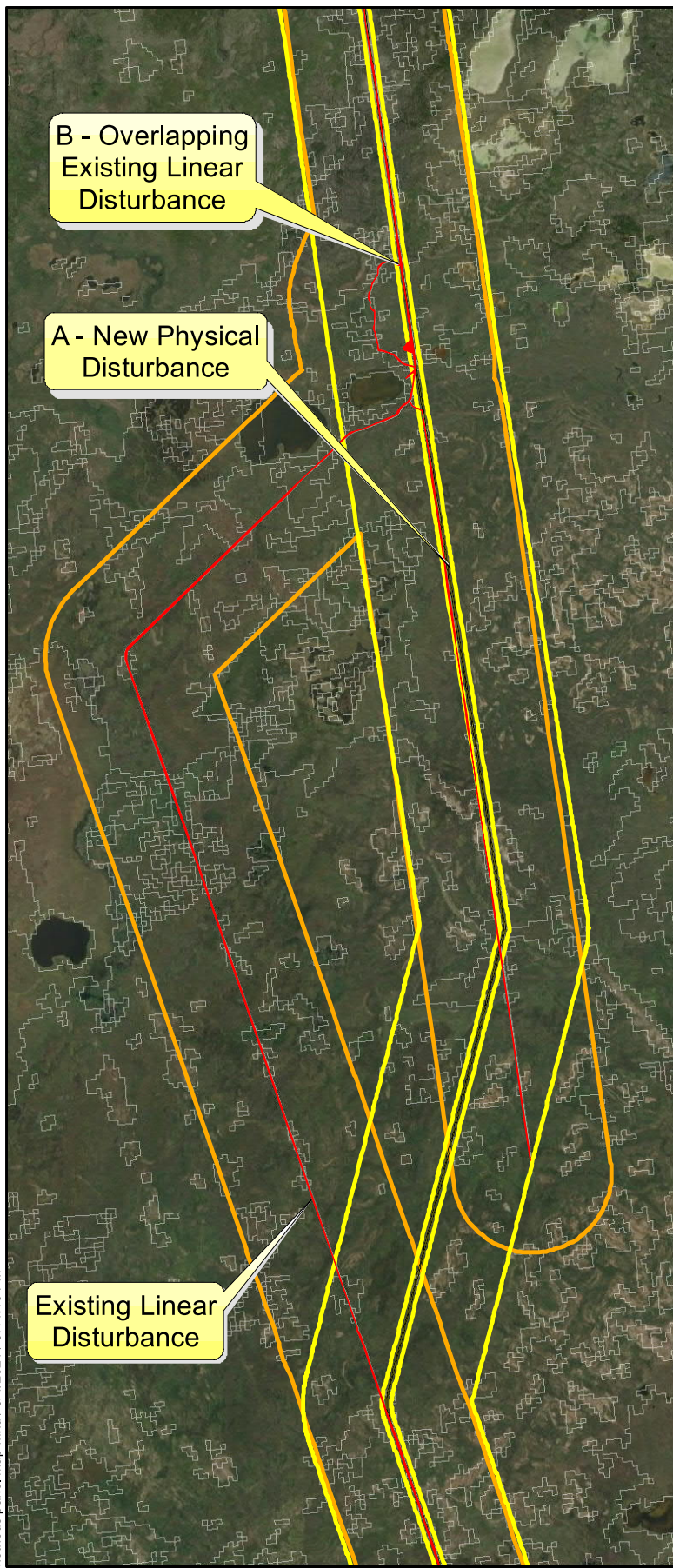
4 - Quantify residual effects of the T̄jch̄q ASR

Residual effects of a project result from new direct and indirect disturbances on the landscape after mitigation is considered. Direct disturbance resulting from the Project is calculated as the area of physical disturbance caused by the Project (i.e., the road surface, ROW, and borrow source footprints). Indirect disturbance resulting from the Project is calculated as the area within 500 m of the direct disturbance (i.e., the ZOI). Areas that overlap with existing disturbance (Step 1), including the Old Airport Road and its ZOI, were removed from the total area of residual effects. The remaining area was then overlaid with the RSF model for caribou habitat (Step 2) using ArcMap spatial software to determine relative value of habitats within the area of residual effects. Figure 3-1 presents an illustration of how residual effects of the T̄jch̄q ASR (including its ZOI) are calculated in relation to the Old Airport Road and its ZOI.

5 - Apply offset ratios and finalize Habitat Balance Table

Offset ratios were established based on the type of disturbance (i.e., direct vs. indirect disturbance) affecting habitat quality for boreal caribou (t̄qdzı) as determined in the RSF model (Step 2) (refer to ratio determination details provided in Section 5.2). Once the residual effects of the Project were quantified (Step 4), the offset ratios for each area were applied to determine the total area required for offsetting. Direct disturbance was offset at a 4:1 ratio, indirect disturbance was offset at 2:1 for habitat selected by caribou, and 1:1 for habitat not selected by caribou. Offsetting work is expected to focus on connecting, restoring, or maintaining high-value habitat for caribou. A summary of the offset ratios and rationale as well as the calculations are provided in Section 5 as the final Habitat Balance Table.

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Disturbance Type	Offset Ratio
Road Surface & Right-of-Way	4:1
Zone of influence (habitat selected by caribou)	2:1
Zone of influence (habitat not selected by caribou)	1:1

Habitat selected or not selected by caribou is determined by the Resource Selection Function Model. ZOI includes areas adjacent to the Tłı̨ch̨o ASR and borrow sources.

ID1	Area Description
Road Surface and ROW (60 m wide, 97 km long)	
A	New Physical Disturbance
B	Overlaps with Existing Linear Disturbance
Zone of Influence (500 m buffer on ROW)	
C	TASR ZOI overlapping existing Linear Disturbance
D	TASR ZOI overlapping existing Zone of Influence
E	New Disturbance (unselected habitat)
F	New Disturbance (selected habitat)

Compensation

- 4:1 - Direct Disturbance
- 2:1 - ZOI (Selected Habitat)
- 1:1 - ZOI (Unselected Habitat)
- Not Required
- Existing Disturbance

3.3.3 Determine Offset Options

Offsetting options were developed based on current offsetting approaches used for caribou in western Canada and informed through consultation workshops (Section 4). Typical offsetting for caribou focuses on restoring legacy anthropogenic disturbance such as old roads or seismic lines (i.e., legacy linear features) because existing linear features may affect caribou by improving predator movement efficiency, improving human-hunter access, and in places where linear features are in high density, fragmenting habitat. Restoration of legacy linear features provides an improvement to disturbed habitat by reducing movement efficiency of predators and hunters, creating habitat continuity, and reducing habitat patchiness on the landscape (Golder 2015). Restoring linear features is the primary offsetting measure for the Final Habitat Offset Plan, with Offset Support Measures intended to improve and monitor the success of offsetting.

Some existing linear features have been mapped within 10 km of the Tłı̄chǫ ASR and Highway 3; however, it is unclear at this time how many of those linear features are available for offsetting (e.g., some may be valued Traditional Use trails), and not all of the linear features have been mapped in this area. Appendix D outlines a framework for an Implementation Plan that addresses the key actions, including timelines required by GNWT to identify candidate and final linear features for offsetting.

3.3.4 Refining the Approach

Measure 6-3 requires a decision framework to prioritize restoration areas, mitigations, and offsets, including references to the research on which the decision framework was based. The prioritization of offsets relied on feedback from consultation with the Tłı̄chǫ Government, WRRB, YKDFN, NSMA, ECCC, and GNWT-ENR (Section 4). Using the information shared during the consultation, proposed offsetting options that addressed the residual effects of the Project and the concerns of the Participants were selected.

The Wek'èezhì Management Area is a relatively intact region of NWT with less pressure from human disturbance than other regions of western Canada (e.g., Alberta and British Columbia). The Tłı̄chǫ ASR will be a new linear feature on a landscape with very few existing linear features. The approach taken with this Final Habitat Offset Plan reflects the wishes of the Tłı̄chǫ Government and WRRB, and the existing intact condition of the Wek'èezhì region by recommending offsets within the Wek'èezhì Management Area, and not in other regions of NWT that may have more linear corridor disturbance available for restoration (e.g., some of the southwest portions of the Dehcho Area). The approach to the Final Habitat Offset Plan also aligns with the NWT Recovery Strategy for the Boreal Caribou, which looked at population trends within different regions of the NT1 range (CMA 2017). A decision matrix was developed that compared proposed offsetting options to the residual effects of the Project (Section 5.4).

Offset prioritization was completed by considering:

- the feedback from the engagement process;
- the strength of relationship between the proposed offsetting option and the residual effects of the Project;
- which options will best improve conditions for boreal caribou (tǫdzı); and
- how well the options align with the federal Recovery Strategy for the Boreal Caribou and the Recovery Strategy for the Boreal Caribou in the NWT (Environment Canada 2012, CMA 2017).

Following the consultation process (Section 4), a number of offset options and offset support measures were proposed in the Draft Plan. The list of proposed offsets was refined for this Final Habitat Offset Plan based on further consultation and evaluating the operational feasibility of implementing each offset. With further consultation, the

operational feasibility of each offset will include financial and logistical considerations to ensure appropriate allocation of resources. The framework for the Implementation Plan outlines key actions, including timelines, that will help to frame this evaluation (Appendix D). Table 3-2 presents each offset option that was proposed in the Draft Plan and a rationale for its continued inclusion or removal from this Final Habitat Offset Plan.

**Table 3-2
 Offset Options Considered in the Draft Plan¹**

Offset Considered in Draft Plan	Objective	Application in Final Plan
Restoration of Existing Linear Features	Accelerate the return of disturbed habitat to functional habitat and reduce additional threats on caribou survival	Priority 1 Offsetting Option (Section 5.4.1)
Reforestation of Fire-Disturbed Areas	Accelerate the return of disturbed habitat to effective habitat	Priority 2 Offsetting Option (Section 5.4.2). Modified from Draft Plan and continues to be an option in response to Indigenous support. Focus should be on restoring habitat in existing or proposed protected areas and areas where habitat selected by caribou has been fragmented by fire.
Effectiveness Monitoring	Determine the effectiveness of the offsets completed	Support Measure (Section 5.4.3)
Fire Suppression	Maintain remaining habitat	Not continued as an offset support measure. GNWT-ENR is already looking at including some patches of boreal caribou habitat as a Value at Risk in their range plan and so would not provide the additionality needed to qualify as an offset.
Enhanced Collar Programs	Gain further understanding of caribou habitat use	Not continued as an offset support measure. Collar programs exist, and additional collaring was not supported.
Increased Protected Areas	Maintain remaining habitat	Modified to prioritize restoring habitats in protected areas to provide permanency of the offset (which increases the value of the offset). Restoring habitat in Protected Areas is an Offset Support Measure (Section 5.4.4).

Offset Considered in Draft Plan	Objective	Application in Final Plan
		Modified to continue as an Offset Support Measure if applied properly.
Supplemental Research	Assess and improve offset effectiveness	Restoration trials that inform the efficacy of treatment options in the NWT may reduce uncertainty and minimize failure risk.
Bison Habitat Management	Reduce alternate prey and predator use of caribou habitat	Not continued as an offset but monitoring the range of bison is ongoing by GNWT-ENR.
		Not continued as an offset support measure.
Moose Habitat Management	Reduce alternate prey and predator use of caribou habitat	Determined to have high uncertainty of success and too costly to implement. It is expected that moose habitat will be managed along the ROW through regular mowing and brushing.
Hunter Management	Adaptive management option if required to reduce caribou mortality due to the road	Not continued in Final Habitat Offset Plan. Measure 6-2 incorporates similar management considerations.

¹ Bolded rows indicate offset measures that are continued through the Final Habitat Offset Plan.

Restoration of caribou habitat can be achieved from two perspectives, functional restoration and ecological restoration. **Functional restoration** is defined as work completed in an area that addresses an ecological process that negatively affects caribou. Functional restoration in the context of linear feature restoration involves implementing actions that reduce the movement efficiency of wolves, alternate prey, and caribou and reduces or eliminates visual line-of-sight to predators; thereby reducing the negative effects of the linear feature (Dickie et al. 2017). **Ecological restoration** is defined as work completed in an area that results in a self-regenerating ecosystem with ecological processes comparable to pre-disturbance (e.g., forage abundance and distribution, security cover, vegetation, and lichen species composition and abundance, inter-specific interactions and predation), and achieves natural composition and form of the local surrounding environment with similar ecological services to the area prior to disturbance.

Restoration of existing linear features provides a return from disturbed habitat to functional habitat by reducing predator movement efficiency, reducing attractiveness of habitat to alternate prey species such as moose or bison, and improving security habitat for caribou. Linear feature restoration is an accepted and tested method for restoring caribou habitat in most caribou offsetting projects in western Canada (e.g., LiDEA Project, North-Central Alberta) (Filicetti et al. 2019). Restoring habitat in polygonal features, such as old quarries or landings, could contribute to meeting offsetting requirements; however, there is less certainty in the success and time lag of this measure than for

linear feature restoration. As such, linear feature restoration was prioritized as the primary focus for offsetting and polygonal disturbance restoration the secondary focus for offsetting.

Restoration of existing linear features provides a spatial area that is easily quantified and measured to determine its effectiveness in offsetting for boreal caribou (t̄q̄dz̄i) habitat disturbance. Specific areas to target reforestation can be identified using linear feature mapping and the boreal caribou (t̄q̄dz̄i) RSF model (DeMars et al. 2020). In particular, using the linear feature mapping and paired with the RSF model will be helpful to identify locations where restoration will connect patches of habitat selected by boreal caribou (t̄q̄dz̄i) that have been fragmented by linear features. Areas that have linear corridors in highly selected caribou habitat (based on the RSF) within existing or proposed protected areas should be prioritized to reduce the likelihood of re-disturbance from human activities and thereby increasing the permanency and value of the offset. The Implementation Plan will outline the criteria and process for selection of the best areas to focus linear feature restoration efforts.

Reforestation of fire-disturbed areas was supported by Indigenous participants as an approach for offsetting because it directly addresses the current, primary threat to boreal caribou (t̄q̄dz̄i) in the Wek'èezhì Management Area. Areas that have burned may regenerate naturally over time; however, natural regeneration of forests is limited by site-specific conditions such as seed viability/germination success, soil moisture, and substrate. Reforestation of fire-disturbed areas serves to restore tree cover and restore security cover for caribou by reducing caribou visibility by predators. In addition, reforestation activities will result in changes in forest composition, which will improve conditions to expedite restoration of terrestrial and arboreal lichens (caribou forage) and reduce attractiveness of habitat to alternate prey species such as moose or bison (Duncan 2011, Roturier et al. 2007). Suitable area exists in the Wek'èezhì Management Area to offset the Project in burned areas through reforestation; however, uncertainty exists whether restoration of fire-burned areas is an operationally or financially feasible option in NWT. Adding to the uncertainty, the RSF model developed by GNWT-ENR shows that some boreal caribou (t̄q̄dz̄i) select habitat within mapped burns. Furthermore, ground-truthing of habitat value to identify specific areas to reforest still needs to be conducted (DeMars et al. 2020). Research trials and long-term monitoring will be needed to help to determine the efficacy of this offset option for the T̄j̄ch̄q̄ ASR or future projects in NWT that require offsetting for boreal caribou (t̄q̄dz̄i).

Reforestation provides a spatial area that is easily quantified to meet the offset target. Specific areas to target for reforestation can be identified using current fire burn data, the boreal caribou (t̄q̄dz̄i) RSF model, and results of ground-truthing of habitat values to identify the locations that are the most feasible from an operational and financial standpoint. Areas that have burned within existing or proposed protected areas should be prioritized to reduce the likelihood of re-disturbance from human activities (such as from new developments) and thereby increasing the permanency and value of the offset. The development and implementation of an operational planting program will support the selection of the best areas in which to focus planting effort and promote the growth and vigour of seedlings and colonization of lichen (Duncan 2011, Roturier et al. 2007), and could provide a shorter timeframe to establish security cover for caribou and reduce movement efficiency of predators. Colonization of lichen is an assumption that has worked in other jurisdictions but still needs to be tested in NWT.

Following guidance regarding effective habitat thresholds for boreal caribou (t̄q̄dz̄i) from Environment Canada (2012) and CMA (2017), specific ecosite conditions within burned habitat in the Wek'èezhì Management Area should be investigated to focus on improving habitat patch distribution and restoring large contiguous polygons of undisturbed habitat (>500 km²). Reforestation activities may require some site preparation such as excavator mounding to improve microsites for tree seedling survival and growth. This information, along with the specific locations where each

prescription will be applied, will be a focus of the Implementation Plan. Effectiveness monitoring will be required because offsetting (and in particular, reforestation) is a relatively new concept in NWT, and reforestation and re-colonization of lichen may take many years to become functionally effective for caribou use.

Effectiveness monitoring and adaptive management will be important in determining the success of the offset measure implemented. Effectiveness monitoring itself is an offset support measure and should be incorporated into all aspects of offsetting. The Implementation Plan will describe appropriate performance targets for each offset measure (e.g., a reduction in human hunter use along restored linear features), including considerations for adaptive management if an offset is not meeting performance targets and criteria for when an area is deemed ecologically or functionally restored for boreal caribou (t̥q̥dzi) (Appendix D). Potential approaches for determining the effectiveness of offsetting include:

- Monitor and assess the effectiveness of treatments in reducing predator movement, by using methods that may include: game cameras, conducting ground-based or aerial track surveys, monitoring collared predators, or assessing movement efficiency for predators (e.g., measure the height of barriers, effective coverage of width of linear corridor).
- Monitor use of restored corridors by alternate prey through use of game cameras or track/pellet surveys, density of forage species, and/or evidence of browse.
- Monitor use of treated corridors by caribou through use of game cameras, monitoring of collared animals, track, and/or pellet surveys.
- Continue to conduct mortality investigations on collared caribou and determine if mortality was natural or predator induced.
- Monitor population level trends for the boreal caribou herd where offsets are present to assess total numbers, calf recruitment, mortality rates, and habitat use/connectivity. Detecting population level trends may be difficult to attribute to ROW impacts, but the data exist, and analysis may assist in directed studies to assess actual mechanisms of impact.

Reporting for effectiveness will require GNWT to develop a new regulatory framework or registry that the T̥j̥ch̥q̥ ASR offsetting can be tracked within (e.g., treatments completed, monitoring, and rate of success).

Fire suppression is no longer explicitly considered as an Offset Support Measure. GNWT-ENR is evaluating the identification of specific areas of boreal caribou (t̥q̥dzi) habitat to be included as Values at Risk in their fire management system. Where it is included, boreal caribou (t̥q̥dzi) habitat would be the third priority in the hierarchy, behind: 1) human life, and 2) property/infrastructure. Because this initiative is likely to occur in the future already, it is not considered as an offset for the T̥j̥ch̥q̥ ASR.

Establishing new or expanded protected areas was considered in the Draft Plan; however, it does not restore habitat that has already been disturbed and initiatives are already underway to set aside certain areas for conservation. This offset option has been modified in this Final Habitat Offset Plan to focus more on **restoring degraded habitats in existing or proposed protected areas** (e.g., through linear feature restoration or reforestation/habitat improvement) or areas proposed for Enhanced Management in the Wek'èezhii Boreal Caribou Range Plan. A better understanding of the location and amount of proposed and existing protected areas will be an important step in implementing this option. Once implementation has begun on all available linear features and polygonal disturbance, additional restoration effort could look to current or future protected areas to complete additional habitat restoration work if more offsets are required.

3.4 Assumptions and Limitations

While restoration of linear disturbances is relatively well-studied and commonly used in other jurisdictions, studies specific to the northernmost portions of the boreal forest in the NWT are limited. As such, there is a high degree of uncertainty related to several aspects of using ecological restoration to achieve quality habitat for boreal caribou (t̄qdz̄ı). For example, there is uncertainty about whether restoring (through transplanting) lichens as a forage source for boreal caribou is possible and in timelines necessary to achieve those outcomes (e.g., the pace of growth and survivorship of planted seedling trees in the NWT make generating predictions regarding timelines and reasonable restoration benchmarks difficult). A key assumption supporting this plan is that active ecological restoration / revegetation of linear features will in fact speed up the return to functional caribou habitat over natural regeneration. This Final Habitat Offset Plan will be a test of this assumption. Assumptions are also made on the functional restoration methods recommended to restore boreal caribou (t̄qdz̄ı) habitat. For example, based on success in other jurisdictions, it is assumed that measures such as fences, wood piles, hummocks, and even shrub growth that provide short-term blockage of visual line-of-sight and restrict physical access by predators will be effective here in reducing predator movement efficiency and decreasing predation rates.

Applying offsets for boreal caribou (t̄qdz̄ı) in NWT is inherently experimental, and therefore it is important to establish measurable monitoring goals for both the treatments selected and the response and impacts on caribou (t̄qdz̄ı) and predators. An example of confirming assumptions about methods recommended to restore boreal caribou (t̄qdz̄ı) habitat is reforestation. Procuring seeds and seedlings suitable for planting may be difficult in NWT. To improve seedling survival, seeds from tree species that grow in the Wek'èezhì Resource Area should be collected and germinated in advance of planting, which may take considerable time. Consideration of trees species selection and procurement of a nursery to germinate seeds will need to be completed in advance of tree planting.

The operational and financial feasibility of offsetting can be more accurately estimated once linear features are identified for restoration, and objectives, site-specific prescriptions, accessibility, and extent of area can be confirmed. These costs can be reduced significantly if the goal is to functionally restore linear features by reducing predator movement efficiency and allowing natural succession (which may or may not require some site preparation such as surface scarification) to ecologically restore the sites. Therefore, uncertainty about operational and financial feasibility can be managed through strategic decision-matrix that considers ecological value of the options with costs and resource allocation to maximize benefits (e.g., multiple accounts analysis framework). Implementation is subject to appropriations and budgetary constraints of the GNWT.

No existing regulatory framework or registry currently exists where the T̄łch̄q ASR offsetting can be tracked (e.g., treatments completed, monitoring, and rate of success). A formal process to manage data from T̄łch̄q ASR offsetting will be necessary to track effectiveness monitoring and adaptive management and to inform future offsetting for other development projects.

While the concept of applying offsetting measures outside of the Wek'èezhì Management Area was considered during workshops, offset recommendations were prioritized in the region where the T̄łch̄q ASR will operate. This commitment was based on the direction provided by the authorities with jurisdiction in the region, which also aligns with the MVEIRB (2018a) and the Recovery Strategy for the Boreal Caribou (*Rangifer tarandus caribou*) in the Northwest Territories (CMA 2017).

An **Implementation Plan** will be required to identify specific areas, describe specific restoration treatments based on site-limiting factors (e.g., mounding or tree planting), personnel, and timelines to implement this Final Habitat Offset Plan. The Implementation Plan will include an effectiveness monitoring and adaptive management plan to monitor the success of the offsetting work and document effectiveness for future offsetting projects in NWT. Appendix D presents a framework for implementation that provides specific guidance and timelines for developing the Implementation Plan such as any pre-screening required (e.g., access availability, seed sourcing, ground-truthing, and site level prescriptions).

Although mapping of existing linear corridors was completed to quantify residual effects for the Final Habitat Offset Plan, data gaps still exist. Ongoing mapping of existing linear corridors and polygonal features has continued through the development of the Final Habitat Offset Plan, and mapping will continue to provide insight into additional candidate areas that may be suitable for restoration. Therefore, mapping existing linear corridors should be continued prior to the development (as discussed in Appendix D) of the Implementation Plan to identify additional areas (i.e., outside the ZOI) suitable for linear feature restoration that have not already been identified (Section 5.5). Any new areas identified should be vetted by the Tłıchǫ Government and WRRB and all other affected Indigenous organizations to ensure the proposed areas are not important traditional trails. Newly mapped spatial data should be shared with GNWT-ENR, so they can update their anthropogenic disturbance layer and track new disturbance against the baseline condition of the ZOI, if desired.

Nine borrow sources will be developed for construction of the Tłıchǫ ASR. All nine borrow sources will be restored following construction, which will reduce the residual effects of the Tłıchǫ ASR. Restoration of the borrow sources will be implemented following construction, and the objective will be to address residual effects of the Project by reducing predator movement efficiency and caribou sightability and restrict human access to the areas developed for borrow sources. Land surveys of the extent of disturbance for the final borrow sources following construction will provide more detail on the actual area required for restoration.

4 CONSULTATION

The consultation was completed over three workshops and numerous phone calls and emails between workshops during the draft planning phase of the habitat offset plan. Continued consultation through to the Final Habitat Offset Plan stage has included regular conversations with the Collaborators Working Group to verify the approach that will be taken. A summary of the consultation feedback integrated into this document is provided below.

Traditional Knowledge that was considered in the development of the Final Habitat Offset Plan and how it was incorporated is presented in Appendix A. A description of the resources shared with Indigenous groups to support their involvement in the drafting of the Final Habitat Offset Plan is provided in Appendix B.

4.1 Workshop 1 - February 22, 2019

Workshop 1 was attended by staff from Tłı̄chǫ Government, WRRB, GNWT-ENR, GNWT-INF, and Associated Environmental Consultants Inc. (Associated). It was held over one full day in Yellowknife. It was a productive workshop that facilitated a common understanding of some key offsetting concepts, established a shared understanding of the purpose of engagement, and found agreement on a path forward for future engagement.

Key outcomes from Workshop 1:

- Acknowledgement by all participants that offsetting is a new concept in the NWT. A focus of all workshops was to ensure that all Participants understood offsetting and how it was applied in context of the Tłı̄chǫ ASR.
- Shared understanding that the Wek'èezhì Management Area is intact relative to other regions in southwest NWT. Existing disturbance in the Wek'èezhì Management Area is predominantly natural (e.g., fire-related), and offsetting may require innovative options compared to other regions in Canada that have more human disturbance (e.g., linear features).
- Shared concern that the timelines for engagement and development of the Final Habitat Offset Plan are challenging.
- Consensus that a great deal of work has been done already, and the Collaborators Working Group should use existing information and not start from the beginning. A list of important documents and reports was identified and considered in this Final Habitat Offset Plan (Appendix B).
- Shared understanding that the timeline to develop the Final Habitat Offset Plan required close coordination with all Participants to meet Measure 6-3.
- Consensus that the work should focus on lands within the Wek'èezhì Management Area and that the work provides a unique opportunity to study the success of some options in preparation for a territory-wide offset framework.
- Consensus that Elders and Harvesters will have the best information and the Collaborators Working Group will need to engage with them to get complete information.

Following Workshop 1, a tentative schedule and engagement process was agreed upon, including who should be engaged and how the process should proceed.

4.2 Workshop 2 - April 23 and 24, 2019

Workshop 2 was attended by staff from Tłı̄chǫ Government, WRRB, Elders and Harvesters from Whatì and Behchokǫ, GNWT-ENR, GNWT-INF, and Associated. The workshop was intended to include members of the public in the discussion; however, a funeral in the community meant people could not attend the public session. Workshop 2 was

held over two days in Behchokq. This was the first workshop to include Elders and Harvesters from Whatì and Behchokq and was conducted with the help of translators from each community.

The objective of Workshop 2 was to introduce the concept of offsetting to Elders, Harvesters, and the public, and begin discussions on their Traditional Use of the land and gain insight into areas important to boreal caribou (tqdzì). During the workshop, Associated asked Elders and Harvesters questions about their use of the land and boreal caribou (tqdzì), and the condition of the land and how it has changed over time. Associated looked for guidance from Elders and Harvesters for different areas or methods that could be used to improve the land for boreal caribou (tqdzì).

Key outcomes from Workshop 2 included a better understanding of the existing condition for boreal caribou (tqdzì) in southern NWT, a better understanding of the Elders' knowledge of how boreal caribou (tqdzì) use the land, and a better understanding of how Tłıchq Harvesters use the land. A draft list of potential options for offsetting that will improve conditions for caribou was developed during this workshop.

4.3 Workshop 3 - May 9 and 10, 2019

Workshop 3 was held over two days. Day 1 was attended by the Collaborators Working Group (Tłıchq Government, WRRB, GNWT-ENR, and GNWT-INF) and Elders and Harvesters from Whatì and Behchokq. Day 2 was attended by all staff from the Collaborators Working Group as well as staff from the YKDFN and the NSMA.

May 9 - Behchokq

This was a follow-up workshop with Elders, Harvesters, and the public, held in Behchokq. The purpose was to have Associated report back to Elders and Harvesters about what was heard during Workshop 2, and validate and complete information about the offsetting options being proposed. Part of this workshop was intended to be shared with the public; however, there was another funeral in the community and the public session was not well attended. Feedback from this workshop indicated that the information gathered during Workshop 2 was relevant and correct and the proposed options for offsetting were supported by all. A focus for discussion was again on protecting caribou (tqdzì) habitat from wildfire.

May 10, Staff Only - Yellowknife

The Collaborators Working Group and staff from the NSMA and YKDFN met in Yellowknife to discuss a strategy to develop the Draft Plan, agree to a schedule for review of draft documents, and share input on the options presented for offsetting to date. Topics of discussion again lead to challenges with offsetting in NWT, options to address the challenges, and a discussion about what the Plan should include.

The workshop was held as a series of round-table discussions where participants were provided opportunities to ask questions and provide comment on the Draft Plan process and content to date. Specifically, attendees were asked what they liked about the options being proposed, what improvements or limitations they foresee, and what type of content and detail they expect when the Draft Plan was complete. Feedback from this workshop indicated that the Plan followed an acceptable approach; some questions remained about how certain aspects of offsetting would be addressed in the Plan.

4.4 Continued Collaboration and Communication

Collaboration and information gathering continued following the delivery of the Draft Plan to the Collaborators Working Group for review. Two Concordance Tables (Appendix C) that represent the review of two versions of the Draft Plan summarizing comments from the Collaborators Working Group were developed and shared with all

participants to address feedback and demonstrate how comments were incorporated into the Draft Plan. Information from reviews during the development of the Draft Plan, comments from the workshops, and comments from follow-up phone calls were all incorporated into the Concordance Tables.

Through the development of this Final Habitat Offset Plan, collaboration and communication with the Collaborators Working Group has continued as follows:

- Presentations of the Draft Plan approach during two Tłıchǝ ASR Corridor Working Group meetings (in-person December 2019 and by phone conference July 2020).
- Continued conversations via email, phone calls, and conference calls with GNWT-ENR, GNWT-INF, ECCC, WRRB, Tłıchǝ Government, NSMA, and YKDFN.

5 OFFSET DETERMINATION

5.1 Effects Description

Residual effects of the Project on boreal caribou (t̄qdzı) habitat have been assessed as potential effects on habitat availability, habitat distribution, and survival and reproduction of boreal caribou (t̄qdzı) (Golder 2017). Residual effects of the Project are quantified as the incremental increase in disturbance to boreal caribou (t̄qdzı) habitat that the Project will have once mitigation measures have been applied in full. The primary mitigation applied to the Project was avoidance of effects through project design. The T̄łchq̄ ASR is designed to overlap with the existing Old Airport Road to avoid new disturbance to selected habitat and ecosystems.

Residual effects of the Project will affect boreal caribou (t̄qdzı) in two distinct ways: **directly** as a result of the physical footprint of habitat disturbed, and **indirectly** in the ZOI where sensory disturbance may affect habitat use by boreal caribou (t̄qdzı).

5.2 Habitat Offset Calculations

The spatial area that is required for offsetting is the spatial area where residual impacts of the T̄łchq̄ ASR have an effect on boreal caribou (t̄qdzı) habitat. Direct disturbance (i.e., areas where physical habitat loss will occur from the Project) will be offset at a 4:1 ratio. Indirect disturbance (i.e., the ZOI) will be offset depending on the value of the habitat that will be indirectly disturbed (Table 5-1). A 4:1 multiplier ratio was chosen for direct disturbance in consideration of feedback from ECCC (Appendix C). This is the singular ratio that ECCC has recommended on all federal application reviews in western Canada for offsetting disturbance to caribou habitat to date, and it is in line with common practice for biodiversity offsetting in several jurisdictions in Canada.

The ZOI of the road surface and ROW will have an indirect effect on boreal caribou (t̄qdzı). Because the boreal caribou (t̄qdzı) habitat within the ZOI will not be physically disturbed and sensory effects are anticipated to be intermittent and low in magnitude (Golder 2017), the offset ratios applied to the ZOI are reflective of the level of habitat use by caribou (t̄qdzı) that will be indirectly affected. For habitat that was selected by boreal caribou (i.e., ranked 6-10 in the RSF model [DeMars et al. 2020]), an offset ratio of 2:1 is applied to the ZOI, and for habitat that was shown to be not selected (i.e. ranked 1-5 in the RSF), or slightly selected by boreal caribou (t̄qdzı), an offset ratio of 1:1 is applied to the ZOI.

Table 5-1
Habitat Offset Ratios by Disturbance Type and Area

Habitat Disturbance Type	Disturbance Area	Offset Ratio
Direct	Road Surface	4:1
Direct	Right-of-Way	4:1
Indirect	Zone of Influence (Habitat Selected by Caribou) ¹	2:1
Indirect	Zone of Influence (Habitat Not Selected by Caribou) ¹	1:1

¹ Zone of Influence includes areas within 500 m of direct disturbance. Habitat selected or not selected by caribou is determined by the Resource Selection Function Model (Section 3.3.2).

Section 3.3.2 describes the methods followed to quantify residual effects of the Project. Table 5-2 is the habitat balance table that summarizes the total area of each disturbance type for the T̄łchq̄ ASR road surface, ROW, and ZOI.

The final spatial area required for offsetting (i.e., Total TASR Offset Commitment) is provided with the offset ratios applied. Figure 5-1 illustrates the existing disturbance that has been mapped within 10 km of the Tłı̨chǫ ASR and Highway 3 to date. Additional linear features exist in these areas but have not yet been mapped. All of these mapped linear features are accessible from either Highway 3 or the Tłı̨chǫ ASR corridors.

All borrow sources developed for the Tłı̨chǫ ASR will be restored following construction and will not contribute to residual effects of the Project and prior to restoration of the borrow sources, GNWT-INF will update the Conceptual Closure and Reclamation Plan with details of the restoration activities and resubmit it for approval. The Total Area Required for Offset (Table 5-3) should be updated for the Implementation Plan to provide an accurate estimate of the residual effects of the Project and the total area required for offsetting.

Lac La Marte

Marian Lake

Rae

Edzo

Great Slave Lake (north arm)

Tlicho ASR Corridor

Highway 3 Corridor

Hwy 3




-  Existing Linear Disturbance
-  Existing Polygon Disturbance
-  Mapping Boundary

Figure 5-1 disturbance.mxd / 3/19/2021 / 11:45:57 AM



PROJECT NO.: 2018-2330.030.209
 DATE: March 2021 N
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 km

FIGURE 5-1: MAPPED EXISTING DISTURBANCE WITHIN 10 KM OF TLICHO ASR AND HIGHWAY 3
 Government of Northwest Territories
 Department of Infrastructure
 Tłı̨chų All-Season Road

**Table 5-2
 Caribou Habitat Balance Table with Offset Calculations for Tłı̨chų ASR**

ID ¹	Area Description	Total Area (ha)	Offset Ratio	Total Area Required for Offset (ha)
Road Surface and ROW (60 m wide, 97 km long)				
A	New Physical Disturbance	508.7	4:1	2,034.8
B	Overlaps with Existing Linear Disturbance	55.0	0	0
	Net Area of New Physical Disturbance	508.7	4:1	2,034.8
Zone of Influence (500 m buffer on ROW)				
C	TASR ZOI overlapping existing Linear Disturbance	45.9	0	0
D	TASR ZOI overlapping existing Zone of Influence	8,808.3	0	0
E	New Disturbance (unselected habitat)	425.2	1:1	425.2
F	New Disturbance (selected habitat)	193.2	2:1	386.4
	Total Net Area of ZOI Disturbance	9,472.6		811.6
Total Offset Commitment				2,846.4

¹ ID Notes:

See Figure 5-2.

A = The area where the Project road surface and ROW will have a new physical disturbance on natural ecosystems.

B = The area where the Project road surface and ROW overlaps with the existing road surface of Old Airport Road or other linear features.

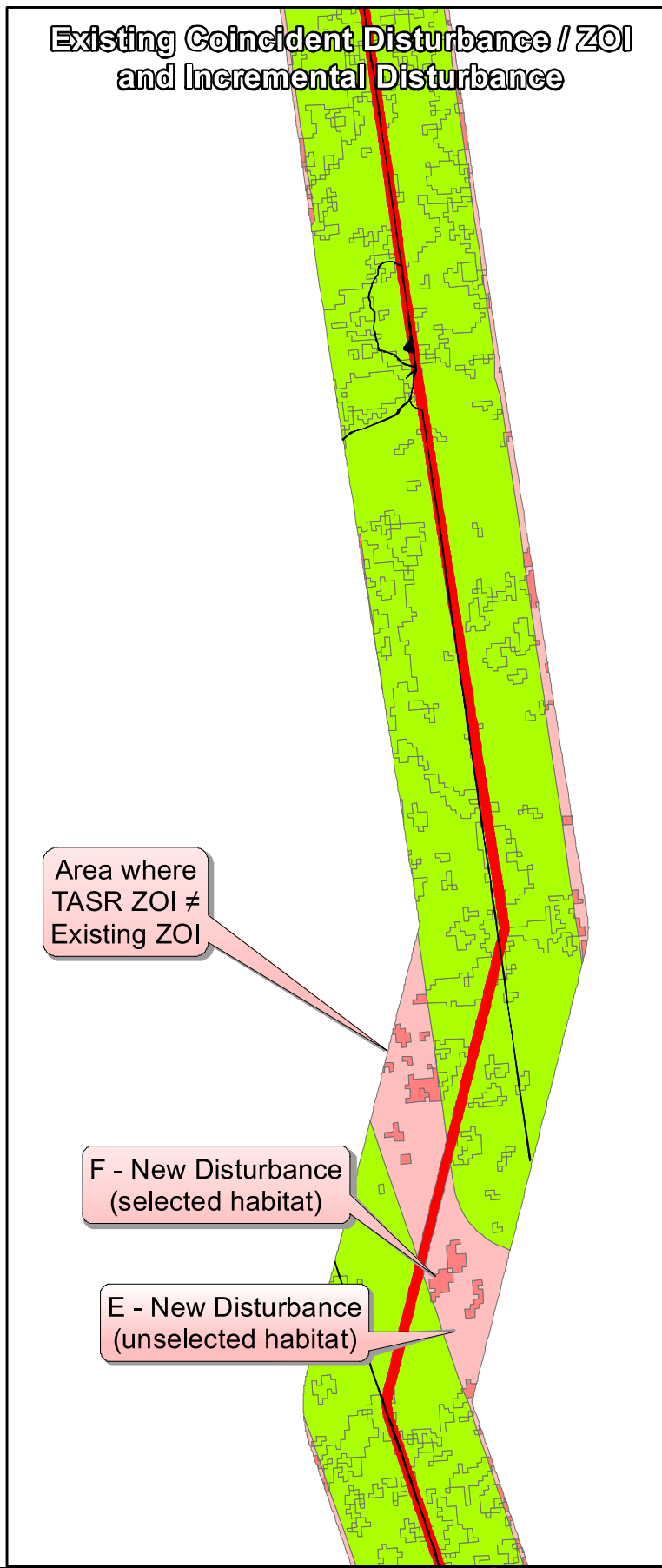
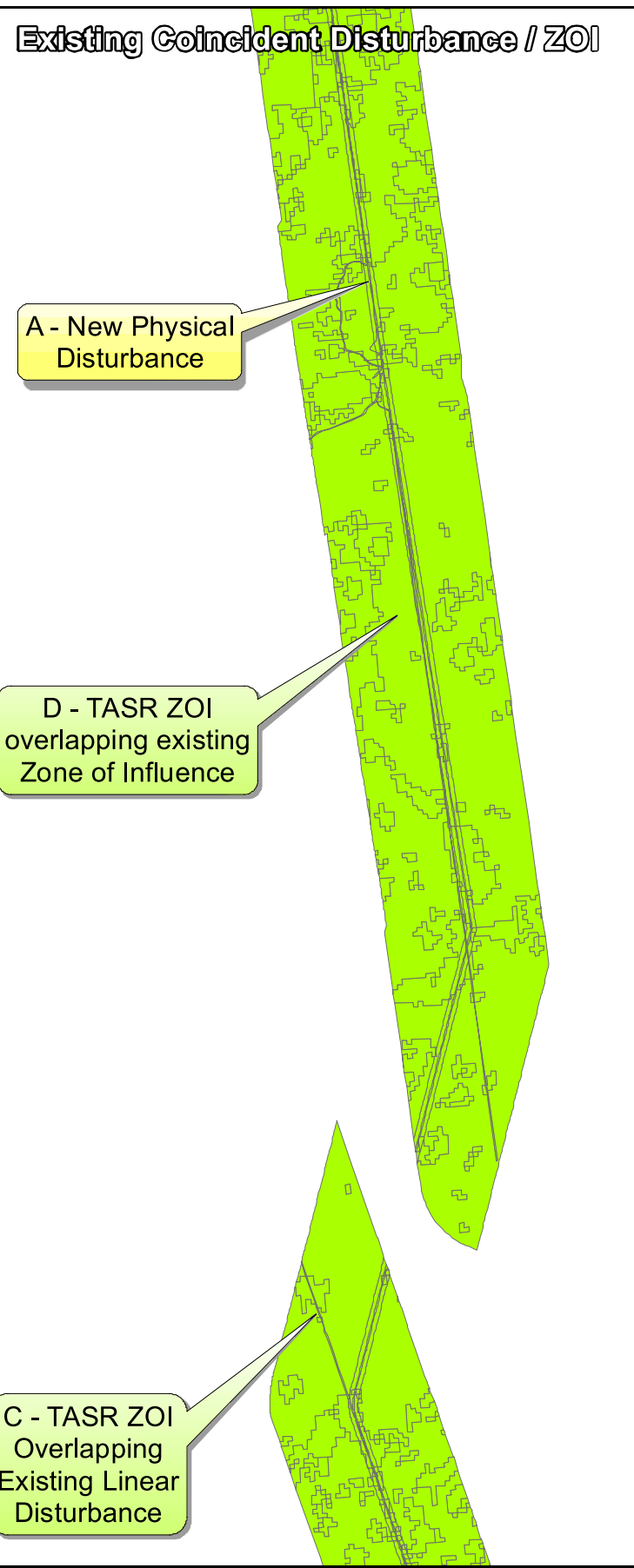
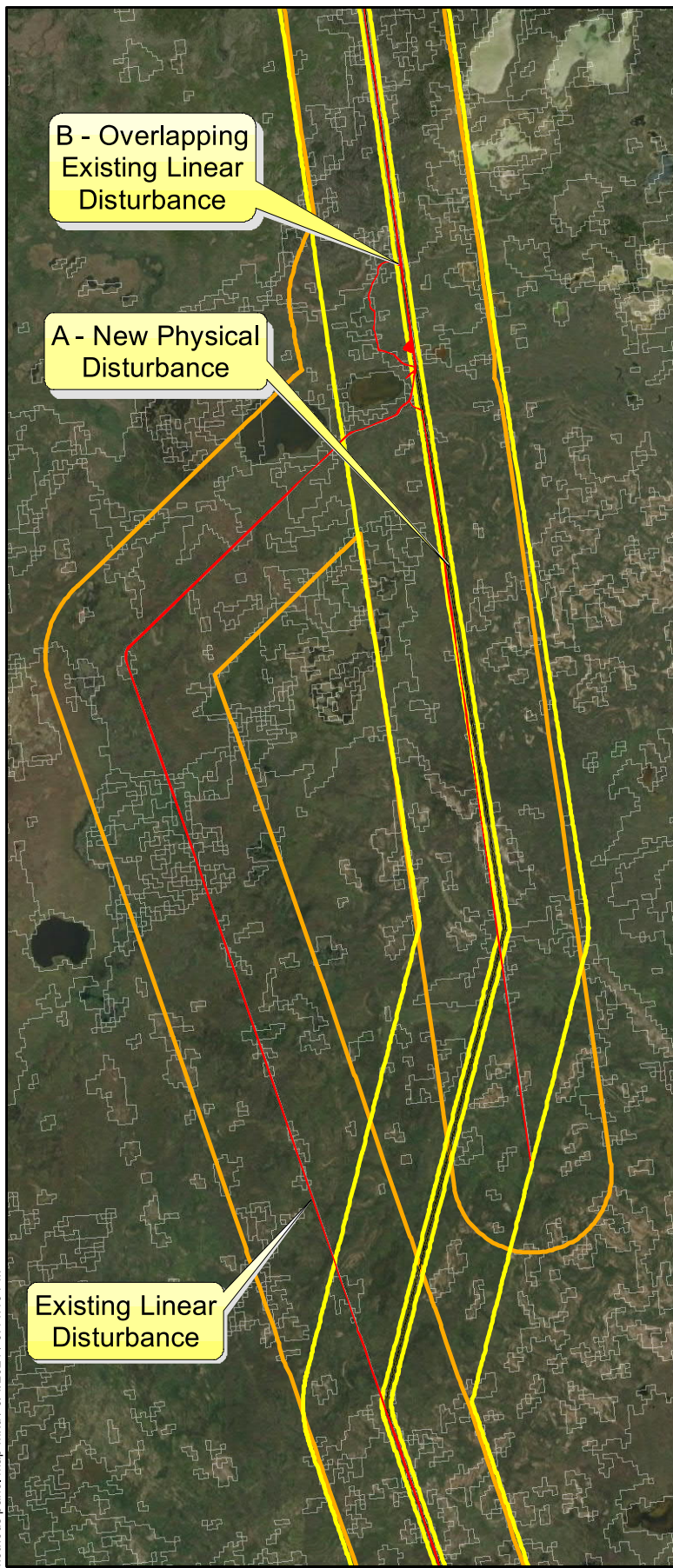
C = The area where the Tłı̨chų ASR ZOI overlaps with existing linear disturbance, including the Old Airport Road, pullouts, or roads.

D = The area where the Tłı̨chų ASR ZOI overlaps with the existing ZOI from the Old Airport Road.

E = The area where the Tłı̨chų ASR ZOI will have an indirect effect on habitat not selected by caribou (based on the RSF model).

F = The area where the Tłı̨chų ASR ZOI will have an indirect effect on habitat selected by caribou (based on the RSF model).

methods panel map.mxd / 5/4/2021 / 3:14:49 PM



Disturbance Type	Offset Ratio
Road Surface & Right-of-Way	4:1
Zone of influence (habitat selected by caribou)	2:1
Zone of influence (habitat not selected by caribou)	1:1

Habitat selected or not selected by caribou is determined by the Resource Selection Function Model. ZOI includes areas adjacent to the Tłı̨chǫ ASR and borrow sources.

ID1	Area Description
Road Surface and ROW (60 m wide, 97 km long)	
A	New Physical Disturbance
B	Overlaps with Existing Linear Disturbance
Zone of Influence (500 m buffer on ROW)	
C	TASR ZOI overlapping existing Linear Disturbance
D	TASR ZOI overlapping existing Zone of Influence
E	New Disturbance (unselected habitat)
F	New Disturbance (selected habitat)

Compensation

- 4:1 - Direct Disturbance
- 2:1 - ZOI (Selected Habitat)
- 1:1 - ZOI (Unselected Habitat)
- Not Required
- Existing Disturbance

Based on recent mapping of existing linear features completed to date, approximately 670 ha of linear disturbance and 29,076 ha of existing ZOI are potentially available as candidates for treatment within 10 km of Highway 3 and the Tłı̄chq ASR (Figure 5-1), subject to the application of eligibility criteria. Upon restoration of a linear feature, the footprint of the restored area plus the area of ZOI associated with that restored area will be credited as offset habitat. Additional linear features exist that have not yet been mapped but are visible in high-resolution imagery. Given this calculation, sufficient habitat offset opportunity exists in candidate linear features and their ZOIs alone to offset for residual effects of the Tłı̄chq ASR.

**Table 5-3
 Offset Commitments and Area of Candidate Linear Feature Disturbance Mapped**

Feature Type	Total Net Residual Impacts	Offset Commitment ¹	Opportunity for Offsetting ²
Road + ROW	508.8 ha	2,034.8 ha	670 ha (existing roads and trails)
ZOI	618.4 ³ ha	811.6 ha	29,076 ha (existing ZOI)
	1,127.2 ha	2,846.4 ha	29,746 ha

¹ Refer to Table 5-2.

² Estimated area of existing linear features to date in Wek'èezhì. These areas require confirmation that they are available for restoration.

5.3 Construction Restoration

Restoration following construction of the Tłı̄chq ASR will focus on restoring borrow sources and any construction-related disturbance within the ROW. Restoration will focus on returning ecosystems to boreal caribou habitat where possible and addressing the residual effect of survival and reproduction. Prior to restoration of the borrow sources, GNWT-INF will update the Conceptual Closure and Reclamation Plan with details of the restoration activities and resubmit it for approval.

The Project will have a residual effect on up to 508.8 ha of road surface and ROW, including an additional 618.4 ha of ZOI (for a total of 1,127.2 ha) of landcover (Table 5-4). Borrow sources will be restored beyond permit condition requirements, which currently require limited restoration such as terrain reshaping, watercourse maintenance, and topsoil pullback. The current permit conditions are not expected to address any of the residual effects of the Project, so instead, the borrow sources will be restored with the objective to address the residual effects of changes in habitat availability and changes in survival and reproduction (Golder 2017). As a result, the net residual effect of the Project does not include the area of the borrow sources.

5.4 Habitat Offsetting

The offsetting options presented in this section are of greatest benefit to boreal caribou (t̄q̄dzı) in the Wek'èezhì Management Area based on the current environmental threats (Sections 5.4.1 and 5.4.2). The traditional offsetting technique of restoring legacy linear features is the primary focus for offsetting for the Tłı̄chq ASR, followed by restoring polygonal features, and then habitat restoration (e.g., reforestation in burned areas of existing or future protected areas) as the tertiary offsetting option if additional area is still required for offsetting. Additional 'Support Measures' have the goal to increase the effectiveness of the habitat restoration offset measures. Also proposed are complementary Offset Support Measures to monitor, enhance, or adaptively manage the effectiveness of those options.

The ecological restoration of linear features and reforestation in NWT are long-term measures that may take upwards of 80 years until habitats are considered ecologically restored for caribou; however, functional restoration can be achieved almost immediately if the applied offsetting measures are effective. Establishing performance targets, effectiveness monitoring objectives, and adaptive management strategies will benefit the offsets for the Tłı̨chǫ ASR and other future projects in NWT that may require offsetting.

5.4.1 Priority 1 - Restoration of Existing Linear Features

The first priority for offsets will be the identification of existing linear disturbance in the Wek'èezhì Management Area suitable for restoration. Three primary objectives of linear feature restoration will include:

- Human access management;
- Recovery of vegetation along linear features; and
- Impeding movement efficiency of predators.

Restoration of linear features that are acceptable to Tłı̨chǫ Government, NSMA, YKDFN, and GNWT-ENR could employ proven methods for restoration including rough disturbance, visual barriers, mounding, tree bending and planting of conifers on suitable sites as described in the Boreal Caribou Habitat Restoration Operational Toolkit (Golder 2015). Initially, priorities will include sections of the Old Airport Road that will not be developed into the Tłı̨chǫ ASR, within the ZOI in areas where linear features are redundant (e.g., in cases where linear features are parallel to the Tłı̨chǫ ASR, it is assumed that the Tłı̨chǫ ASR will be a preferred travel route), and along the Highway 3 corridor and segments of existing disturbance outside the ZOI (Figure 5-1).

Legacy linear features in the Wek'èezhì Management Area are relatively limited, and not all are available for restoration. Land that is occupied or used by active land use permits for borrow sources, permanent features, cabins, or traditional trails used by community members for cultural and sustenance purposes are deemed as not available for restoration. Opportunities that do not appear in existing disturbance mapping data (e.g., linear features that have not yet been mapped and recognized by ECCC or GNWT-ENR) will likely be sufficient to meet the offset commitment required for the Tłı̨chǫ ASR; however, setting aside new protected areas or conducting reforestation or restoration of habitat in existing or proposed protected areas may be a suitable alternative if implementation has begun on all linear and polygonal features and more offsets are needed. Incorporating protected areas into offsetting will ensure that the offset work will not be disturbed in the future by human development and could help to protect the offsetting investment from future human disturbance. Future mapping of human disturbance within candidate and established protected areas in the Wek'èezhì Management Area is required to determine the feasibility of this option.

Human access management will protect rehabilitating ecosystems and improve security for caribou and can be accomplished by several techniques, including:

- informative signage indicating a corridor is being rehabilitated;
- revegetation (tree or shrub seedling) planting; or a combination with:
- physical impediments such as excavator mounding, tree bending, coarse woody debris placement (slash rollback), or fencing (Golder 2015).

Recovery of vegetation along linear features can be accomplished by excavator mounding in non-permafrost areas or surface scarification to create favourable microsites for seedling planting, and tree planting to improve regeneration timelines. When paired with human access management, promoting natural regeneration by leaving the site to revegetate naturally may be suitable for areas where vegetation will return naturally such as upland sites with fertile

soils. If natural regeneration is the proposed prescription, low impact site preparation may accelerate regeneration in the form of scarification or soil decompaction.

Impeding movement efficiency of predators can be accomplished by integrating visual barriers that are at least 0.5 m in height (Dickie et al. 2017). Several techniques to achieve this include:

- excavator mounding;
- revegetation (tree or shrub seedling planting or willow/poplar staking);
- tree bending (if suitable conditions exist)⁶;
- coarse woody debris placement (slash rollback); or
- fencing.

5.4.2 Priority 2 - Restoration of Polygonal Features

The second priority for offsets will be the identification of existing polygonal features that are suitable for restoration in the Wek'èezhìi Management Area, within 10 km of the Tłı̄chq̄ ASR. The primary objectives of polygonal feature restoration will include a focus on revegetating the site with native plant species to return the site to a condition similar to the adjacent natural ecosystems. For example, if the adjacent site is dominated by spruce forest, the target seral climax condition should include spruce as the predominant species in the canopy.

Restoration of polygonal disturbance could follow methods similar to linear feature restoration including: roughening the surface to improve microsites and promote seed germination; installing visual barriers, if it would benefit caribou at the site; mounding, if excessive moisture is a concern; and planting conifers on suitable sites, as described in the Boreal Caribou Habitat Restoration Operational Toolkit (Golder 2015). Initially, priorities for polygonal feature restoration will target borrow sources that have been abandoned and are not related to the Tłı̄chq̄ ASR and legacy landings or cleared areas that were used for forest harvesting that are no longer under an existing harvesting licence.

5.4.3 Priority 3 - Reforestation of Fire-Disturbed Areas

The third priority will be reforestation of fire-disturbed areas. Reforestation could be an effective method to gain offsets for the Project. Uncertainty remains on the operational or financial feasibility of this option, so offsetting using reforestation of fire-disturbed areas should only be considered if restoration has been initiated in all possible linear and polygonal features and the total offset area required for the Project (Section 5.2) has not been achieved.

The primary objectives of reforestation will be to:

- accelerate the natural forest regeneration time (from a natural regime);
- produce security cover for boreal caribou (tq̄dzı); and
- connect large patches of preferred habitat (based on the RSF model) to reduce habitat fragmentation.

Reforestation in the North is not commonly prescribed, as commercial logging has not been a dominant industry and limitations of suitable growing conditions due to a short season and permafrost are significant considerations.

⁶ Tree bending has been implemented primarily in southern jurisdictions, where suitable site conditions allow. Suitable conditions for tree bending are likely limited near the Tłı̄chq̄ ASR because of the short growing season and poor nutrient conditions in peat/bog/fen areas common in NWT.

However, due to the relatively recent increase in fire severity (Wotton et al. 2017), natural forest regrowth may not be sufficient to maintain viable important range for boreal caribou (t̥q̥dz̥i) (Environment Canada 2012).

Reforestation of fire-disturbed areas is proposed as a tertiary offset option in locations that were burned in the last 40 years, are shown to be not preferred by boreal caribou (t̥q̥dz̥i), and are within existing or proposed protected areas or within Enhanced or Intensive management area which will be identified in the Wek'èezhìi Boreal Caribou Range Plan (GNWT 2019). Specifically, the focus would be on fragmented habitat within patches of large, undisturbed areas where burns separate existing patches of habitat currently used by boreal caribou (t̥q̥dz̥i), based on Traditional Knowledge and results of the RSF model that show boreal caribou (t̥q̥dz̥i) habitat avoidance. Reforestation is intended to reduce caribou visibility to predators by breaking up line-of-sight in burned openings (i.e., improve security for caribou) rather than to improve availability of forage for caribou (i.e., focus on improving habitat value).

Areas will be prioritized for reforestation that:

- show evidence of substantially delayed or insufficient natural tree regeneration;
- are operationally and financially feasible;
- are within severe to moderate burn intensity; and
- will connect habitat patches selected by caribou using the RSF model and Traditional Knowledge.

Surveys should be conducted ahead of implementation to target specific areas that are operationally feasible, and because natural ecosystems will respond differently to reforestation and severely burned areas may have degraded soil conditions, reforestation success may be compromised as a result. During workshops, Elders and Harvesters suggested using local seed sources for trees. Ongoing monitoring and adaptive management can help to improve the chances for successful reforestation, including setting performance targets and documenting throughout the monitoring phase the: species mixes, lichen fragment characteristics, seedling size and age, planting density, fertilizers (e.g., fertilizer 'tea' bags), manual tending required to remove brush, and site preparation applied improve planting conditions (e.g., mounding of planting sites). This monitoring can be reviewed regularly, and actions adapted to improve reforestation. Data collected during this work will benefit future projects in NWT where offsetting may consider reforestation as an option.

The effectiveness of reforestation through monitoring will be measured against a combination of performance targets including seedling survival, growth rate, function as security cover, and function as suitable microhabitat for lichen re-establishment (arboreal and terrestrial). Monitoring for replanted areas will include assessment of measures to reduce growth of shrubs and forage for alternate prey and use of areas by alternate prey and predators (e.g., deploying camera traps and photo points). Protection of restored areas, such as closing access routes or restricting land use activities, may be necessary to prevent recurring human disturbance. Manual brushing, selecting older seedlings from locally sourced stock, or additional fertilization may help improve seedling succession. Establishing controls will be essential for comparisons of regeneration metrics.

A detailed Implementation Plan should be developed before any work proceeds and will be valuable in determining the best sites to focus on, the site-specific treatments including species that should be planted, and other site-specific information that will promote successful reforestation.

5.4.4 Restoring Habitat in Protected Areas

Restoring habitat disturbance, either by reforesting burned areas less than 40 years old or decommissioning legacy linear features, in protected areas should be considered when determining where to offset for the Final Habitat Offset Plan. If opportunities arise to restore habitat in protected areas, those efforts will enhance offset permanency, will be less likely to be disturbed by humans in the future, and may improve overall value for boreal caribou (ṯḏẕı) over the long term. Restoring habitat in protected areas has legal and political challenges, such as navigating land use objectives or existing regulations that restrict work within a protected area, and therefore should only be considered once all linear and polygonal features near the Ṯł̱cẖq̱ ASR have been restored. Ultimately, decisions to conduct offsets in protected areas will fall on land managers and decision makers within GNWT.

5.4.5 Support Measure – Effectiveness Monitoring

As the concept of offsetting for caribou (ṯḏẕı) is new in NWT, it is necessary to assess the effectiveness of both mitigation and offsetting measures to determine which approaches work best in restoring caribou habitat and reducing caribou displacement and mortality. Monitoring will be supplemental to the offsets implemented and will include the development of performance targets for:

- assessing survival and growth of shrubs, trees, and lichen (i.e., forage and security habitat);
- continuing to monitor caribou habitat use through GPS collar data or camera trap surveys;
- assessing use of offset areas by alternate prey (e.g., bison and moose); and
- assessing and detecting changes in use of offset areas by human hunters and predators.

5.5 Timelines for Implementation Plan

Measure 6-3 requires provision of expected timelines for offsetting. This Implementation Framework identifies some of the key steps necessary to provide detailed timelines for restoration activities for the Ṯł̱cẖq̱ ASR Project. GNWT-INF will be required to develop detailed timelines in collaboration with GNWT-ENR to determine the desired approach.

The steps for GNWT-INF to complete and establish detailed timelines for implementation are as follows (Table 5-4):

1. Determine the ultimate disturbance footprint of the Ṯł̱cẖq̱ ASR route that incorporates the restoration measures to restore habitat following construction. Calculate the residual effect of the Ṯł̱cẖq̱ ASR on boreal caribou (ṯḏẕı) habitat. **This will be completed by Q2 of 2022** or as soon as construction and restoration are completed and will include a final quantification of offsets necessary.
2. Continue to collaborate with the Ṯł̱cẖq̱ Government and WRRB, and consult with ECCC, NSMA, YKDFN, and any other affected Indigenous group during the planning, development, and implementation of an operational Implementation Plan. Through collaboration with Indigenous groups and other stakeholders, develop a list of final linear and polygonal disturbances that will have restoration treatments applied.

Develop a descriptive list of candidate linear disturbances for offset restoration and develop a decision framework with ecological and social criteria (i.e., performance measures) to prioritize or rank restoration actions for specific footprints or disturbed areas. Approximately 670 ha of candidate linear disturbance and 29,076 ha of existing ZOI are currently available candidates for treatment within 10 km of Highway 3 and the Ṯł̱cẖq̱ ASR (Figure 5-1); screening should begin with these linear disturbances. **This will begin in Q2 of 2022 and be completed in Q3 2022 to allow consultation and implementation to begin in Q3 2022.**
3. Work with GNWT-ENR to review and implement the offset actions and monitoring needed to evaluate the efficacy of restoration in the proposed candidate areas. The collaboration should include discussion on site assessment criteria or any necessary consultation to finalize an operational Implementation Plan for

restoration of existing linear disturbances and reforestation of fire-disturbed areas. **This will be completed in Q2 2022 to allow consultation and the beginning of Implementation Plan development in Q3 2022.** A detailed schedule for implementation would be provided within the operational Implementation Plan.

4. **The Tłı̄ch̄o ASR Implementation Plan will be completed by November 2022 (Q4 2022).** The Implementation Plan should be revised as needed to respond adaptively to monitoring results. Should linear restoration be deemed to not be effective, other offsetting options would be explored as necessary to meet the functional restoration goals of the Final Habitat Offset Plan.
5. Acquire and germinate appropriate seed from conifer trees and use seedlings in any planting proposed. Include Indigenous support wherever necessary to collect seed or advise on techniques. Seedling planting or aerial seeding may be used to promote germination. Seeds may need to be collected from specific locations in NWT to ensure that the seedlings planted are physiologically adapted to the short growing season and cold climate of the region in NWT they will be planted. Seeds may require between 18 and 20 months before they have germinated and grown to an acceptable size for planting. **This will commence in Q1 2023 to ensure seedlings have enough time to grow for planting in Q1 2024/2025.**
6. **Begin offsetting based on the Tłı̄ch̄o ASR Implementation Plan in Q3 2023** or as soon as site conditions allow.

**Table 5-4
 Proposed Timelines for Preparing Implementation Plan**

Action		2021				2022				2023				2024				2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Develop Implementation Plan																									
1	Determine offsets required based on residual effect of TAsR																								
2	Collaborate with Indigenous organizations; develop list of candidate and final linear disturbances for restoration																								
3	Determine appropriate offsets																								
4	Finalize the Implementation Plan																								
Implementation																									
5	Procurement of resources to begin work																								
6	Acquire seeds and begin germination																								
6	Begin offsetting using the Implementation Plan																								
Ongoing Restoration Until Completion																									
Construction Complete																									

5.6 Decision Framework

Figure 5-2 presents a decision framework for determining which offset measure should be prioritized in the Wek'èezhì Resource Area. The framework presents a decision tree to implement the two offset measures planned: 1) restoring existing linear features, and 2) reforesting existing burned areas within future or existing protected areas. The framework illustrates an approach to finalizing the Implementation Plan, including phases that will require engagements with Elders, Harvesters, and community members, and implementing the work once all locations and offset measures have been finalized. A Multiple Accounts Analysis may provide a practical way of incorporating all of the decisions into a balanced decision model.

The **Planning** stage focuses on finalizing the total area required for offsetting for the Project, in particular, determining the total area required for offsetting and drafting an Implementation Plan. Identifying candidate offset areas at this stage and verifying with Indigenous organizations that the linear features are suitable for restoration will be important.

Indigenous Engagement will begin early in the process and continue throughout to the Implementation and Effectiveness Monitoring stages (Figure 5-1). A pre-treatment inventory of candidate linear features for offsetting will

be an important step to understand the most effective location for restoration and to develop site-specific prescriptions (e.g., if access management is the goal, then mounding, ripping, tree bending, and planting shrubs and trees would be most prescriptions). This stage will require close collaboration with the people that use the land to determine if the area proposed for restoration is an important traditional trail. During this stage, the Implementation Plan and restoration areas will be finalized, and the restoration measure will be selected (i.e., access management, impede line-of-sight, and/or revegetation).

The **Implementation Plan Development** stage is when the plan is written and all future considerations have been incorporated (e.g., Indigenous participation, linear feature selection, site-specific restoration treatments have been chosen). Appropriate effectiveness monitoring programs will be fully developed to ensure offsets meet the desired objectives. Measurable performance targets and criteria for offsetting success will be set during this stage. Appendix D provides a framework for development of this plan.

The **Implementation** stage will focus on the physical work of restoring linear features, followed by identifying suitable areas for reforesting fire-disturbed areas, in particular restoring habitats in protected areas (if available) to enhance permanency of the offset.

The **Effectiveness Monitoring** stage will focus on long-term monitoring of the offsetting work. Monitoring should be conducted with the support of Indigenous community members. Monitoring should consider boreal caribou range planning work happening concurrently, and may include monitoring methods such as:

- field survey of treatments including tree survival assessments (Years 1 to 3);
- vegetation response plots or photo boards (Years 1 to 5 with a revisit at Year 10);
- remote camera deployment and image analysis (Years 1 to 3);
- wildlife tracking; or
- ongoing monitoring and analysis of existing GPS collars on wildlife in the region.

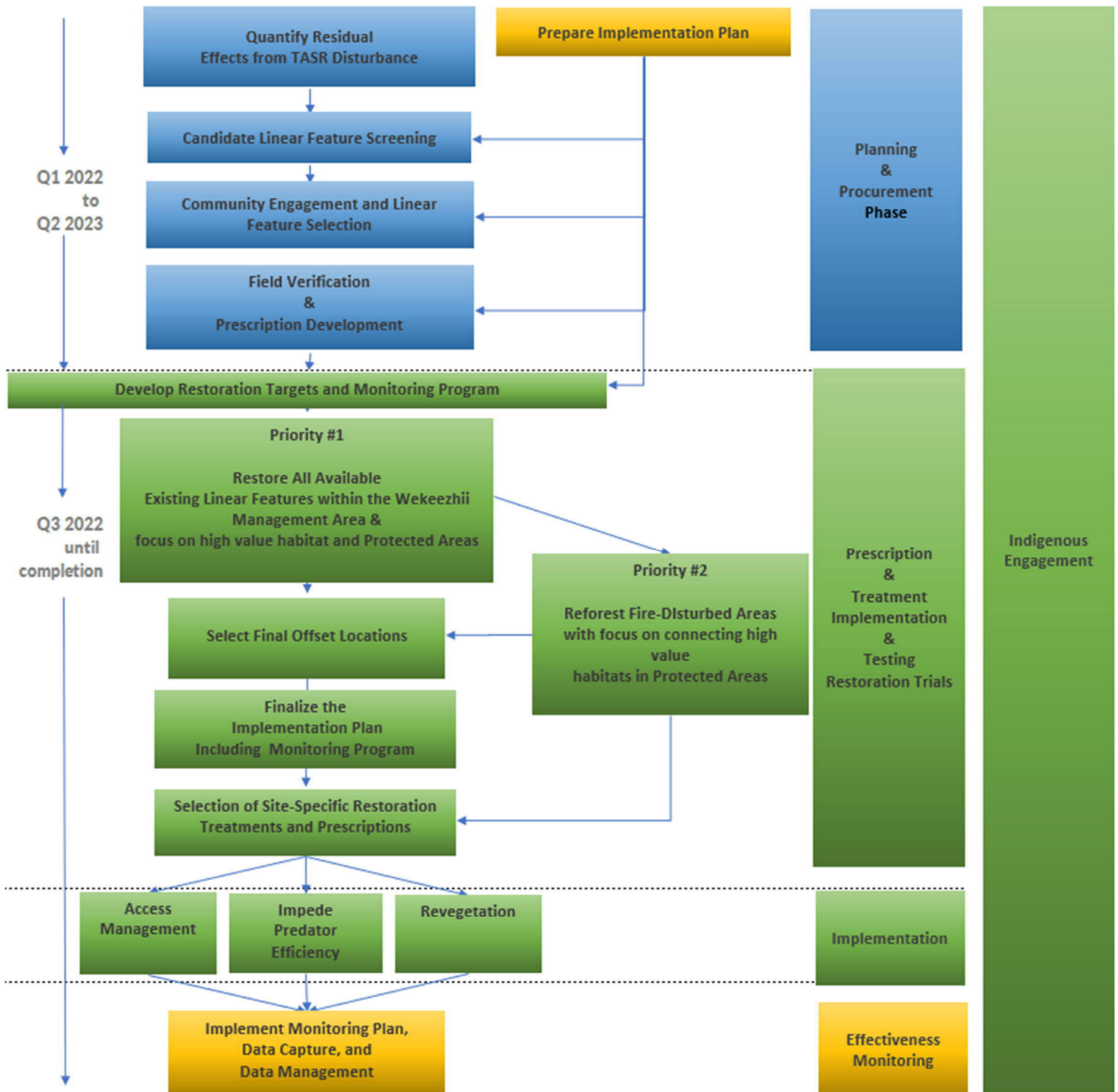


Figure 5-3
 Decision Framework for Offset Option Selection

6 SUMMARY AND RECOMMENDATIONS

Habitat offset calculations are the area required for offsetting based on the current knowledge of residual effects of the Tłıchq ASR on boreal caribou (t̄qdzı) habitat. Direct disturbance is the areas where physical habitat loss will occur from the Project; direct disturbance will be offset at a 4:1 ratio. Indirect disturbance (i.e., the ZOI) will be offset depending on the value of the habitat that will be indirectly disturbed (Table 5-1). The ZOI for the road surface and ROW will have an indirect effect on boreal caribou (t̄qdzı) habitat. Because the boreal caribou (t̄qdzı) habitat within the ZOI will not be physically disturbed and sensory effects are anticipated to be intermittent and low in magnitude (Golder 2017), the offset ratios applied to the ZOI are reflective of the residual effect as well as of the level of habitat use by caribou that will be indirectly affected.

For habitat that was shown to be selected by boreal caribou (t̄qdzı) in the RSF model (DeMars et al. 2020), an offset ratio of 2:1 is applied to the ZOI, and for habitat that was shown to be not selected by boreal caribou (t̄qdzı), an offset ratio of 1:1 is applied to the ZOI. Table 5-2 is the habitat balance table that summarizes the total area of each disturbance type for the Tłıchq ASR road surface, ROW, and ZOI. The final area required for offsetting (i.e., Total Tłıchq ASR Offset Commitment) is provided with the offset ratios applied.

No existing regulatory framework or registry currently exists where the Tłıchq ASR offsetting can be tracked (e.g., treatments completed, monitoring, and rate of success). A formal process to manage data from Tłıchq ASR offsetting will be necessary to track effectiveness monitoring and adaptive management, and for future offsetting applications.

Based on the current calculations, the total area of the road construction is **9,472.6 ha** and net area impacted (residual effect area) is **811.6 ha**. Based on the Road Surface + ROW + ZOI and calculated offset ratios, the **Total Area Required for Offset** is **2,846.4 ha**. Based on recent mapping of existing linear features completed to date, approximately 670 ha of candidate linear disturbance and 29,076 ha of existing ZOI are currently available candidates for treatment within 10 km of Highway 3 and the Tłıchq ASR (Figure 5-1). Additional linear features exist that have not yet been mapped and are visible in high-resolution imagery. All of the candidate linear features available for offsetting are accessible from the Tłıchq ASR and Highway 3.

In line with the mitigation hierarchy, there is still opportunity to reduce the **Total Area Required for Offset** through mitigation. Mitigation following construction should focus on restoring legacy borrow sources and any additional linear features within the ZOI that are not used as traditional trails. Restoration should focus on returning ecosystems to functional boreal caribou (t̄qdzı) habitat to reduce the area of residual effect and the amount of total offset area required for the Project. For borrow pits, this means that additional revegetation will be implemented beyond the minimal reclamation standards contained within land use permits and doing so will reduce the residual effects of the Project and ultimately the total offset required.

With respect to the use of existing trails for potential offset areas, it is important to identify and remove from restoration planning any traditional trails that have continued use and value to the communities. However, some of these trails may be available for restoration if they are not important traditional trails. Consultation with Tłıchq Government, WRRB, and other affected Indigenous organizations will be important to determine their use and value to Indigenous peoples (i.e., the past, current, and future Traditional Use). Priority for offsets is the identification of existing linear disturbance in the Wek'èezhìi Management Area suitable for restoration.

Objectives of linear feature restoration are to:

- Manage human access;
- Recover vegetation along linear features; and
- Impede movement efficiency of predators.

Potential offset areas that do not appear in existing disturbance mapping data (e.g., linear features that have not yet been mapped and recognized by ECCC or GNWT-ENR) will likely be sufficient to meet the offset commitment required for the Tłı̄ch̄o ASR. However, if not all of the offsetting can be completed on linear features, compensation may require another offset measure, such as reforestation or restoration of habitat in existing or proposed protected areas and high value caribou habitat (based on the RSF habitat model and Traditional Knowledge).

Reforestation of fire-disturbed areas is an alternate approach proposed for offsets; however, this option has been modified from the Draft Plan following the consultation process. Reforestation could be an effective method to gain offsets for the Project, and the focus for areas to implement this should look to existing or proposed protected areas that have burned in the past and disturbed high-value caribou habitat that may benefit from reforestation (e.g., reduced predator movement efficiency, reduced human access, reduced alternate prey habitat). Offsetting using reforestation of previously burned areas should only be considered if all possible linear features have been restored and the total offset area required for the Project has not been achieved.

Objectives of reforestation are to:

- Accelerate the natural forest regeneration time (from a natural regime);
- Produce security cover for boreal caribou (t̄ōdzı); and
- Connect large patches of habitat to reduce habitat fragmentation.

A detailed **Implementation Plan** should be developed before work proceeds (Appendix D). The Implementation Plan will be valuable in determining the best sites to focus on for offsets, the tree species that should be planted, and other site-specific information (e.g., soil moisture, nutrient condition) to promote successful reforestation. During this stage, costs associated with the proposed offsets will become clearer because the total area and type of restoration will be better understood. Prescriptive details on offset actions will include the total area of mounding or tree planting required for a specific linear feature. The Implementation Plan would also provide a detailed effectiveness monitoring plan based on site-specific restoration objectives.

As offsetting for caribou (t̄ōdzı) is new in NWT, it is necessary to assess the effectiveness of mitigation, restoration, and offsetting measures to determine which approaches work best in restoring caribou habitat. Monitoring will be supplemental to the offsets implemented and will include the developing and monitoring performance targets for

- assessing survival and growth of shrubs, trees, and lichen (i.e., forage and security habitat);
- continuing to monitor caribou habitat use through GPS collar data and camera trap surveys;
- assessing use of offset areas by alternate prey (e.g. bison and moose); and
- assessing and detecting changes in use of offset areas by human hunters and predators.

Challenges are certainly present in moving forward with a detailed Implementation Plan. These include the important discussions and decisions based on:

- where (i.e., which linear corridors or burned areas specifically) the offsetting work should be completed;
 - this requires an engagement strategy with affected Indigenous groups in the coming year(s);
 - efficient approach may be to have candidate areas selected in advance and negotiate / screen out those that are not suitable;
- the procurement process and decision criteria for who will implement the offsetting work; and
- the development of a site-specific restoration treatment plan (e.g., mounding with seedling planting) to confirm habitat offset amount, budget, and schedule.

We recommend using the proposed decision framework for selecting restoration areas and monitoring to determine the most successful prescriptions for use as offsets under various conditions in an adaptive management framework.

Rationale for detailed planning that identifies the need for both short- and long-term monitoring programs following implementation are provided in Appendix D.

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CERTIFICATION PAGE

This report presents our findings regarding the Government of Northwest Territories Department of Infrastructure Tlicho All Season Road Caribou Habitat Offset Plan.

Respectfully submitted,

Prepared by:



Keenan Rudichuk, R.P. Bio.
Project Biologist



Sean Sharpe, M.Sc., R.P. Bio.
Project Biologist

Reviewed by:



Corinna Hoodicoff, M.Sc., R.P. Bio.
Manager, BC/Northern Division

APPENDIX A – TRADITIONAL KNOWLEDGE INCORPORATED

Workshop Number ¹	Key Themes and Points	What we heard and Associated's Response	Offset Plan Section that addresses Traditional Knowledge Shared
Elders			
1, 3	Why only looking in Wek'èezhii for the offset plan? Offsetting should not be based on jurisdictional lines, but on the population range, otherwise offsetting may not be effective. Why not look outside the boundary, since the ṯdzı don't move based on boundaries.	Measure 6-3 identified organizations that we must collaborate with. Together it was decided that we would first focus on offsetting within the jurisdiction of the project. There is limited human or linear disturbance in the area, but there is a lot of fire disturbance which has had a big impact on ṯdzı habitat. NWT offsetting policy is in development, we can inform that work. It is a good opportunity to see how offsets can work in areas that have low linear disturbance near the project footprint.	Effectiveness is the primary focus. Although we are not initially looking outside the boundary, it doesn't mean that consideration cannot be included in our work to inform future policy work. Infrastructure needs to keep the project on track and if looking outside Wek'èezhii, cannot accommodate additional time in the schedule to extend engagement beyond the current timeframe.
2, 3	Animals have wisdom. They use their sense and their memory to move and use the land.	Associated documented priority areas used by ṯdzı and areas no longer used by ṯdzı.	Map of priority offsets areas and actions.
2, 3	Climate change is having a big impact on the land and animals. Increased fire frequency and intensity is changing the land for people and ṯdzı. Fire is the major factor that has changed ṯdzı numbers and use of Wek'èezhii.	There needs to be emphasis for offsetting on protecting ṯdzı habitat that is left from fires. Offsets should include measures to fight fires quickly and identify ṯdzı habitat as a critical value to protect. By doing some planting, we can help bring the soil back. We would just be helping the natural process go a bit faster. It can take time, but eventually it is enough for trees to take root again.	Offset measures that address local fire-fighting capability, identification of ṯdzı habitat as a critical value for fire protection and restoring burned areas linking remaining ṯdzı habitat.
1,2, 3	We need to balance the needs of people and wildlife.	The public and community needs that road. We need to help people, but we also need to help animals and hunters.	The purpose and objectives of the offset plan and mitigation plans are to minimize impacts on animals and people, during construction and use of the road.
2, 3	There is support for the idea of trying to help the forests come back faster, though there is some doubt if it can work. Conditions are different here than in the South.	We propose doing some testing to see what works best. We will gather seeds from the area, start them in a nursery and then plant the seedlings and monitor how well they do. Sites will be chosen where trees were growing well before fire.	Offset measures that propose replanting in strategic areas and site preparation that increases seedling survival and growth (e.g. mounding)
3	We can't only focus on bringing back forest. Ṯdzı need food and they eat lichen. Can you help with that?	It is possible to seed lichen and encourage lichen growth more quickly. There are two types ṯdzı like to eat: on the ground and in trees.	Offset measures for ṯdzı will include consideration of speeding up lichen re-establishment through replanting and site preparation such as mounding and rough ground disturbance.
3	Replanting and other offsetting activities can provide a way to get people out on the land.	This is a benefit. it will create small work projects. We will propose that mitigation and offset work is conducted by local communities, especially youth.	The offset plan recommends community-based offsets implementation.
3	There is some concern about using radio collars on ṯdzı as part of monitoring and research.	We understand that collaring is disruptive to animals, but collars have improved a lot (lighter and drop off over time) and we are careful which animals we collar (larger females). In our experiences collared cows have continued to do well and we have not seen increased mortality associated with collars. Still, this is something we would have to watch carefully. We propose supporting government studies in collaboration with the communities. The use of remote wildlife cameras can also be used to understand ṯdzı and predator movements related to offset measures.	Monitoring is important for understanding the effectiveness of offset measures but will be done in collaboration with Communities. The objective is to continue existing ENR studies, not increase or add large numbers of new collars.
3	It is a good idea to collar wolves to see where they are and how they are behaving, where they are killing caribou. There are mixed views about killing wolves and bears.	It is a good idea to collar wolves to see where they are and how they are behaving, where they are killing caribou. Some will see it as a good economic opportunity that will help the ṯdzı, but other have spiritual beliefs that do not allow them to kill wolves or bears.	Offset measures may include recommendations for increased killing of wolves or bears, but only if predation is determined to be a problem in the offset area.
3	Traditional Knowledge and western science need to work together.	Need to involve the community in the design and implementation of studies and report the results to them.	All Offset measures will rely on a collaborative approach using western and Traditional Knowledge.
2, 3	Include a focus on White Beach area for caribou offsets and consideration as a protected area.	The White Beach area has been added to the priority area for implementing offset measures. These include potential as a protected area and removal of mineral tenures.	Map of priority offsets areas and actions. Potential consideration as a protected area.

Workshop Number ¹	Key Themes and Points	What we heard and Associated's Response	Offset Plan Section that addresses Traditional Knowledge Shared
3	Learn from what has been done in other places.	We will learn from other Indigenous people and other offset projects, to exchange ideas about how to deal with fires, replanting, wildlife, etc.	Inclusion of learnings and approaches from other offset plans and projects.
2, 3	There are concerns that buffalo along the TASR displace t̓d̓zi.	Although bison are a concern for highway safety and possible impacts on t̓d̓zi, they are also a species at risk so management of them will require a balance of conflicting objectives.	Propose mitigation measures that decrease bison habitat along the road right of way to reduce attraction of bison to the TASR. Offsets measures will focus on improving t̓d̓zi habitat and decreasing bison habitat value.
2, 3	Restoration for offsets using trails would restrict traditional use and trails that are culturally important.	The limited number of trails and linear features in Wek'èezhii make direct habitat offsetting a less preferred and available option as many of the trails are important for cultural reasons.	Offsetting measures may include linear disturbance in some cases, but much of the focus on offsetting will be on fire suppression and habitat restoration of burns.
2,3	Consideration of reducing moose and moose habitat as an offset for caribou. After fires, the bush is often too thick for caribou and moose increase in the area and caribou leave.	Tl̓icho Government noted that it may not be a good idea to look at reducing moose forage because hunters also hunt moose near What̓i. Thinning of bush may be considered an approach to offsets in some areas where moose have increased.	In some areas, it may be suitable to use offsets to increase t̓d̓zi habitat, but it will have to be balanced with community need for moose.
2, 3	Consultation is important to make sure that things are done right for the land and people. Security of people's land, campsites, access to wildlife and trees are important cultural things that will be affected by the road and new access opened to more people from outside. Social impacts of the road are a concern to many elders.	Knowledge holder's information is confidential and not shared with the public in detail. Concern about increased access and impacts will be passed on to Infrastructure. Although social issues outside of the scope of the offset plan, the concerns will be passed on to Infrastructure to include in mitigation and monitoring. If increased access and hunting of t̓d̓zi due to the road occurs, legislation and regulations to restrict hunting may be required as part of mitigation.	Specific locations identified in workshops were not put in the plan. The balance of traditional access using linear trails vs increased use by the public are considered in recommendations for habitat offsets using trails. Generally, regulation and legislation would not be considered as offsets, but as mitigation measures. The offset plan will be part of the overall mitigation plan.
2	T̓d̓zi are always moving and numbers are changing. The cycle of use and abundance of caribou will come back and there will be an "explosion" of caribou on the land.	We acknowledge that caribou may return naturally, and the offset plan is intended to compliment traditional knowledge and help speed up the return of caribou.	Through collaboration, both traditional knowledge and western science are used to identify components and priorities of the offset plan.
2, 3	Restoration of burned areas may take many years before the habitat is again suitable for t̓d̓zi.	We need to try different pilot approaches to re-growing trees and lichen and monitor to identify which techniques work best and where. Fire protection of remaining t̓d̓zi habitat is very important.	Fire suppression in remaining important t̓d̓zi is a priority consideration in the offset plan.
2, 3	Collaring wolves (and bears) may be important to understand interactions and threats to t̓d̓zi.	Monitoring of effectiveness of offset measures needs to include assessment of predators use of the ASR right of way and offset areas.	Monitoring of effectiveness of offset measures needs to include assessment of predators use of the ASR right of way and offset areas.
2, 3	T̓d̓zi need large islands for protection while calving.	Increased fire protection of large islands and possible predator control on large islands may be considered in the offset plan.	Areas for offset measures priorities are mapped.
2, 3	T̓d̓zi are part of all wildlife and our environment and any offset plan must look at the integration of all aspects.	We are looking at an ecological approach to offsetting that considers interactions of t̓d̓zi with other animals (small mammals, fish, other animals like moose and bison, and predators such as wolf and bear)	Offset measures are identified that benefit t̓d̓zi, but also balance the needs of other animals and their environment needs, as well as social and cultural needs for those animals.
Harvesters			
2, 3	The land is big and changing all the time. The map you are presenting is a big area and difficult to think of restoring fires that big.	We agree that the map is small compared to the land. Our actual offset efforts will look to places within old burns, for example, that would benefit t̓d̓zi the most. We will look to restore connection to patchy habitat by reforesting areas between to create habitat patches bigger than 500 ha.	Offsetting effort for reforestation will first look to fire intensity maps and identify easy-to-restore corridors where burn intensity is moderate. Regeneration of moderate burn intensity should be more successful than high intensity because the soil will still have nutrient availability.

Workshop Number ¹	Key Themes and Points	What we heard and Associated's Response	Offset Plan Section that addresses Traditional Knowledge Shared
2, 3	Caribou use burned areas less than non-burned (or older burns). Future burns may further reduce caribou (t̄qdz̄i) habitat connectivity in the Wek'èezhìi Management Area.	We recognize that fire affects caribou and their habitat and that the remaining areas are important to protect from future fire if caribou avoid burned areas. Recent collar data suggests that caribou may use burned areas for some purpose; however, not enough information is available from the collars to completely understand why caribou are selecting burns. A better understanding may be gained by analyzing collar data to see why they are selecting burned areas and see if that behaviour changes as we conduct reforestation	Reforestation of specific burned areas will increase the speed at which forests grow. We believe that the sooner trees grow back, the sooner caribou will begin to use the new forests for security. Lichen growth will occur over time which will provide more habitat value sooner than if it is left to recover naturally.
2, 3	There are many important cabins and trails that should not be disturbed.	We understand that many cabins and trails are used currently and historically in the region. The mapping shared by the T̄jch̄q Government (i.e., the Dene Mapping Project) demonstrates this well.	The offset plan recommends that no significant restoration of linear features occurs along the T̄jch̄q ASR. Mapping of cabins and trails has been completed, and those maps will be reviewed by T̄jch̄q citizens before any work is completed.
2, 3	Moose use areas that have burned recently more than caribou.	Moose tend to use early seral (young growth) vegetation because it is palatable and provides good nutrition for them. Caribou eat the shoots of young shrubs also, but primarily rely on older forests that have abundant lichen and wet areas for survival and reproduction. In some extreme instances, moose out-compete caribou for habitat and their high density can stall forest generation through intensive foraging.	Options for reforestation include vegetation management, which may be reduction of moose food. Less food for moose in some areas will deter their use and promote use by caribou.
2, 3	Many traditional trails exist and are continuously used in the Wek'èezhìi Management Area. Harvesters use different areas to hunt, trap, and gather different species.	We recognize that some areas are more valuable to species than other. Through mapping exercises with Elders and Harvesters we have a reasonable understanding of areas used by caribou, moose, furbearers and other trap species, and bison. We understand that many of the existing trails off of the existing Old Airport Road are used throughout the year for various reasons.	Offsetting to restore legacy linear features has been proposed along the Highway 3 corridor, and target areas should be selected in consultation with T̄jch̄q Government and other users of the land.
2, 3	The new road may result in more hunting pressure on caribou (t̄qdz̄i).	Efforts to reduce hunting pressure on caribou would fall under mitigation. Discussion on creating no-hunting zones was dismissed through the Environmental Assessment process; however, mitigation to reduce hunter access will be included in the mitigation plan.	Mitigation measures identified in the Environmental Assessment of the T̄jch̄q ASR and Wildlife Mitigation and Management Plan will address the increase in hunting pressure. Large policy changes, such as changes to hunting regulations are not within the scope of a habitat offset plan. Through the consultation process for this plan, GNWT-ENR has been involved in discussions about increased hunter pressure on boreal caribou (t̄qdz̄i).
2, 3	Much of the land is burned and the remaining areas with good caribou (t̄qdz̄i) habitat is limited.	Burns create patchy habitat. If forest restoration is an offset that is supported by the Collaborators Working Group, then we would look to restoring areas that will return connectivity to habitats through tree planting and other reforestation techniques that are economically feasible. Selecting priority areas that are moderately burned that, once reforested, create patches of contiguous habitat larger than 500 ha will be the target.	The Habitat Offset Plan focuses on restoring habitat disturbed by wildfire. We also identify fire suppression as a valuable tool to protect existing areas with good habitat from being burned in the future.
2, 3	How do we know how healthy the land is? Ashes from burns may have polluted waters that wildlife drink. Will the people who live off the land get sick from eating t̄qdz̄i or drinking from the water?	We are not aware of any specific studies that look at vegetation, water, or wildlife health in the region outside of the footprint of the T̄jch̄q ASR. It is possible that studies have occurred, and GNWT-ENR will know more. Potential offsetting options could look at t̄qdz̄i health as part of the option to address survival and reproduction.	Supplemental research has been recommended as an option to monitor the ongoing health and well-being of boreal caribou (t̄qdz̄i) and the land. General "environmental studies" to determine the quality and health of water and vegetation does not qualify as an offset to caribou; however, if monitoring is conducted in areas where reforestation occurs, for example, they may qualify as offsets.
2, 3	Bison are moving up the road (to the north) and pushing out caribou (t̄qdz̄i).	We have heard reports that bison have been moving further north. Bison and caribou tend to not live together and are competing species for certain resources. Management to reduce forage for bison, which would deter their use, will be addressed by a mitigation plan for the T̄jch̄q ASR.	The habitat offset plan recommends measures to change forage that is preferred by bison. Similar to moose, if the forage changes, then we anticipate fewer bison will use the area, promoting more use by boreal caribou (t̄qdz̄i).

¹ Workshop 1 held February 21-22, 2019; Workshop 2 held April 23-24, 2019; Workshop 3 held May 9, 2019.

APPENDIX B – INFORMATION REVIEWED

MVEIRB Public Registry Documents

Document Title	Source	Public Registry ID ¹	Originator
Project Description Report 2016	MVEIRB Public Registry	7	Developer
Appendix BB - 11 x 17 Figures of TASR road routes	MVEIRB Public Registry	7	Other
Appendix U - Stantec Archaeological Impact Assessment Report August 2014	MVEIRB Public Registry	7	Developer
Summary of Community Scoping Session in Whatì	MVEIRB Public Registry	19	Review Board
Traditional Knowledge Study Report - May 16-16	MVEIRB Public Registry	28	Developer
Recovery Strategy for the Woodland Caribou, Boreal Population in Canada	MVEIRB Public Registry	38	Federal or responsible minister
Note to File - GNWT TASR flight route video - October 7	MVEIRB Public Registry	51	Review Board
Note to file - GNWT TASR updated Sept 1, 2016 flyover video	MVEIRB Public Registry	55	Review Board
Recovery Strategy for Boreal Caribou (<i>Rangifer tarandus caribou</i>) in the Northwest Territories	MVEIRB Public Registry	106	Parties/Public
Developer's Adequacy Statement Response	MVEIRB Public Registry	110	Developer
Overview - Boreal caribou habitat and habitat use in the Wek'èezhìi, 2012	MVEIRB Public Registry	177	Parties/Public
Boreal caribou habitat and disturbance in the Wek'èezhìi, 2013	MVEIRB Public Registry	178	Parties/Public
Caribou distribution data (commitment 3)	MVEIRB Public Registry	189	Developer
Caribou distribution data maps	MVEIRB Public Registry	190	Developer
WRRB response to Commitment 11	MVEIRB Public Registry	210	Parties/Public
NSMA's technical report	MVEIRB Public Registry	214	Parties/Public
WRRB's technical report	MVEIRB Public Registry	215	Parties/Public
Tłı̨chų Government's technical report	MVEIRB Public Registry	216	Parties/Public
YKDFN's technical report	MVEIRB Public Registry	217	Parties/Public

Document Title	Source	Public Registry ID ¹	Originator
WRRBs Technical Report - boreal woodland caribou	MVEIRB Public Registry	228	Parties/Public
Summary of elder site visit of the TASR alignment	MVEIRB Public Registry	234	Developer
GNWT response to WRRB technical report on boreal caribou	MVEIRB Public Registry	240	Developer
NSMA's public hearing presentation	MVEIRB Public Registry	250	Parties/Public
Tłıchǫ Government public hearing presentation for day 2	MVEIRB Public Registry	252	Parties/Public
YKDFN's public hearing presentation	MVEIRB Public Registry	254	Parties/Public
WRRB's public hearing presentation for day 2	MVEIRB Public Registry	256	Parties/Public
WRRB's public hearing presentation for day 3	MVEIRB Public Registry	257	Parties/Public
NSMA's closing arguments	MVEIRB Public Registry	281	Parties/Public
WRRB's closing arguments	MVEIRB Public Registry	282	Parties/Public
YKDFN's closing arguments	MVEIRB Public Registry	283	Parties/Public
Tłıchǫ Government's closing arguments	MVEIRB Public Registry	284	Parties/Public
Tǫdzı (Boreal Caribou) and the State of Their Habitat	Wek'èezhì Renewable Resource Board	n/a	Wek'èezhì Renewable Resource Board
Traditional Knowledge Report Summary - YKDFN	Yellowknives Dene First Nation	n/a	YKDFN
North Slave Métis Alliance Report of Traditional Knowledge	North Slave Métis Alliance	n/a	NSMA

Additional Documents Reviewed

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APPENDIX C - CONCORDANCE TABLES OF COMMENTS

Table 1 – Concordance of comments on the First Draft (delivered June 17, 2019) of the Boreal Caribou Habitat Offset Plan for the Tłı̨chǫ All Season Road.

The following table reflects the comments made by the Collaborators Working Group, including Government of the Northwest Territories' Department of Infrastructure (GNWT-INF), Department of Environment and Natural Resources (GNWT-ENR), Tłı̨chǫ Government (TG) and the Wek'èezhìi Renewable Resources Board (WRRB); as well as, North Slave Métis Alliance (NSMA) and Environment and Climate Change Canada. Although a copy of the draft HOP was delivered to them, no comments were received from the Yellowknives Dene First Nation. Comments addressed here are those that were more than editorial in nature or made direct recommendations for changes in text.

Organization	Page Reference	Topic	Comment	Response
GNWT-INF (Benjamin Bey)	3-1	Offset Ratios	Any rationale for the different ratios? A sentence or 2 on the reason(s) for having different ratios by disturbance type may help.	Included in revised Draft.
GNWT-INF (Benjamin Bey)	3-1	Reforestation	This paragraph [referencing reforestation in Section 3.2.3] seems to be out of place. Please consider moving it under section 3.2.4 Prioritize Offsets. My concern also is that Tłı̨chǫ and Whatı̨ Community Governments may be looking to see fire suppression as one of the primary focuses because it was one of their major concerns and somebody may be disappointed that fire suppression is rather playing a second fiddle.	This paragraph was moved. Offsetting is typically (and preferably) an activity with measurable outcomes relating to improving caribou habitat. While fire suppression will have a positive impact on protecting remaining caribou habitat, it is not a method commonly used in caribou habitat offset planning. This recommendation was introduced during the workshops as fire was the primary impact to caribou habitat in the area, and although its recognized as not a typical offset, will protect remaining habitat and habitat that has been restored (as part of the Tłı̨chǫ ASR offsetting) from destruction by fire. Later revisions of the HOP considered fire suppression a support measure for offsetting.
GNWT-ENR (James Hodson)	i	Collar Programs	ENR does not feel collar programs should be an offset. It should be part of the overall offsetting program, but would be part of the monitoring phase to assess effectiveness of offset actions.	To clarify, the recommendation of caribou collars is to monitor the effectiveness of the offset and it was considered a monitoring recommendation rather than an offset.
GNWT-ENR (James Hodson)	i	Bison Management	There's an implicit assumption that bison are impacting caribou, which needs to be tested. Otherwise efforts could be misdirected. I would also refer to this as Bison Habitat Management, since we can't take actions such as increasing bison harvest because that would be counter to the Mackenzie Bison management plan.	Changed the title to include 'habitat'. Bison habitat management recommendations are about alternate prey dynamics, not interspecific competition. Bison habitat management plan may conflict with caribou habitat management and moose habitat management, and coordination will be required to ensure that caribou offset efforts are not compromised by bison habitat management.
GNWT-ENR (James Hodson)	i	Moose Management	Also might want to call this Moose Habitat Management. The danger with this is that if you reduce moose which are already at low density in the region, people may just turn to harvesting more boreal caribou.	As above (reference to bison management)
GNWT-ENR (James Hodson)	i	Hunter management	I'm not sure this [hunter management] should be included as an option right now, given that GNWT already ruled this out through the modification of Measure 6-2 (which called for establishing a no-hunting corridor along the road).	Hunter management was a point of discussion during the workshops, so included here but is considered adaptive management (rather than an offset option); technically management of hunting pressure is a mitigation measure for the Tłı̨chǫ ASR and including this as a recommendation further supports the need for ongoing consideration. Measure 6-2 of the REA also discusses hunter management.
GNWT-ENR (James Hodson)	i	Final HOP	Not sure if I'm comfortable kicking this ball down the road [referencing the Final Habitat Offset Plan]. We'd have to have the residual effects figured out at minimum 90 days prior to opening the road which is when the final plan is due. Construction may not be complete by then, so we won't know what the final footprint is. Permits and licenses have already been issued, and the wildlife management and monitoring plan [WMMP] for the project will be finalized by September. At this point the mitigation measures are already identified. The residual impacts were already identified and quantified during the environmental assessment.	The project footprint (direct impact) can be evaluated from the design drawings (currently in development) prior to construction. Mitigation of the potential impacts will be informed by the WMMP, and residual impacts can then be quantified so areas for offsets may be more accurately calculated. Recall that: Direct Impacts – Mitigation = Residual Impacts, and Residual Impacts x Offset Ratios = Area of Offsets

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				The final draft HOP presents conceptual area of offsets, although we recognize these are overestimated without final design drawings. Because residual impacts are multiplied by offset ratios, it is beneficial to confirm amounts and locations of residual impacts before confirming offset areas.
GNWT-ENR (James Hodson)	1-2	Borrow sources	In the updated project description for the TASR submitted for the land use permit and water licencing phase, there are now 21 borrow sources under consideration. These should be included on the map. A 500 m buffer should also be applied to the borrow sources, as the 500 m buffer applies to all types of human disturbance, not just roads.	There are 21 identified borrow sources that may potentially be developed, although not all are expected to be needed. Since a 500 m buffer will be applied to each of these and multiplied with an offset ratio, it is prudent to confirm which are being used and reclaimed (mitigation) before confirming offset commitments. The calculations in the final draft HOP includes all 21 borrow sources as an estimate, understanding that the final number is likely to be approximately 13.
GNWT-ENR (James Hodson)	1-4	Reclamation	Not clear to me from the closure and reclamation plans that the borrow sources would ever really be restored to what could be considered boreal caribou habitat. Maybe this is another offsetting option - i.e. requiring a higher standard of restoration of borrow sources than is currently planned to make sure they return to boreal caribou habitat as much as possible.	Restoration of borrow pits is considered mitigation rather than offsetting. However, we have recommended caribou-specific objectives for reclamation (e.g., planting with trees) rather than just grass seeding.
GNWT-ENR (James Hodson)	2-1	Fire disturbance	<i>"approximately 60% of the Wek'eezhii Resource Management Area provides undisturbed habitat for boreal caribou (t̄q̄d̄zi)."</i> ENR's most recent assessment based on more accurate fire perimeter mapping suggests there is 65.9% undisturbed habitat in the Wek'eezhii portion of the range with 34.1% fire disturbance and 0.8% human disturbance. You can cite the May 2019 version of the NWT boreal caribou range planning Framework as the source for these numbers.	Numbers have been updated and references cited.
GNWT-ENR (James Hodson)	2-1	Caribou Habitat	<i>"Therefore, all ecosystems in the Northwest Territories range (NT1) of boreal caribou (t̄q̄d̄zi) that have not been affected by fire within 40 years or human disturbance is considered suitable, effective habitat."</i> Not really. Just because an area is considered undisturbed does not mean that it is suitable or effective for boreal caribou. The national [Recovery Strategy] recognizes this in the second component of the critical habitat definition which is related to biophysical attributes.	Recognizing that baseline data was not available at the time the final draft HOP was drafted, a conservative approach was taken, and all land that would be disturbed by the T̄l̄ch̄q̄ ASR was considered effective habitat for caribou. Recommendations in the final draft discuss improvements to the quantification, in particular, overlay the project footprint on a habitat suitability map and ground-truth to determine the most effective areas before implementing any offsets. Use of only recent caribou use areas (e.g. collared caribou in the last 5 years) was considered too narrow a time to adequately describe caribou habitat needs and habitat value.
GNWT-ENR (James Hodson)	2-1	Quantification of Footprint	[Referring to Table 2-1] In a later table the total buffered disturbance footprint is ~10,000 ha - why are the estimates so different?	The initial estimate of potential impacts was a conservative projection (Adequacy Statement Response, Golder 2017), including allowances for potential deviations from the Old Airport Road, which may not necessarily reflect the actual footprint following design. The purpose of the table is to reflect the overall impact of fire disturbance in the region, and the overall impact of the T̄l̄ch̄q̄ ASR in context. final draft
GNWT-ENR (James Hodson)	3-2	Quantification of Offsets	<i>"A habitat balance table should be developed, once designs are finalized, that presents area summaries of final Project footprint, the area restored following mitigation, and the remaining residual effects which require offsetting."</i> But we need to have a final plan to the WRRB 90 days before the road opens. We should be able to come up with a good enough estimate now rather than waiting for more precise final numbers, and I don't think it will change the magnitude of the offset area that much.	The estimated project footprint presented is based on the Adequacy Statement Response, Golder 2017, which is based on a conceptual alignment following the Old Airport Road, without the benefit of design drawings or mitigation. The footprint was calculated by applying a conservative width including a 50 m (and at the La Marte River crossing a 100 m) buffer along the 97 km length to allow for possible deviations from the Old Airport Road alignment that may be necessary (approximately 485 ha extra). For example, if a 4:1 offset ratio is applied to this extra area, and reforestation costs approximately \$5,000/ha (that were referenced in other comments); the result of overestimating the project footprint (especially in absence of mitigation) is up to \$9.7m (= 50 m x 97,000 m x 4 x \$5,000).

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GNWT-ENR (James Hodson)	3-2	ZOI buffer	Later on in the draft plan you apply an offset ration of 1:0.5 for areas of burned habitat within the 500 m buffer. If we have evidence from collar data that boreal caribou are using those burned areas should they really be given a lower value?	It is not typical to offset for potential impacts in the ZOI (based on professional experience and the examples from projects reviewed); however, the measure committed INF to do this. A more modest ratio was recommended in the ZOI due to relatively low frequency and type of traffic expected to cause disturbance to caribou. As most of the linear corridor that the road will follow is already existing, potential disturbance in the ZOI should be monitored relative to baseline conditions now.
GNWT-ENR (James Hodson)	3-3	Reforestation	Big assumption that we can actually speed up reforestation and succession. The offset program should include a research design with appropriate controls to test whether this is actually the case. Based on results that Golder presented to us, on linear features at least, restoration projects only seem to speed things up by 10 years or so.	The hypothesis is that large burn areas may take longer to naturally restore on their own than with support of reforestation, so even achieving improved habitat cover after 10 years of growth is not insignificant. The primary goal of reforestation is to provide improved security for caribou (through tree cover), in which case 10 years advanced regeneration is a significant improvement. Response monitoring and the inclusion of different approaches and reference controls is an important part of determining effectiveness of this approach. The same discussion is relevant to direct offsets to restore existing linear developments as some research show that techniques used may have variable site-specific effectiveness (also the reason that offsets typically use ratios greater than 1:1)
GNWT-ENR (James Hodson)	3-4	Linear Features	I still don't think we've done enough homework to say that these features are "not immediately available". There are short linear features that extend off of HWY 3 that currently contribute to the human disturbance footprint in the region that should be evaluated as candidates for restoration. Since some of them provide access into caribou habitat for humans I think there could be a benefit to restoring them.	Agreed. Recommendations in the final draft HOP include ground-truthing potential areas for restoration along Highway 3 as well as along the Old Airport Road where the Tłı̄chǫ ASR does not follow the same alignment. Recommendations also include improved mapping that should be shared with GNWT-ENR, ECCC, and consultation should continue with affected Indigenous groups. The complication in this approach is that because the ZOI is included in areas that must be offset, short perpendicular trails or trails within the ZOI would not be counted as area for offsets.
GNWT-ENR (James Hodson)	5-1	Offset Ratios	<p>"Existing disturbed habitat is assigned lower offset ratio (e.g., 0.5:1), while undisturbed habitat is assigned a larger offset ratio (e.g., 4:1)." More rationale should be provided for this. If we have evidence that boreal caribou are using fire disturbed habitat why is it getting a lower value than the road that will replace it? I would advocate that it be 1:1. There is no acknowledgement in the report that ENR shared the boreal caribou collar data with you, and I don't see how it was considered in identifying the specific areas you identified for restoration.</p> <p>Why is existing anthropogenic disturbance rated higher than burned habitat? That doesn't make biological sense to me. If anything I expect it would be of lower value than burned habitat.</p>	<p>The collar data is one of many things considered; however, recognizing that the data are recent and representative of few individuals, careful consideration was taken to not overinterpret these locations. A reference to these data is included on page 3-5/6. Ideally, once a suitable Resource Selection Function for habitat value and use is developed for these caribou, the model could be used to assist in interpretation of the value of specific areas affected by the road and of areas proposed for offsets.</p> <p>The final draft offset plan considers all areas within the project footprint as suitable habitat, and all physical disturbance was assigned a preliminary 4:1 offset ratio. In other offset plans, disturbed habitat typically is assigned lower offset ratios and permanently disturbed habitat such as a road footprint receives the largest offset ratio.</p>
GNWT-ENR (James Hodson)	5-2	Offset Area	[Referring to ZOI offset area in Table 5-2] Is this overlap with existing buffered anthro disturbance, or overlap with existing unbuffered anthro disturbance? If it's unbuffered it seems like a high number. Would be helpful to a map explaining how these numbers were derived.	An explanation was provided, and a descriptive figure added (Figure 3-1).
GNWT-ENR (James Hodson)	5-3	Reforestation	What criteria, other than connecting undisturbed patches, did you consider? Any of the sites you identified will required detailed site assessments to determine whether natural regeneration is even an issue, and whether the type of site would be suitable for reforestation. Need to keep in mind that any area that doesn't have road access will require helicopter access to conduct reforestation	The areas were intended to be potential candidates to consider during the implementation phase. Specific areas within the proposed polygons would be ground-truthed and targeted for restoration if the potential for site-specific operability and regeneration potential was deemed likely based on the site

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			during summer which will be crazy expensive. I think these information gaps and considerations need to be acknowledged as next steps that will be required for the final plan.	<p>characteristics. Recommendations in the final draft HOP recognize that more detailed plans will need to be developed during implementation, including silviculture management plan and confirming operability of specific candidate sites.</p> <p>In the absence of caribou habitat suitability mapping, burned areas within reasonable proximity to access, age of the burns, and the opportunity to connect fragmented remaining habitat were primary consideration factors. Caribou collar data available to date were overlaid with these areas to confirm habitat use.</p>
GNWT-ENR (James Hodson)	5-3	Reforestation	How does planting burns with conifers necessarily lead to increased lichen cover? I could see the value in it from the point of view of reducing moose browse if burned areas are predominantly coming back with deciduous vegetation. If we reforest these areas with a high density of trees it could actually slow lichen recovery if the level of canopy closure is too high.	Recognizing that lichen recovery is a long-term objective of reforestation, detailed silviculture plans can reflect prescriptions for reforestation that would accommodate this objective (i.e. planting densities, species, etc.) and may include recommendations for lichen seeding, which has been shown to be effective in northern BC and Alberta. The objective is to restore lichen communities similar to Pine-Lichen assemblages that were present before fires. The presence of tree cover is also considered as a factor increasing security for caribou and therefore increasing the effectiveness of lichen patches for forage and the potential for arboreal lichen establishment to compliment terrestrial lichen regrowth. During monitoring, canopy closure should be assessed as one of the factors facilitating optimal lichen survival and growth.
GNWT-ENR (James Hodson)	5-3	Reforestation	[Referring to Figure 5-1 recommending potential areas for reforestation] I would like to see the collar data overlaid with these areas to see if this actually true.	Collar point locations were compared, understanding the limitations of the data, and looked at movement tracks (by connecting collar points). The data were standardized (i.e., eliminated the inconsistencies in collar re-locations from the geo-fence along Tłıchǫ ASR) and a kernel density analysis was run to show higher density re-locations to confirm potential habitats to reforest. However, it is recognized that the need to not over-interpret these data from few individuals during a relatively short timeframe. When a Resource Selection Function habitat model is available using the caribou data, it should be applied to prioritize placement and type of offsets.
GNWT-ENR (James Hodson)	5-5	Bison Management	I think the most useful thing we could do to help limit the spread of bison into caribou habitat would be to control the vegetation along the TASR right of way to make sure it is not attractive to bison. This is not something that is already proposed as mitigation for the project so it could be considered as an offset.	This is the intended approach for Bison Habitat Management (Section 5.3.6) and also with respect to moose habitat management. Typically, management of vegetation within the footprint of a project right of way would not be considered offsets, but would be part of the mitigation used to determine residual effects.
Tlıcho Government (Michael Birlea)	NA	Implementation	The first point to add throughout the Plan is that all research, management and field trials need to have a basic requirement added into them to ensure that elders and knowledge holders are providing direction, participating in the design and implementation of agreed upon work, and then reviewing findings. I noted a range of required studies, trials or efforts, such as further fire suppression review, the field trials for the re-forestation and the management approaches for bison - all of these (and any other work anticipated) requires the deep engagement of the knowledge holders.	Recommendations in the final draft include the need to continue the important involvement of Elders and Harvesters through the implementation of the plan, including future monitoring.
Tlıcho Government (Michael Birlea)	NA	Implementation	A second point is that the Tłıchǫ Agreement also requires that work undertaken in the region have economic outcomes Tłıchǫ people, meaning that contracting opportunities in the Tlıcho region should flow first to Tłıchǫ people.	Recommendations in the final draft HOP include the need to support economic benefit in the Tłıchǫ region through the implementation of the plan.

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Tłicho Government (Michael Birlea)	NA	Reforestation and Fire Suppression	<p>[Truncated] In its basic form, this view of fire presented in the Offset Plan suggests that habitat disturbance due to fire may be reduced by 1) accelerating restoration of burned areas and 2) protecting remaining old forest areas that are considered core habitats for caribou. The logical consequence of these two approaches is a shift to an increase in old age classes of forest habitats, which become more likely to burn over time. Since this is likely not the intention or operational scope of the Offset Plan, the text should be revised to present a broader ecological perspective and role of wildfire in boreal caribou ecology, and it should provide more specific details and scale for how the offsetting recommendations may be implemented.</p> <p>The recommendations can be made more practical and useful if they define the spatial scale at which they will be applied, and the timeframe by which they will be evaluated. Both the spatial and temporal scales of these recommended actions need to be better described in the draft Offset Plan</p> <p>... even if all candidate offset areas could be treated instantaneously, the net reduction in disturbed areas is ~1.7% (30,742/1,813,041). Although the Wek'èezhii Boreal Caribou Range Plan will develop a strategy for habitat management, the Offset Plan should provide some more insight on the relative scale of potential or expected implementation of offset options, as highlighted in Table 5-3.</p>	<p>It is recognized that fire suppression may lead to increased intensity in wildfire over the long-term if recent weather patterns and fire behaviour continues. It is also recognized that GNWT's Fire Management Division will need to be involved in any changes to policy that will affect the land over the long term. The objective for caribou is to maintain a network of suitable habitat with characteristics that allow caribou to remain a viable part of the ecosystem. Wildfire is recognized as part of boreal caribou ecology, but scale, intensity and frequency of wildfire are thought to be changing so management may be necessary in the short term to protect high value caribou habitat remnants from loss.</p> <p>An expected maximum spatial scale of offsets (Table 5-2) has been defined at about 12,000 ha (this maximum number will fluctuate with adjustments to ratios), which is about 2% of the Wek'èezhii (spatial scale). It is also recognized that the effects of reforestation will take a minimum 10-15 years on suitable growing sites to begin to be functional as offsets for security cover and mortality reduction, and potentially greater than 80 years for restoration of lichen forage for caribou (temporal scale). At this relatively small scale, it is speculated that there is little contradiction in (slowly) restoring burned areas and substantially contributing to future wildfires.</p> <p>To develop monitoring objectives for effectiveness of these recommendations, well-established practices of reforestation in other jurisdictions can be referenced. This is a recommendation for the implementation plan, once more specific reforestation prescriptions can be developed.</p> <p>The objective of habitat offsets is to compensate for residual effects on boreal caribou (tòdzi), or those effects that remain following the implementation of the mitigation measures proposed for the Tłicho ASR (i.e. achieve "no net loss" of habitat). The goal of the offset plan is to increase functional habitat for boreal caribou rather than solely reduce the disturbance on boreal caribou habitat (as may be with a recovery plan).</p>
Tłicho Government (Michael Birlea)	NA	Reforestation and Restoration	<p>With respect to reforestation and linear feature restoration, it would be helpful to have additional insight on the criteria that would be used to assess effectiveness from the perspective of structural (i.e., vegetative) or functional (i.e., use by caribou and/or other wildlife) restoration. In addition to Golder (2015), other useful references are Ray (2014), Pyper et al. (2014), and Dabros et al. (2018). Criteria to assess structural or functional restoration would provide the time scale, by which data would be collected to assess effectiveness. For example, structural restoration based on line of site or height of vegetation may occur within a few years to a decade, whereas functional use by tòdzi would likely require several decades. This is a key piece that is currently missing from the draft Offset Plan, which would inform the type of implementation and effectiveness monitoring that should be undertaken.</p>	<p>One of the greatest risks to caribou in linear disturbance and fire-affected areas is loss of security cover (i.e., tree canopy loss results in improved line-of-sight for predators, which increases opportunistic predation) for caribou. The intention of reforestation in fire-affected areas is to restore the forest cover earlier than it would naturally, which will initially provide cover for caribou, reconnect fragmented habitats, reducing opportunistic predation by wolves, bears, or other predators. Functional habitat restoration for food such as terrestrial lichen use by caribou would be a longer term objective. The short term offset objective is reducing predation risk as quickly as possible. Reforestation would be one approach to help achieve these, in conjunction with other measures such as mounding, fencing, and tree bending (where feasible).</p> <p>Metrics to measure this would be developed based on all available literature.</p>
Tłicho Government (Michael Birlea)	NA	Reforestation	<p>There is considerable uncertainty around the field methods and effectiveness of habitat restoration techniques outlined in the Offset Plan. The plan should provide additional details and a framework that may be used to prioritize the types of field trials needed to develop the optimal methods for planting trees and restoring naturally burned areas. This should also consider whether techniques to accelerate lichen growth may be used to enhance productivity within winter foraging habitat (for</p>	<p>Many regions in Canada and elsewhere have been using reforestation to accelerate the rate of natural succession with success. Effectiveness monitoring objectives (e.g. tree seedling survival and growth) and adaptive management (e.g. site preparation, supplemental planting) will be developed with reforestation prescriptions through the implementation phase. Recommendations in the final</p>

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			example see: Duncan 2015, Rapai et al. 2017, Roturier et al. 2017). As mentioned above, practices for linear feature reclamation (Golder 2015, Pyper et al. 2014, Dabros et al. 2018) should be considered and tested before widespread application.	draft HOP mention that trials should be conducted with Indigenous support before full implementation, understanding that the trials may result in some delays in implementation. The need for adaptive management approaches to determine the most effective approaches is an important component of the implementation of the offset plan.
Tłıchq Government (Michael Birlea)	2-2	ZOI buffer	Table 2-2 should acknowledge that habitat availability for caribou is reduced through sensory disturbance and behavioral impacts; the 500 m buffer is an approximation of this zone of influence (ZOI). Indirect disturbance in the ZOI is acknowledged in Section 3.1	The potential sensory disturbance in the ZOI contributes to caribou avoiding or reducing the use of that habitat, rather than changing the availability of habitat (i.e. the habitat is still there but caribou use it less). It is recognized that uncertainty lies in the 500 m ZOI, and the final draft HOP discusses this uncertainty, with recommendations on how to improve certainty (e.g., improved caribou habitat mapping, monitoring, and field trials).
Tłıchq Government (Michael Birlea)	1-3	Project map	A figure similar to Fig 1-1 should be added to show the Wek'èezhì Resource Management Area with respect to the TASR. The Offset Plan identifies the WRMA as the relevant area for implementing mgmt. strategies for caribou habitat so it should be clearly shown.	Wek'èezhì Resource Management Area was added to Figure 1-1.
Tłıchq Government (Michael Birlea)	5-5	Supplemental Research	This section [5.2.5] should also emphasize baseline research on fire ecology in the WRMA. A rationale for implementing fire suppression should be informed by an empirical assessment of the natural range in variation in fire frequency and severity, (i.e., average fire return interval), and consider the impacts of climate change scenarios. An understanding of the natural fire regime plus plausible scenarios of climate change will help assess the potential for unintended consequences or risks of the proposed offsetting strategy for suppressing fires.	There are many opportunities to coordinate research on fire ecology with caribou habitat and this can be incorporated into adaptive management of the offset measures taken after implementation. Discussion in the final draft HOP recognizes the need to include GNWT's Fire Management Division in any decisions surrounding wildland fire.
Tłıchq Government (Michael Birlea)	5-5	Bison Management	Simplest mgmt. strategy is to define areas where bison would be removed through hunting. This would be coordinated with management of Mackenzie bison herd which would be defined for its specific geographic range. the specific hypotheses for effects of bison on caribou should be outlined, i.e., forage competition, interference, apparent competition, etc.). should refer to publications by Jung et al. (2015a, 2015b) Implementing vegetation management actions at a large scale to discourage bison would likely be prohibitively expensive. Details of a proposed method combined with rough cost estimates for treatment (\$/km2) should be considered if this were to be a realistic and viable option. Treatment costs and areas to be treated should be incorporated in to the decision framework.	Measure 6-2 discusses the plan for GNWT-ENR and Indigenous groups to determine sustainable levels of harvest of caribou in the North Slave portion of the NT1 range. If harvest levels are deemed to exceed sustainable levels, the GNWT-ENR and Tłıchq Government will submit a management proposal to the WRRB that will suggest implementing measures to ensure harvest levels in the region is kept to sustainable levels. It is understood that a broadscale vegetation management plan may be costly; however, we recommend that mitigation measures along the right-of-way (i.e., revegetation) include species that are not palatable to bison. The work that Jung et al. conducted in Yukon will benefit this planning. Linear corridors have the potential to more easily facilitate colonization of new areas for bison if they provide suitable forage quality and quantity. As caribou may be affected by increases in bison, the objective is to manage the road corridor so that it does not encourage expansion of the bison range. Other management tools such as hunting of bison would require further assessment due to the conservation status of the bison.
Tłıchq Government (Michael Birlea)	5-5	Moose Management	"In specific areas where moose have increased relative to boreal caribou (tqdzı), we propose that manual brushing and replanting be used to favour habitat attributes for boreal caribou (tqdzı) to provide some habitat separation between moose and caribou." This proposed approach is likely to be too costly and ineffective at a small spatial scale. Effectiveness measures such as increased or decreased use by caribou, moose, and predators will be dependent on spatial scale of the treatment. Removal of early successional shrubs through brushing followed by replanting should be tried on a small scale and evaluated to determine whether larger scale application would be feasible and cost-effective.	As above, this approach would be focused in close proximity to the Tłıchq ASR. Part of the intent of reflecting this is to consider potential for reforestation to have unintended effects by supporting alternate prey species that compete with or result in an increase predation on caribou due to increased predator numbers or use of the area. Recommendations in the final draft HOP mention the need for a

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			Depending on the vegetation to be replanted and the technique, it is likely that additional site preparation would be required.	detailed implementation plan, which may include trials and monitoring to determine effectiveness.
Tłıchq Government (Michael Birlea)	5-8	Decision Framework	<p>For the habitat options (Reforestation, Linear Feature Restoration, Fire Suppression), and potentially the others, it would be useful to add two criteria to the Decision Framework (and Table 5-3):</p> <ol style="list-style-type: none"> 1) Estimated likely area (ha) to be treated (course scale: to the nearest 100 ha) 2) Estimated approximate treatment costs (\$/ha) (course scale: to the nearest \$100) <p>Currently the framework (Table 5-3) ranks the Priority of an option by the number of residual effects it addresses. A more informative way to assess the options would be to assign a categorical ranking of Nil, Low, Medium, or High for likely effectiveness for each of the three residual effects. This would more clearly separate the options and provide a more transparent assessment. For example, Enhanced collar programs should be ranked as Nil because collars do not improve residual effect on habitat or population demography (see comment below); they do however provide empirical data on habitat use/selection, and can be used to monitor adult female survival, calf recruitment, and population growth.</p>	<p>As above, estimated area (ha) to be treated is expected to differ greatly once designs have been finalized. Approximate treatment costs will vary depending on the type of treatment and location relative to the Tłıchq ASR. A more appropriate setting for determining total area to be treated and total cost per treatment is within a detailed implementation plan, which has been recommended to be developed once designs are finalized.</p> <p>The lack of quantification of some of these factors precluded opting for more resolution on the ranking of each offset option (e.g. nil, low, medium, high) because they would be subjective rankings.</p>
WRRB (Jody Pellissey)	1-2	ZOI buffer	The Habitat Offset plan frequently references an Environment Canada report from 2012 when discussing the use of a 500m buffer (Environment Canada, 2012). Upon further investigation it is noted that another Environment Canada report from 2011 (Environment Canada, 2011b) was the supporting document in concluding the use of a 500m buffer. <i>“However, supporting analyses of a range of buffer widths demonstrated that a 500 m buffer on anthropogenic disturbance provided an appropriate, minimum approximation of the zone of influence of these features on caribou demography.”</i> As stated, the 500m buffer is used as a minimum approximation for buffer zone establishment. The WRRB asks for more research to be conducted on the buffer zone and the implementation of a buffer reflective of preventative measures rather than reflect a minimum of offsetting.	<p>The Environment Canada reference was updated to reflect the WRRB comment. As mentioned above, offsetting for the ZOI is a new concept and typically only direct project effects (i.e., the project footprint) are included in offsetting efforts.</p> <p>The Habitat Offset Plan is not intended to restore habitats within the 500 m buffer; rather, the final draft HOP is intended to restore habitats elsewhere as compensation for indirect effects that may occur in the ZOI. It is reasonable that some areas along the Tłıchq ASR will have a ZOI much less than 500 m, but also in some instances greater than 500 m with respect to causing reduction in habitat use by caribou. Potential disturbance effects within a ZOI are also likely to be a gradient response (greater near the road and less further away) as opposed to total loss of habitat in the project footprint.</p> <p>Further investigation into restoring actual disturbance ZOIs could be included in the detailed implementation plan. As a ZOI typically reflects caribou behavioural response or risk of mortality from predators using the linear corridor, mitigation is the usual approach to manage potential impacts in a ZOI. Therefore, residual impacts in a ZOI have typically not been included in determining offsets in other projects. In this project, we are proposing offsets due to potential residual impacts due to disturbance within the ZOI and propose monitoring to determine actual disturbance and habitat use within the ZOI relative to baseline conditions (before the road construction). Monitoring will provide the ability to evaluate disturbance within the ZOI and whether the 500 m buffer is suitable for maintaining effective caribou use.</p>

Organization	Page Reference	Topic	Comment	Response
WRRB (Jody Pellissey)	3-4	Fire Suppression	“Ancillary options can be applied to the reforestation work that also qualify as offsets, such as funding towards fire suppression, which also functions as an appropriate effectiveness measure.” It is very unlikely that the GNWT will use resources to fight a fire in the middle of the Wek’èezhii Resource Management Area unless human life or structures are at risk. Due to the remoteness of the project area, the WRRB has little faith that including this as an offsetting measure will be effective and should instead be used as a complementary measure to save caribou, excluded from the habitat offset.	The GNWT are reassessing the Values at Risk that will be protected from wildfire. Discussion to include non-human values have been evaluated. This is complementary because it will protect the work done for this offset, and ultimately improves the effectiveness of the offsetting (reforestation).
WRRB (Jody Pellissey)	5-1	ZOI buffer	“The “500 m buffer” is applied outside of the ROW cleared area and will remain in the condition that it currently exists; however, indirect effects of the project may occur within this area.” As indirect effects may occur within this area, it is recommended that the buffer be increased to go beyond the “minimum approximation for buffer zone establishment” as suggested by Environment Canada in order to decrease potential effects on boreal caribou (t̄qdzı) as much as possible.	<p>The 500 m ZOI buffer has been recommended by Environment Canada and other provincial or territorial regulators for heavily used roads in industrial settings to reflect a zone where caribou might be disturbed and reduce or avoid use of available habitat. It has been used in other projects as a best management approach recognizing that actual disturbance to caribou may be more in some areas and less in others. To recommend a smaller or greater ZOI, monitoring of use before and after projects is needed to assess the effectiveness of mitigation measures and the actual residual impacts. One of the primary difficulties in applying offsets to a ZOI is that the disturbance is usually a gradient and requires monitoring to quantify. For instance, within a 500 m zone, the frequency and type of traffic are major factors affecting whether caribou are displaced or spend less time in habitats near seismic lines and resource roads.</p> <p>As evaluated in the Adequacy Statement Response (Golder 2017), this is an existing ROW with some winter traffic. The T̄ıch̄q ASR is expected to support about 40 vehicles per day, through all seasons, with little industrial presence. There is little evidence in the literature to support increasing this buffer further. In addition, increasing the buffered area increases the area required for offsetting, and does not affect the potential effects of the road on boreal caribou. Findings of the final draft HOP propose that monitoring and research are necessary to assess and adaptively manage potential residual impacts to caribou within the 500 m ZOI identified in the plan.</p>
WRRB (Jody Pellissey)	5-1	Offset Ratios	Please provide more rationale for the use of the different ratios.	Offset ratios are values placed on disturbed habitat that are intended to compensate for the new disturbance created by the project. Typically, the offset (i.e., area compensated) is larger than the area of impacts because the offset gains may be lower or less certain than the amount of area impacted. For example, for 1 unit of good habitat disturbed, the offset is 2-4 times greater because the conservative estimate is that the offsetting may only be ½ to ¼ as effective as the residual disturbed footprint. With respect to offsets related to the ZOI, because the disturbance is expected to be a gradient (greatest near the road and likely very low at 500 m distance) and the effect is not total (e.g. some caribou may avoid habitats within the ZOI at times when traffic is greatest) resulting in a reduced effective value of habitat rather than loss, offsets were proposed at ratios of less than where there is total or permanent habitat loss.

Organization	Page Reference	Topic	Comment	Response
WRRB (Jody Pellissey)	5-4	Fire suppression	While it is noted that fire suppression is needed in order to maintain healthy and suitable habitat for boreal caribou (t̄qdz̄i), the WRRB worries that including fire suppression into the offset plan will go unfulfilled. The WRRB believes this should be done complementary to offsetting plans rather than included in them. Boreal caribou (t̄qdz̄i) habitat should be added to the core values for fire protection.	See response to similar comment above.
WRRB (Jody Pellissey)	5-4	Enhanced collar program	Collaring may be a way to monitor the success of an offset, but it is unclear why collaring itself would be considered an offset. More explanation is required before the WRRB will consider this as an option.	In the final draft HOP submission to the WRRB, collaring was considered an Offset Support Measure, and not an 'Offset Option', such as Restoration of Existing Linear Features or Reforestation of Fire-Disturbed Areas are.
WRRB (Jody Pellissey)	5-8	Enhanced collar program	In Table 5-3, enhanced collar programs were considered moderate, not high so it is unclear why this option was considered to have "the strongest relationships".	Table 5-3 has been revised and priorities for each re-evaluated.
NSMA (Shin Shiga)	NA	Spatial extent	1. NSMA maintains that the offsetting options should include areas outside the Wek'èezhìi Resource Management Area (WRMA), particularly when there are more effective offsetting options not far from the project site, and likely within the habitat of the impacted boreal caribou populations.	<p>The approach taken in the Adequacy Statement Response (Golder 2017) was questioned in the Response to Environmental Assessment because it considered effects within the NT1 range, where little baseline data exists for boreal caribou (ECCC, p 132), and which reviewers concluded diluted the effects of the project because the region was too large. Similarly, beneficial effects on boreal caribou from offsetting for the T̄j̄ch̄q̄ ASR would also be diluted and difficult to determine effectiveness.</p> <p>A resounding message from the Collaborators Working Group for the final draft HOP was a desire to focus efforts within the Wek'èezhìi Resource Area. Administrative boundaries have been established the NT1 range to attempt to detect regional changes in the population, as identified in the NWT Recovery Strategy for Boreal Caribou (CMA 2017¹), one of which is the North Slave Region, which includes the Wek'èezhìi Resource Area. By maintaining the offsetting measures within the Wek'èezhìi Resource Area, the offset measures can be consistent with the NWT Recovery Strategy (CMA 2017) and kept to a geographic area where effects can be measurable.</p>
NSMA (Shin Shiga)	NA	Reforestation	2. Reforestation may be an effective long-term recovery strategy for the purpose of NWT/Federal SARA. We do not think it is an appropriate offsetting tool for the project impact. Major declines and extirpations of boreal caribou can occur prior to when offsetting would become effective. If the replanting program is successful in "skipping" successional stages and speeding up regeneration, it will likely take 40 - 60 years for forest to become functional, connective, and shielding habitat, and 80-100 years for habitat to regenerate to conditions needed in core range (e.g., to contain the appropriate food sources such as lichen). Impacts to boreal caribou, however, are occurring on a much more rapid time scale. While population trends in the NT1 range are less well understood, other boreal caribou populations have shown rapid declines in concert with increasing anthropogenic disturbances. For example, from 2000-2015, the West Side Athabasca River herd in northern Alberta lost half of its population within an ~8-year period, while the East Side Athabasca River herd lost half of its population within 7 years. Both populations declined by 80% within 13 years (Pembina Institute, 2017). This sort of	<p>Fire has been identified as the primary impact to caribou in this region, rather than high density industrial development, for example, as experienced in the Athabasca region of Alberta. Since there are relatively few linear features available for restoration (many of which are used as winter transportation corridors as there are so few roads in the region), reforestation was included to improve long-term habitat condition for boreal caribou.</p> <p>The initial intention of reforestation is to aid in the regeneration of security habitat, which can be defined by specific tree height and density. Restoration of existing linear features is considered the priority, but in order to achieve offset</p>

¹ Conference of Management Authorities (CMA). 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 Northwest Territories, Yellowknife, NT. 57 + xpp.

Organization	Page Reference	Topic	Comment	Response
			<p>population trend would not be aided by habitat that comes into functional rotation on the much longer time scale, as is central to the current plan. The TASR project is expected to have near-immediate implications to caribou populations, and likely requires near-immediate offsetting success.</p>	<p>objectives for the Wek'èezhìi region, alternate approaches need to be considered due to the lack of existing linear disturbance (in current mapping for the region).</p>
<p>NSMA (Shin Shiga)</p>		<p>Collar monitoring</p>	<p>3. Research, experiment, and collar monitoring are not offsets. The TASR project traverses a landscape with true offsetting options that are available and can be selected. Therefore, accepting research and experimentation in lieu of true offsetting is not appropriate for the TASR. As the proposed reforestation plan has not been demonstrated as successful for caribou habitat enhancement in similar subarctic, geological areas, it is considered experimental only. Ultimately, this research is likely needed as part of the NT1 boreal caribou recovery strategy, which should have sufficient financial support from the federal government to enable the finalization of the legally mandated recovery plan for boreal caribou, required of the competent Minister(s) under Federal Law (i.e., SARA, s. 37). Closing off linear corridors outside of the WRMA (previously created by anthropogenic disturbances), for example, may greatly assist caribou populations on a short time frame by reducing mortality rates of young and adults (via reducing hunting efficiency rates of predators). As these are some of the predicted impacts of the TASR, such offsetting could address like-for-like effects on a similar time scale.</p>	<p>Recommendations in the final draft HOP have clarified that research and collar monitoring are considered measures to support effectiveness monitoring of offset measures (restoration of linear corridors and reforestation). While restoring linear corridors is a priority for caribou habitat in some regions, many corridors are used for transportation in the absence of established roads, so restoration of linear corridors was not a sufficient offset for the Tlichó ASR. By moving offset efforts outside of the Wek'èezhìi region, monitoring effectiveness and results of these efforts will be diluted.</p>
<p>NSMA (Shin Shiga)</p>		<p>Reforestation</p>	<p>4. Reforestation is unlikely to be feasible. Replanting or promoting trees used by caribou, such as tamarack (<i>Larix laricina</i>), jack pine (<i>Pinus banksiana</i>), and spruce (<i>Picea</i> spp.), along with the allowance of an appropriate composition of understory and ground cover to eventually provide forage, would likely require a detailed silviculture monitoring plan to determine the plan's effectiveness. Coniferous trees are slow growing, particularly in the subarctic, and pioneer and early successional species such as trembling aspen (<i>Populus tremuloides</i>) and balsam poplar (<i>Populus balsamifera</i>) may colonize a site quickly and outgrow/outcompete planted seedlings, if not frequently removed. Therefore, the proposed program may require a high monetary and personnel investment to prevent the site from defaulting to movement through natural successional stages.</p>	<p>The initial objective of reforestation as an offset is to provide security cover habitat, and eventually more productive caribou habitat (e.g., forage), recognizing this is a long-term goal. A detailed silviculture plan will be developed (prior to any planting) to consider a range of variables, including appropriate species, suitable densities and other measures to promote success of the approach. Requests to conduct trials in advance of large-scale reforestation have been made and will be a consideration in the operational implementation plan.</p>
<p>NSMA (Shin Shiga)</p>		<p>Reforestation</p>	<p>5. If this plan is implemented (more appropriately as part of the boreal caribou recovery plan), a silviculture plan should be included with the following well-researched information:</p> <ul style="list-style-type: none"> i. Required funding needs for probable success. ii. Measures to monitor and manage the stand (i.e., planted area) until it reaches free-growing status; this would likely require 5-10 years of monitoring after planting seedlings, and potentially much longer given the northern climate. Note that this time frame would be greatly increased if aerial seeding is proposed. Efforts would need to be made to achieve free-to-grow status as quickly as possible while also ensuring seedling survival and maintaining stocking levels. iii. Desired tree stocking levels and densities for caribou. iv. Ecologically suitable tree species that meet objectives for caribou habitat. v. Plans to reduce competition for light, moisture, and nutrients by managing brush around planted trees (while assessing the direct impacts of personnel managing re-growth on caribou). vi. Monitoring for post-planting survival rates and replanting where necessary to meet desired stocking levels. Seedling damage from plant-eating mammals (e.g., snowshoe hare) could potentially be an issue that may need to be managed. vii. Integration of a research component into the reforestation plan, including information on components of the silviculture plan that work relatively better/worse, and the timeline and conditions wherein caribou begin to use the habitat. 	<p>Agreed, a silviculture plan that includes monitoring and adaptive management as necessary is recommended as next steps (operational implementation plan). The comment includes excellent measures for inclusion in the implementation of offsets and recovery planning.</p>

Organization	Page Reference	Topic	Comment	Response
NSMA (Shin Shiga)			To summarize we think that the GNWT INF needs to: 1. Consider offsetting options outside of WRMA (there is no ecological or legal reason to be bound within WRMA); 2. Re-evaluate the efficacy and appropriateness of reforestation as the primary offsetting option; and 3. Prioritize offsetting options that have immediate and proven impacts such as restoration of existing linear features.	See responses to previous comments on addressing these.
Environment Climate Change Canada (Isabelle Duclos)	1-2	Wildfire and caribou habitat	If important habitat attributes were present before fire, they will come back with regeneration. Burned areas are future effective habitat for caribou! – SHOULD NOT BE CONSIDERED EQUIVALENT to a winter road disturbance!	Environment Canada considers burned areas as ‘disturbed habitat’. The final draft HOP includes all areas that will be disturbed as effective habitat. Because fire is not considered a permanent disturbance, burned areas are considered for applying offsets such as reforestation. However, overall caribou habitat disturbance assessment includes all habitat disturbance including permanent and temporal impacts such as fire.
Environment Climate Change Canada (Isabelle Duclos)	1-2	Wildfire and caribou habitat	Don’t agree because of comment above. Burned areas will eventually contribute to the 65%. So it is similar to destroying efficient habitat! you are still permanently altering habitat that would have recovered from the fire, and thus contribute to the 65% Also, are you removing from calculation of offset the area of the winter trail only, or all the segment of the road where the trail was???	See response above.
Environment Climate Change Canada (Isabelle Duclos)	2-1	Footprint	<i>The Adequacy Statement Response estimates that the Project will affect 0.1% of undisturbed habitat (i.e. habitat not recently affected by wildfire) in the Wek’èezhii Resource Management Area (Table 2-1; Golder 2017).</i> So 0.1% of the 60%? + burned habitat with good habitat attributes, so > 0.1% What about burned that will regenerate in effective habitat? What is exactly included? Road + ROW. Does not account for the fragmentation. Habitat on east side might not be used anymore by caribou. This is a huge loss. Need to be considered somewhere in this offset plan.	The objective of the final draft HOP is to compensate for residual impacts of the project, so “no net loss” of habitat is achieved. The Adequacy Statement Response demonstrated that 0.1% of habitat within the Wek’èezhii region will be affected by the project (i.e. not significantly contributing to the 65% undisturbed habitat threshold for boreal caribou as explained by ECCC 2017). Table 5-2 demonstrate the residual impacts of the project that offsets are applied. With the offsetting areas identified, up to 4 times this area will be restored (e.g. offset ratio of 4:1 applied). Note, the results of the Adequacy Statement Response (Golder 2017) assessed that the road would not pose a barrier to movement to prevent caribou from using habitat on either side of the road.
Environment Climate Change Canada (Vicky Johnston)	3-2	Footprint	<i>“The existing winter trail is estimated to be 8 m wide (approximately 75 ha) and is an existing linear disturbance on the land. The Tłıchq ASR footprint will include the proposed all-season road surface and ROW, and the existing winter trail will be removed from that total.”</i> I don’t understand how this fits into calculations- it reduces amount of offset needed, but by how much, and where?	In determining residual impacts, the Tłıchq ASR will mainly follow the alignment of the Old Airport Road, which is an existing cleared trail used in winter. Initially, the footprint of Tłıchq ASR, where it follows the Old Airport Road, was to be removed from the residual impact calculation. However, in consultation with the Collaborators Working Group, the residual impacts will be calculated as the whole Tłıchq ASR footprint and identify offset opportunities along the portions of the Old Airport Road that are not part of the footprint. This calculation is not possible until design drawings with the actual alignment are available. This is part of the next steps to finalize this Draft Habitat Offset Plan.
Environment Climate Change Canada (Isabelle Duclos)	3-2	Footprint	<i>“The area of the existing winter trail that aligns with the new all-season road will be removed from the total disturbance of the Tłıchq ASR, helping to reduce the overall quantified residual effects.”</i> But the new road is larger than the winter trail....Assume that the existing road is as wide as the new road and therefore won’t push the 500m buffer any father out. The new road will push away the current 500 m buffer applied to the winter trail.	See comment above. The 500 m ZOI buffer is estimated from the anticipated width of the Tłıchq ASR (8.5 m plus the 51.5 m ROW); see Table 5-2.

Organization	Page Reference	Topic	Comment	Response
Environment Climate Change Canada (Vicky Johnston)	3-5	Limitations of Offset Plan	<p>"We have identified limitations of the Draft Habitat Offset Plan presented here, including basing this draft plan on the details and assessment as presented in the Adequacy Statement Response for the Tłıchq ASR Project (Golder 2017) and the evaluation provided in the Report of Environmental Assessment and Reasons for Decision (MVEIRB 2018)." Are you saying that using these two documents has introduced limitations into the reliability of the offset plan?</p>	<p>The Adequacy Statement Response (Golder 2017) was developed from a conceptual alignment following the Old Airport Road alignment, and designs for the Tłıchq ASR are now in development. Once the design drawings are available, the area of residual impacts will need to be confirmed so that more accurate offset areas are calculated. The limitation introduced for the Draft Habitat Offset Plan is the need to confirm total areas for offset objectives (currently a conservative estimate has been assumed, but this will change).</p>
Environment Climate Change Canada (Vicky Johnston)	3-6	Footprint and Mitigation	<p>"Following the submission of the Draft Habitat Offset Plan, we recommend the following steps be completed prior to submitting the Final Habitat Offset Plan:</p> <ol style="list-style-type: none"> 1. Quantify project footprint with design drawings of the road and borrow pits to more accurately identify the area affected by the Project footprint. 2. Apply the mitigation recommendations (e.g., Adequacy Statement Response (2017) and WMMP (2019)) to more accurately quantify residual effects of the Tłıchq ASR, including width of rights-of-way, restoration following construction." <p>In no. 2 in the text box- am I to understand that areas that are restored post-construction and subtracted from the offset needed? Even though they will not be functional habitat for many years?</p>	<p>To calculate residual impacts, effects of mitigation are removed from the total footprint (e.g., any borrow sources that will be reclaimed after construction are not considered residual impacts). Currently, an assumption has been made to conservatively estimate the residual impacts of the Tłıchq ASR project, and the recommendation is to calculate residual impacts once design drawings and mitigation are finalized. The overall effect of not doing so is multiplying the over-estimated residual impacts by a factor of 4 (because of the 4:1 offset ratio), and significantly inflating commitments for offset beyond those necessary.</p>
Environment Climate Change Canada (Isabelle Duclos)	5-1	Offset Ratios	<p>"Existing disturbed habitat is assigned lower offset ratio (e.g., 0.5:1), while undisturbed habitat is assigned a larger offset ratio (e.g., 4:1)." Ratio for burned area should be larger than Anthropogenic disturbance as burned areas will eventually contribute to the 65%.</p>	<p>Revisions have been made to include this. The ratio for burned areas has been changed to 4:1.</p>
Environment Climate Change Canada (Vicky Johnston)	5-1	Offset Ratios	<p>I do not understand how you came up with these specific offset ratios</p>	<p>Addressed this in the revised Draft Habitat Offset Plan.</p>
Environment Climate Change Canada (Isabelle Duclos)	5-1	Offset Ratios	<p>[The offset ratio for the 500 m ZOI buffer (Table 5-1)] Should be higher than 1:1 i.e. than anthropogenic. Burned areas will contribute to the 65%</p>	<p>There is no direct footprint within the ZOI. Traditionally, offsets are applied to areas where habitat is directly affected, not in areas of indirect effects, as in the ZOI. It is reasonable to offset at 1:1 for the ZOI because no actual habitat (e.g., forage or security habitat) will be disturbed, and only speculation exists about caribou response to the road. Including the ZOI as an indirect disturbance that requires offsetting is an extremely conservative measure that may be precedent setting (i.e., no other examples of this were identified in the background review for this final draft HOP).</p> <p>The ratio also reflects that any disturbance is likely a gradient, with effects greater near the road and less or absent at 500 m distance. We also consider that avoidance or reduced use by caribou are the likely temporary responses and may not apply to all caribou or all habitats within the ZOI. Monitoring is required to assess and adapt the management of potential residual impacts to road use disturbance.</p>

Organization	Page Reference	Topic	Comment	Response
Environment Climate Change Canada (Isabelle Duclos)	5-1	Offset Ratios	[Buffered anthropogenic disturbance in Table 5-1] Is this the 500 m buffer, or something else? Below there is Anthropogenic Disturbance (not buffered) Difficult to understand this table.	Revised Table 5-1 to be clearer.
Environment Climate Change Canada (Vicky Johnston)	5-8	Decision Framework	I do not understand why anything other than addressing offsets for habitat are discussed or contemplated for action under an offset plan. Not saying they are not legitimate actions, but why under this plan? Following that argument, I do not know why addressing hunting pressure created by the road is not as high a priority as, say, moose competition with caribou. If one is addressed through this plan, the other should be too---or neither should be, and they should be addressed elsewhere.	Feedback from workshops held with the participants (listed at the start of this concordance table) were instrumental in developing a long-list of proposed offset options. Hunter management was addressed under Measure 6-2 and was included in the final plan as an offset support measure. In the final draft HOP it is considered an adaptive management technique.
Environment Climate Change Canada (Vicky Johnston)	5-9	Linear Disturbance	<i>"Because this option [restoring linear disturbance] addresses all three residual effects, it was given high priority; however, to ensure we do not affect trails important to First Nations, we will look to select legacy linear features adjacent to Highway 3 for priority selection."</i> Wont these be lower 'quality' though (close to a linear barrier and disturbance) and so offset ratio will need to be higher?	Ideally, locations selected for linear feature restoration near Highway 3 will be outside the ZOI of that highway, although some portion of the linear feature may be within the ZOI. It could be argued that restoring those portions of linear features within the ZOI will have greater benefit to caribou than those outside the ZOI because it will limit access by human hunters and predators such as wolves. This reflects the need to consider all risks to caribou. Although a ZOI may reflect a residual impact to disturbing some caribou at certain times, restoring a linear feature within a ZOI immediately reduces predation risk, usually considered a much great risk to caribou sustainability.
Environment Climate Change Canada (Isabelle Duclos)	5-9	Hunter management	Increased hunting pressure is more of a concern than Bison/Moose mgt. So priority for hunter management should be higher. Habitat fragmentation is more important here than direct/indirect habitat loss from the building and use of the road. (i.e. east portion of the road might not be used anymore by the caribou if caribou don't cross the road, because of the road itself, or because they are killed by road users). **For me, Fragmentation + Increased hunting pressure are the 2 main concerns with this new road and will/could have a huge impact on the pop. If Enhanced Collar Programs will determine if hunting needs restriction or not (ENR), then Collar programs should be HIGH PRIORITY. BUT under the Enhanced Collar Programs, there is nothing about hunting! *Need to show how hunting/road access will be addressed.	Hunter management is already addressed under Measure 6-2. Management plans to reduce access by hunters along the Tłı̄chǫ ASR technically fall under mitigation for the road.

Table 2 – Concordance of comments on the Second Draft (delivered to reviewers July 12) of the Boreal Caribou Habitat Offset Plan for the Tłı̨ch̨o All Season Road.

The following table reflects the comments on the second draft report made by the Collaborators Working Group, including Government of the Northwest Territories' Department of Infrastructure (GNWT-INF), Department of Environment and Natural Resources (GNWT-ENR), Tłı̨ch̨o Government (TG) and the Wek'èezhì Renewable Resources Board (WRRB); as well as, North Slave Métis Alliance (NSMA) and Environment and Climate Change Canada. Although a copy of the draft HOP was provided, no comments were received from the Yellowknives Dene First Nation. Golder Associates (Golder), as the original authors of the Response to the Adequacy Review for the Tłı̨ch̨o ASR, was invited to review the comments and provide a response of their own; their comments are provided along with the GNWT-INF response in the table below. The final Habitat Offset Plan incorporated many of the recommendations provided here. Comments addressed here are those that were more than editorial in nature or made direct recommendations for changes in text.

Organization	Page Reference	Topic	Comment	Response
GNWT - ENR (James Hodson)	3-2	Mitigation	<p>"For example, reducing the width of the ROW, where practical, would influence the amount of offsetting required for the Project."</p> <p>Question for INF - has this been communicated to NSI yet? Are they taking a serious look at this?</p>	<p>Some discussion has begun with NSI. Reductions in the width of the ROW can be implemented as late as during construction (e.g., a 'field-fit design'), and may not be necessary to fully detail during the design phase. Reducing the width of the ROW would be most beneficial along straight stretches where the adjacent ecosystems are comprised of undisturbed forest (i.e., not recently burned). The 60 m ROW is a construction specification in NWT.</p>
GNWT - ENR (James Hodson)	3-5	Reforestation	<p>Staff from our forest management division pointed out that since fire is the predominant natural driver of succession and regeneration it may be unrealistic to think we can improve on nature. Also, in severely burned areas, it may not be advisable to go directly to planting trees. Establishing pioneer species on those sights might be preferable in the near term to re-establish suitable soil conditions, followed perhaps by tree planting in the longer term.</p>	<p>The intention is not to improve on nature, rather accelerate the rate of reforestation in areas where it makes the most ecological sense. For example, focus should be on areas where trees have been killed during a fire, but the soil is still fertile and viable for seedling growth. By planting stock seedlings (that typically are grown in growth enhancing mediums with fertilizers and/or fungi), it can be anticipated that seedling growth acceleration can be measured decades in advance of natural regeneration (which starts as a seed germinating on perfect soil conditions).</p> <p>Golder Response: Agree with response that intention would be to accelerate rate of restoration where it makes ecological sense. Additional consideration for the Final Offset Plan to consider (rather than focus on tree planting): Like habitat restoration prescription planting within anthropogenic footprint, planting for any restoration of previously burned areas will need to capture a) fire intensity (GNWT Remote Sensing team have developed scripts using archival satellite imagery to look at fire polygons but also fire intensity. There may be areas of lower intensity that are field truthed to be returning on their own, or there may be higher intensity burn areas. There may be areas within fire polygons that are in fact intact unburned habitat that can be captured within the calculation of intact habitat within the regional range plan. GNWT may be able to offset a portion of the Project through investment in remote sensing to refine fire areas within the Wek'èezhì Management Area and/or B) for restoration on the ground, need to focus on addressing site limiting factors (not just growing and planting seedlings). For example, site limiting factors may be addressed through site preparation (e.g. to address water availability and nutrient update of seedlings; Hebert et al. 2014) or water infiltration capacity decrease due to erosion (refer to MRNF 2011).</p> <p>c) Any plan for fire restoration areas should consider strategic location of efforts to expand existing habitat patches or movement areas (EQUIVALENCY ecological function may be enhanced for habitat connectivity/movement) or for overlap with conservation areas (or proposed protection areas) which would increase the value of the DURATION and ADDITIONALITY of the offset site towards NNL or NPI.</p> <p>d) fire restoration measures for boreal caribou will be of high uncertainty, particularity in the north where fire impacts to shifts in peatland ecosystems (Kettridge et al. 2015) or permafrost thaw can increase water saturation in soils and tree mortality/difficulty in establishing trees (refer to Quintin et al. 2009)</p>

GNWT - ENR (James Hodson)	3-7	Reforestation	<p>"GNWT-ENR is re-evaluating their Forest Management Policy and the way they prioritize Values at Risk in NWT".</p> <p>I wouldn't say that we are re-evaluating our Forest Fire Management policy. The existing policy has always allowed for the identification of wildlife habitat as a Value at Risk, it's just not something that's been done very often up to now.</p> <p>It would be more accurate to say that we are evaluating the identification of specific areas of boreal caribou habitat to be included as Values at Risk in our fire management system. It is fair to say that boreal caribou habitat will be a lower priority in the hierarchy than human life and property/infrastructure.</p>	Wording in the final draft HOP has been revised to reflect this comment.
GNWT - ENR (James Hodson)	3-7	Habitat use by ungulates	<p>"In addition, it will be used [reforestation] to provide conditions for quicker restoration of terrestrial and arboreal lichens (caribou forage) and reduce attractiveness of habitat to alternate prey species such as moose or bison".</p> <p>Is there any evidence in the literature that this is true? Would be good to cite some examples to support these statements.</p>	<p>References to support this statement have been added to the final draft HOP.</p> <p>Golder Response: There is very little literature around success of lichen re-establishment or success of lichen transplants. We would consider this a high cost and high uncertainty measure for what benefit would be provided to caribou in the region.</p> <p>Lichen transplants can accelerate and increase terrestrial lichen post-fire (Rapai et al. 2017), but high lichen mortality has been reported at both 3 and 5 years post treatment monitoring within peatlands in NE Alberta (Golder 2019b). Lichen cover has been documented as inversely related to cover of Sphagnum spp., and growth rate of lichen positively related to time since fire (Dunford et al. 2006).</p>
GNWT - ENR (James Hodson)	3-7	Reforestation	<p>"Suitable area exists in the Wek'èezhìi Management Area to complete all of the required offsets in burned areas alone through implementation of reforestation".</p> <p>This is making a big assumption that natural regeneration in burned areas is currently insufficient and that we can do better than nature. I think this assumption should be acknowledged, and it should be acknowledged that a lot more work is needed to identify specific sites where reforestation would actually provide a net benefit and accelerate things</p>	<p>Wording in the final draft HOP has been revised to reflect this comment. The primary focus of offsets will be linear features, followed by polygonal features such as old quarries or landings.</p> <p>Golder Response: support comment by GNWT-ENR. This would be a high cost, high risk and potentially very low benefit to boreal caribou in the region.</p>
GNWT - ENR (James Hodson)	3-7	Mitigation	<p>"Furthermore, if a habitat suitability map (i.e., a Resource Selection Function model) were available for the caribou using habitats near the Project, we could revise the offset ratios by reducing the amount needed for offsetting in less preferred habitat".</p> <p>These RSF models and predictive maps will be available to help inform and refine the final offset plan. But based on our seasonal RSF model results so far, a lot of the study area is preferred habitat for at least part of the year, so I'm not sure this would reduce amount needed for offsetting. I think the RSF models could help us to pinpoint more highly selected areas that could be connected.</p>	<p>Agreed, the RSF models could be used in the Operational Implementation Plan to identify important crossing areas and could be a basis for developing site-specific mitigation (e.g., reduce the ROW width between x and y) and selecting priority areas for restoration work (e.g., focus legacy linear restoration between x and y). Because the high offset ratios have been applied to all footprints, habitat models should be relied upon to identify areas for restoration that might not be captured by looking at recent radio collar data alone.</p> <p>Golder Response: consider if the RSF models can help with the equivalency of similar ecological functions of the impact site (the Project) and the offset site. If RSF can help identify that an offset site for restoration has a higher quantity of ecological function than an impact site from the Project, may support refinement of the offset amount. This however could become a complicated exercise and simplification of the RSF models would likely need to occur.</p>

GNWT - ENR (James Hodson)	3-8	Next steps	<p><i>Comments below referencing blue box "Considerations for Section 3.3"</i></p> <p>I would add as a recommendations:</p> <ul style="list-style-type: none"> - to map out other linear disturbance within the study area that are not currently captured in available datasets. - conduct more detailed assessments of areas of human disturbance to determine which may be candidates for restoration - use RSF models, TK and other available data to refine identification of fire disturbed habitat that could be candidates for reforestation - conduct site assessments of potential fire disturbed offset areas to determine current rates of natural regeneration 	Wording in the final draft HOP has been revised to reflect this comment.
GNWT - ENR (James Hodson)	5-4	Reforestation	<p><i>"Reforestation is being done to reduce (predator) visibility (i.e., improve security for caribou) rather than only improve habitat (i.e., focus on improving habitat value)".</i></p> <p>You could also frame it as reducing attractiveness and suitability of the area for alternate prey like moose and bison, by restoring conifer cover more quickly you reduce the amount of time that these areas might be attractive or productive moose and bison habitat and thus limit attraction of predators to those areas or limit numerical response of predators to more moose or bison. I don't really see line of sight as being the primary issue in burned habitat, since boreal caribou do you use very open sparse conifer habitat, and the do select recently burned habitat in some seasons.</p>	Some of the wording has been revised in the final draft HOP. It is agreed that it will also reduce attractiveness and suitability for alternate prey species, which in turn would reduce the potential for caribou to be targeted as an opportunistic prey species.
GNWT - ENR (James Hodson)	5-7	Bison Habitat Management	<p><i>"Based on Traditional Knowledge, we propose mitigation and support measures that control forage areas suitable for bison..."</i></p> <p>Again, I think the point needs to be made that there is currently no plan to try and manage the suitability of vegetation for bison along the cleared right of way for the TAsR. Even if this would be considered mitigation and not an offset, it still deserves consideration as an additional means of reducing impacts to boreal caribou. I recommend adding something about this here.</p>	Wording in the final draft HOP has been revised to reflect this comment.
GNWT - ENR (James Hodson)	5-8	Hunter Management	<p><i>Comment referencing Hunter Management:</i></p> <p>There should be some acknowledgment that Measure 6-2 of the Report of EA deals with this issue already.</p>	<p>Wording in the final draft HOP has been revised to reflect this comment.</p> <p>Golder Response: Measure 6-2 becomes project mitigation, as well as other measures within the WMMP. An offset measure that could be captured for addressing residual effects from increased hunting which would be directed at the NT1 caribou population could be for example, consideration of removal of non-indigenous caribou tags/year. Currency of effect to offset would need to be clarified in final plan as not linked to hectares of habitat.</p>
GNWT - ENR (James Hodson)	5-10	Enhanced Collar Programs	<p><i>"Enhanced collar programs in areas where reforestation has occurred will provide a long-term understanding of the efficacy of reforestation".</i></p> <p>I would like to understand better what you mean by "enhanced"? The areas identified for offsetting are small within the context of the annual home ranges of boreal caribou, so most of the collaring done to date will capture individuals that already interact with the proposed offset areas. I could see "enhancement" in terms of how the collars are programmed for individuals that might be using the offset areas and deploying more collars on individuals close to offset areas. We might require more frequent collar locations to get fine-scale movement data within offset areas to be able to conclude anything. More frequent collar locations comes at the expense of collar longevity so we'd lose the ability to monitor survival of individuals over the longer term and that could compromise getting demographic information.</p>	<p>Wording in the final draft HOP has been revised to reflect this comment.</p> <p>Additions to the text include: "continued funding to expand or extend the program and include other species that interact with caribou, such as moose, bear, and wolves..."</p>

GNWT - ENR (James Hodson)	5-10	Enhanced Collar Programs	<p><i>"Enhanced collar programs were given moderate priority as the data collected by enhanced collar programs will improve conditions for caribou".</i></p> <p>I'm comfortable with saying that collaring will help to improve our understanding of whether restoration is working or not, but I'm not comfortable saying it will improve conditions for them. We simply don't know the outcome yet.</p>	<p>This comment is agreed upon. The text in the final draft HOP was not altered to reflect this comment.</p> <p>The text in the final HOP should be revised to reflect the statement that: "enhanced collar programs will improve the understanding of whether restoration is working or not."</p> <p>Golder Response: It is very difficult with a single program to understand how restoration influences caribou, particularly given the range of caribou and that collared animals may just not come in proximity to a restoration site (refer to Pigeon et al. 2016 for an example where this type of monitoring failed). I would suggest rewording the text to have a clear objective for the monitoring. If its to understand how caribou, other wildlife and humans use a site that has been restored, it may be challenging to answer this with a telemetry monitoring program as there will be limited sample size at the actual site; not because a site is not restoring, but because caribou do not come into contact with the site over the monitoring period due to their large home ranges and limited number of animals collared.</p> <p>Remote cameras have been used very effectively on a number of restoration monitoring programs in Alberta and BC to understand wildlife use at restoration sites (e.g., Keim et al. 2019) or response to various restoration techniques. Collaring has also been used, but where very intensive treatments have occurred. (e.g., ABMI 2016).</p>
GNWT - ENR (James Hodson)	5-11	Apparent competition between species	<p><i>"Although interspecific competition is unlikely among caribou and moose or bison, an interaction known as 'apparent competition'..."</i></p> <p>This is where you could cite the study from the Yukon that demonstrates this.</p>	References to recent studies (in particular, the study from Yukon) discussing apparent competition were added to the final draft HOP.
GNWT - ENR (James Hodson)	5-12	Offset Options	<p><i>[Referencing Options in Table 5-3 Offsetting Options and Support Measures and their Relationship to Residual Effects Metrics]</i></p> <p>This applies to both linear features and fire disturbed habitat. Might be better to call one "Reforestation of burned habitat" and the other "Linear features restoration".</p>	Table 5-3 was reconfigured in the final draft HOP to better reflect comments received from reviewers. Option titles were revised based on this comment.

Tłıchǫ Government (John Nishi)	5-1	Offset Ratios	<p>"We have assigned an average offset ratio of 0.5:1 for ZOI buffer areas to reflect an average potential disturbance impact (i.e., assigned 1:1 ratio at the edge of the buffer closest to the ROW and 0:1 at 500 m).</p> <p>A more conservative approach, that is more consistent with the Environment Canada disturbance mgmt. threshold would be to apply a 1:1 offset ratio for the 500 m ZOI. This approach would provide a larger benefit to caribou habitat conservation, and be more meaningful in caribou ranges that are subject to higher rates of linear and anthropogenic disturbances relative to wildfire.</p> <p>In other words, the offset ratios should be consistently applicable in other boreal caribou ranges in the NWT.</p>	<p>The final draft HOP recommended a 1:1 offset ratio in the ZOI. A recommendation is made in the final draft HOP to review the ratio for the ZOI once final designs and baseline data are available as there may be justification to increase the ratio in some areas (e.g., areas of known high boreal caribou use) or decreased in some areas (e.g., areas that are within densely forested sections, which may reduce the indirect effects of the road on boreal caribou).</p> <p>The ZOI ratios are different from direct impacts, because any residual impact is likely greater near the road and low or absent closer to the 500 m edge. In addition, behavioural response impacts such as avoidance or displacement are not usually permanent effects, nor do they apply equally to all individual caribou (e.g. some will habituate, some have different thresholds to traffic noise response). As impacts are expected to be graduated, temporary and not affecting all caribou the same, it is reasonable to propose ratios of 1:1 or less until monitoring of ZOI residual effects is underway.</p> <p>Golder Response: Irrelevant to the ratio used, the offset amount needs to link to the Project's residual effects. A ratio of 1:1 for the Project's contributions to the ZOI, although arbitrary, does provide a larger benefit to caribou habitat conservation as stated by the Tłıchǫ Government. There are however examples where risk based multipliers have been used to account for time lags and uncertainties with offset measures. Refer to Northern Resources 2014 and 2016 for a description.</p> <p>Golder Residual Effects Calculation: the 500 m ZOI from the Project must consider the pre-existing ZOI from existing features (e.g., the Old Airport road, other existing trails) for consistency with the Environment Canada disturbance management threshold. Therefore, the residual habitat impact is the ZOI habitat contribution from the Project as compared to baseline.</p> <p>Golder notes that this residual project effect conflicts with the text provided within Sections 1.2, 1.3 (specifically that offsetting is an activity that might compensate for a existing disturbance that was present before the project residual effects occur), 3.3.2 (note for Page 3-3, residual effects need to consider Project base case, application case and Project mitigation. What is reported is NOT residual effects of the Project).</p>
Tłıchǫ Government (John Nishi)	5-2	500 m ZOI buffer	<p>"the consideration for a 500 m ZOI buffer was developed for effects assessment and mitigation for new industrial disturbance and mining projects (Environment Canada 2012)"</p> <p>Disturbance management thresholds at the range scale are based on the 500 m ZOI plus area of recently burned areas, ≤ 40 years old (as established by EC 2012). It would be more appropriate to treat the 500 m buffer with a 1:1 offset ratio, as opposed to discounting it by 50% to a 0.5:1 offset ratio. Also as highlighted in the Considerations text box in Section 2, the range plan and the offset plan should be consistent. Since the range plan needs to incorporate and respond to the EC disturbance mgmt. thresholds, it is not logical to use a discounted offset ratio for the 500 m ZOI. The offsetting measures should at least directly compensate for Project disturbance effects.</p>	<p>The final draft HOP included a 1:1 offset ratio in the ZOI. A recommendation is made in the final draft HOP to review the ratio for the ZOI once final designs and baseline data are available as there may be justification to increase the ratio in some areas (e.g., areas of known high boreal caribou use) or decreased in some areas (e.g., areas that are within densely forested sections, which may reduce the indirect effects of the road on boreal caribou). As discussed in the previous comment, ZOI effects are not the same as direct habitat loss from clearing and it is reasonable to start with a 1:1 ratio unless monitoring suggests residual behavioural impacts are equivalent to actual habitat loss impacts.</p> <p>Typically, offsetting measures are applied to areas where disturbance directly affects the environment (i.e., physical disturbance) and not for indirect effects of the project (as may occur in the ZOI).</p> <p>Golder Response: this response is inconsistent with publicly available caribou offset plans prepared to date for boreal caribou in Canada and not consistent with the Project residual effects. Refer to: Golder 2014, 2017; NGTL 2014, 2019b, 2020; Northern Resource Analysts 2014, 2016; ERM 2018; Watay Power 2019; HydroQuebec 2020. Other examples including Stantec 2017, Westcoast Energy 2020 and Enbridge 2017 did not include indirect disturbance as project(s) overlapped with existing permanent disturbance (and mountain ecotype).</p>

Tłıchǫ
Government
(John Nishi)

5-2

Footprint Areas

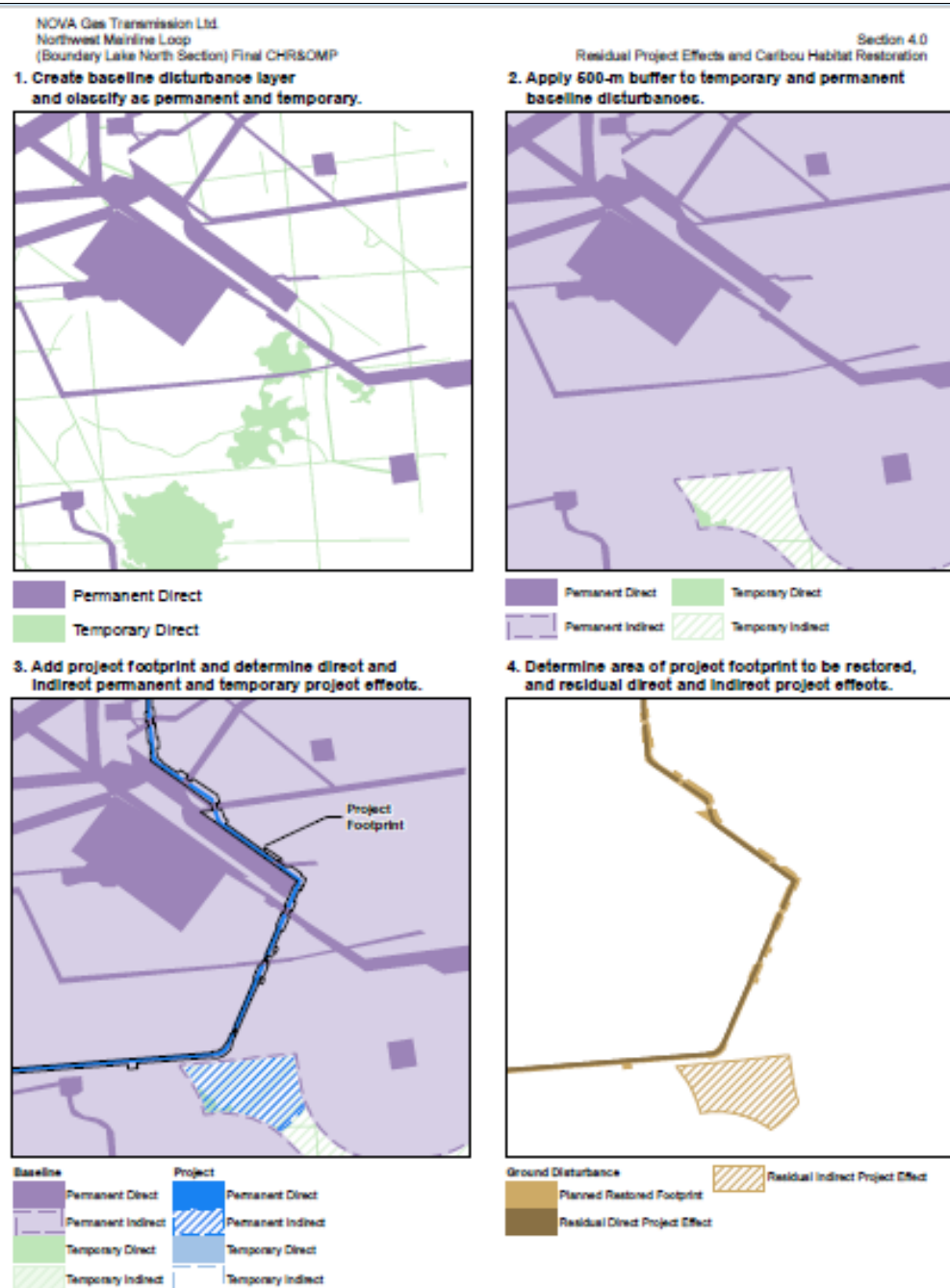


Figure 4-2 Step-wise Approach for Quantifying Residual Project Effects

[Table 5-2, Area in Hectares] These values associated with the road surface, ROW, and ZOI are much larger than the previous values – what is the reason for the difference?

Areas were recalculated to include the area of all 21 potential borrow pits and the ZOI buffers associated with them (a request made by contributors to the Corridors Working Group). Because the final project build-out will likely only require 13 borrow pits, previous versions of the HOP had only included 13 borrow pits and their buffers. Project designs were not available at the time the final draft HOP was written, so in a conservative effort, the maximum total disturbance area was considered in the plan.

Golder Response (to the Tłıchǫ Government): It appears that the Project Residual Effects were not considered, and that a blanket 500 m ZOI was applied without consideration of the baseline conditions. It's understood that the borrow sources need to be captured. In the final Habitat Balance Table, the 500 m ZOI needs to capture the pre-existing ZOI for all Permanent features. Consideration of temporary disturbance (fire, borrow areas that will be reclaimed) as a separate disturbance category should be considered in development of offset ratios.

Tłıchǫ Government (John Nishi)	5-4	Restoration	<p><i>“Restoration of areas that are acceptable to Tłıchǫ Government, Elders and Harvesters, and GNWT-ENR will employ proven methods including rough disturbance, visual barriers, mounding, tree bending and planting of conifers on suitable sites as described in Golder (2015).”</i></p> <p>There is considerably more uncertainty in applying effective restoration methods than what is argued here. As commented on a previous draft of this offset plan, reference to other sources (in addition to Golder 2015) would provide a more realistic and balanced assessment of approaches, methods and monitoring that would need to be implemented to achieve effective restoration. Linear feature reclamation practices should be piloted and field tested in Wek’èezhìi ahead of widespread application.</p>	<p>Recommendations in the final draft HOP include the development of an Operational Implementation Plan, which would include input from the Tłıchǫ Government, WRRB, North Slave Metis Alliance, and Yellowknives Dene First Nation.</p> <p>It is generally agreed that certain trials, including an adaptive monitoring program, would benefit the effectiveness of any restoration work conducted.</p> <p>Golder Response: Agree with Tlıcho Government comment. There are a number of other references which should have been considered within the draft Habitat Offset Plan around caribou habitat restoration. Refer to Golder 2018 for a summary of lessons learned from past restoration programs in Western Canada. Most importantly is the learning that restoration should occur in priority areas, should capture TK in priority restoration area selection, and to focus on collaboration within a landscape scale, to achieve large intact habitat patches within priority areas for species recovery (refer to Golder 2018) versus being applied on a project by project basis (often with little ecological value to caribou). This should be achievable in the context of the Final Offset Plan which is being prepared in parallel with the GNWT regional range plans. The reclamation practices themselves will certainly need to evolve and be adapted through field trials over time to the NWT given the more northern latitude, climate change and fire impacts to permafrost and soil moisture conditions, and traditional human access trails.</p>
Tłıchǫ Government (John Nishi)	5-6	Reforestation	<p>Section 5.2.2 referred to a publication by Wotton et al. (2017) as evidence for the need to implement reforestation as a novel approach in the offset plan. However, with respect to fire suppression it ignores a principal conclusion of the paper, which has substantive potential implications for this section of the report: <i>All future scenarios saw increases in the number of days where crown fires were likely. Furthermore, not only were crown fires more likely but overall the number of days when fire intensities could exceed the capabilities of suppression resources (even large airtankers) also increased substantially (doubling in some end of century scenarios).</i></p> <p>The challenges of wildfire management through the 21st century include not just dealing with an increased number of fires, but also an increased incidence of unmanageable crown fire.</p>	<p>This statement is not contested. Many discussions were had during the Workshops regarding the increase in severity and intensity of fires if fire suppression were implemented to protect caribou habitat. However, the resounding message from elders indicated a desire for some mention of wildfire management in the final draft HOP. Short term fire protection of caribou habitat is proposed for high value areas, similar to how priorities are set for human values such as settlements and infrastructure. This is because wildfires have disturbed greater than 65% of the herd range, which is considered by ECCC to be a critical threshold for maintaining caribou.</p> <p>Golder Response: Agree with Tlıcho Government comment. This is consistent with GNWT Habitat Offset Workshop (2018) and feedback from fire specialists., GNWT fire management team did not support this measure due to negative effects of suppressing wildlife leading to hotter and more severe fires (Bentham pers. comm. 2018). Not sure this is an achievable offset support measure.</p>
Tłıchǫ Government (John Nishi)	5-8	Hunter Management	<p><i>“As an adaptive management option, if an increase in hunter pressure observed, measures such as changes to hunting regulations or other legislation may be necessary to protect boreal caribou (tǫdzi).”</i></p> <p>How would this be monitored? Wouldn’t todzi harvest rates be a better indicator?</p>	<p>Measure 6-2 discusses the plan for GNWT-ENR and Indigenous groups to determine sustainable levels of harvest of caribou in the North Slave portion of the NT1 range. If harvest levels are deemed to exceed sustainable levels, the GNWT-ENR and Tłıchǫ Government will submit a management proposal to the WRRB that will suggest implementing measures to ensure harvest levels in the region is kept to sustainable levels. Tǫdzi harvest rates are an important factor, but also herd number and distribution, habitat use, sex ratio and survivorship of calves must be considered.</p> <p>Golder Response: consider reducing non-indigenous caribou tag numbers as a management measure for GNWT to reduce residual effects of the road. This would be Project mitigation.</p>

WRRB (Randi Jennings)	2-1		<p>1. Recovery strategy should be referenced here, "Conference of Management Authorities. 2017. Recovery Strategy for the Boreal Caribou (<i>Rangifer tarandus caribou</i>) 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. "</p> <p>2. This is how the recovery strategy defined undisturbed habitat and disturbed habitat... wording is so similar here however, if the wording present in the document is to be used it should align with the wording in the recovery strategy (ie. the definition of disturbed habitat due to the roads, seismic lines etc.)</p> <p>"Undisturbed habitat is defined in the national recovery strategy (Environment Canada 2012) as areas that have not burned within the past 40 years, and areas that are further than 500 m from human disturbance footprints visible on 1:50,000 scale Landsat imagery", "Disturbed habitat was defined by Environment Canada as areas that have burned within the past 40 years, and areas that are within 500 m of human disturbance footprints (e.g. roads, seismic lines, cutblocks) visible on 1:50,000 scale Landsat imagery (Environment Canada 2011)."</p> <p>3. Here's some more info from the Recovery strategy "The NWT boreal caribou population was classified as likely self-sustaining by Environment Canada (EC) in 2012 based on habitat conditions at that time and the current understanding of a single NWT population with a continuous range (Environment Canada 2012). Likely self-sustaining was determined based on EC's disturbance management thresholds model, which identifies 65% undisturbed habitat as a threshold that provides a measurable probability (60%) for a population to be self-sustaining." This is considered a minimum threshold because at 65% undisturbed habitat there remains a significant risk (40%) that a population will not be self-sustaining. "</p>	<p>1. Reference included in the final draft HOP.</p> <p>2. Body text revised in the final draft HOP.</p> <p>3. This information was well understood and considered in the final draft HOP.</p>
WRRB (Randi Jennings)	3-3	Mitigation	<p>"We hypothesize that, because of the low traffic volume and proposed low traffic speed for the Th̄chq̄ ASR, the ROW could be reduced to a width less than 60 m in sections where motorist line-of-sight is not impeded. The habitat left intact would then be offset at a lower ratio than if it were physically cleared."</p> <p>Are you considering reducing the ROW to 60m in some sections? Should this then be included in your list of recommendations?</p>	<p>Yes, reducing the total project footprint will reduce the total project disturbance area, reduce the total area of boreal caribou habitat disturbed, and reduce the total amount of offsetting required. Recommendations on how and why reducing the footprint will benefit boreal caribou and the project have been included in the final draft HOP.</p>
WRRB (Randi Jennings)	3-5	Reforestation	<p>"Habitat affected by wildfire will be considered functional habitat in the evaluation because it is anticipated that eventually (i.e., within 40 years) the forest will return to its pre-burned condition."</p> <p>Will these previously burned areas be included in the offsets? this seems contradictory to the fact that your second preferred offset option is reforestation. You are essentially arguing that reforestation is not necessary (?)</p>	<p>Previously burned areas within the project footprint and ZOI will be included in areas requiring offsetting. The purpose of reforestation in previously burned areas is to restore some attributes of boreal caribou habitat faster than natural succession. The primary threat to caribou in the Wek'èezhii Resource Area is habitat loss due to fire. Habitat includes not only forage, but arguably more important, security cover from predators and hunters. Reforestation is intended to improve the rate of regeneration of burned areas to first provide security cover (and habitat connectivity) for caribou. Longer term restoration of forage and connectivity of habitat patches are other attributes resulting from reforestation and protection of regeneration from fire.</p>
WRRB (Randi Jennings)	3-6	Restoration	<p>"We propose initial mapping be undertaken prior to the finalization of this offset plan to identify suitable areas for linear feature restoration that have not already been identified (Section 5.5)."</p> <p>Will this be completed? Timeline?</p>	<p>This is a priority for the Operational Implementation Plan that was proposed in the final draft HOP. Understanding the areas where offsetting will be most effective is important to ensure any work completed has the best chance of being effective. Because the most important role of offsets is to immediately reduce some threats such as predation, restoration of linear features both outside and within the disturbance ZOI are a priority for caribou protection.</p> <p>Golder Response: Restoration within the Project's ZOI will mitigate and reduce the Project's residual effect. This should not be classified as an offset towards NNL.</p>

WRRB (Randi Jennings)	5-1	500 m ZOI buffer	<p>"We have assigned an average offset ratio of 0.5:1 for ZOI buffer areas to reflect an average potential disturbance impact (i.e., assigned 1:1 ratio at the edge of the buffer closest to the ROW and 0:1 at 500 m), recognizing that effects of sensory disturbance in the ZOI are expected to be minimal."</p> <p>Do you mean anything beyond the 500m buffer is 0:1? 500m should still be .05:1 correct?_</p>	<p>The final draft HOP recommended a 1:1 offset ratio in the ZOI. A recommendation is made in the final draft HOP to review the ratio for the ZOI once final designs and baseline data are available as there may be justification to increase the ratio in some areas (e.g., areas of known high boreal caribou use) or decreased in some areas (e.g., areas that are within densely forested sections, which may reduce the indirect effects of the road on boreal caribou). The rationale for a lower ratio in the ZOI is because the disturbance effect is likely a gradient response, lessening as we move from the road. Also, because it is a behavioural response, there is no total area or permanent loss of habitat as the forage and cover are still present within the ZOI. As a result, monitoring is proposed to determine the actual residual effect to caribou within the ZOI and subsequent adaption of the offset plan.</p> <p>Golder Response: Is the proposed monitoring intended to determine if there is reduced use of the existing trail (or the existing ZOI from the trail) by caribou once the Project is constructed? This will be very difficult to assess unless preconstruction data is captured. Note that although limited, Golder has collected remote camera data along the existing trail prior to construction. This should be considered in the calculation of Project residual effects (and subsequent monitoring). Golder can provide 2019 remote camera report.</p>
WRRB (Randi Jennings)	5-2	Residual Impacts	<p>"The 500 m ZOI buffer is an approximation for indirect effects of linear features on caribou; however, the consideration for a 500 m ZOI buffer was developed for effects assessment and mitigation for new industrial disturbance and mining projects (Environment Canada 2012) and is not typically used for calculation of offsets."</p> <p>I can't seem to find this within the Environment Canada 2012 document. However, it does say this... "Environment Canada mapped total disturbance levels on boreal caribou ranges across their distribution in Canada as a predictor of self-sustainability for boreal caribou local populations. The total disturbance footprint was measured as the combined effects of fire that has occurred in the past 40 years and buffered (500 m) anthropogenic disturbance defined as any human-caused disturbance to the landscape that could be visually identified from Landsat imagery at a scale of 1:50,000. Although the effect of anthropogenic disturbance varies for individual ranges (i.e. in some ranges extending up to 14 km), Environment Canada (2011b) demonstrated that the application of a 500 m buffer to mapped anthropogenic features best represents the combined effects of increased predation and avoidance on caribou population trends at the national scale (Environment Canada, 2011b). "</p>	<p>The reference to Environment Canada 2012 is related to the disturbance buffer of 500 m. Direct experience during the conception of those buffered values in meetings with Environment Canada were the basis for the 'new industrial disturbance and mining projects' comments. As indirect effects on caribou are primarily behavioural responses by some caribou (i.e. avoidance or reduced use of habitats within the ZOI), total loss of habitat value is not expected and for the purposes of offsets, a lower ratio was proposed.</p> <p>Golder Response: Link to Project residual effects for discussion around indirect effects. However, Golder would agree that the EC 2011 'that the application of a 500 m buffer to mapped anthropogenic features best represents the combined effects of increased predation and avoidance on caribou population trends at the national scale' has been accepted within both assessment methodology (including for this Project to determine residual effects) as well as within residual effect quantification within final Caribou Offset Plans.</p>

WRRB (Randi Jennings)	5-6	Reforestation	What if the reforestation does not work? As this is the main offset there should be concrete measures of success established.	<p>Reforestation is a practice that has been successfully implemented throughout western Canada, within Yukon and Northwest Territories. It is understood that reforestation is not a primary activity for the Forest Management Branch (FMB); however, recommendations in the final draft HOP are to work with the FMB to identify specific areas where reforestation will be most successful. In addition, trials have been recommended to allow for adaptive management of the proposed reforestation program.</p> <p>It should be noted that the primary offset focus is on linear disturbance, with reforestation second. Restoration of linear features provides immediate returns of habitat value (if completed correctly), including recovering the 500 m ZOI associated with those linear corridors. If enough linear disturbance can be mapped and restored in the planning stages of the Operational Implementation Plan, then reforestation may not be required. However, reforestation is an important consideration, as >65% of disturbance to the caribou habitat is thought to be due to increased wildfire frequency, scale and intensity.</p> <p>Golder Response: Linear restoration does not provide immediate return of habitat value. A time lag needs to be captured within the value of the offset. The time lag has in recent years been explored by Dickie et al. 2016, 2017 and Finnegan et al. 2014 as a function of predator efficiency on treated linear disturbances and height and cover of vegetation. As this would be the first linear restoration program as far north as the NWT, a level of uncertainty should also be considered within an offset ratio. Time lag and uncertainty are risk multipliers to capture within the determination of the offset amount.</p> <p>The comment from WRRB could be captured within an offset monitoring plan which establishes performance goals and measurable targets with an adaptive management feedback loop.</p>
WRRB (Randi Jennings)	5-6	Reforestation	Is a silvicultural implementation plan going to be developed? If so, time scale?	<p>A silvicultural implementation plan is part of the Operational Implementation Plan. This should be completed well in advance of any field work being planned for reforestation. Typically, offset measures are applied once the disturbance is completed. It is anticipated that this plan will be developed once designs are finalized, but before construction begins.</p>
WRRB (Randi Jennings)	5-6	Effectiveness monitoring	Will this monitoring be done through the WMMP or the offset plan? Detail as to how and when monitoring will occur?	<p>The details of the Operational Implementation Plan have not been finalized. It would benefit any plans to include the WRRB and all participants of the Corridor Working Group in the preparation of a plan.</p> <p>Golder Response: Its not clear that the WRRB comment has been addressed. It would make sense if monitoring of offset sites is captured within the WMMP and that monitoring plan details such as how and when monitoring will occur is flushed out within the Final Offset Plan. Frameworks for monitoring habitat restoration exist from other jurisdictions that could be adapted for this purpose. Refer to Government of Alberta 2018, Golder 2018.</p>
WRRB (Randi Jennings)	5-7	Effectiveness monitoring	<p><i>"Remote monitoring by a program of remote cameras in offset areas and survey techniques such as winter track transects are also suggested for the operational monitoring plan."</i></p> <p>Are cameras going to be used as a monitoring technique? First time it is mentioned?</p>	<p>Game cameras have been deployed along the proposed TASR alignment. Game cameras can provide important information about varying degrees of use along the TASR, but also have their limitations. As one of multiple tools proposed for monitoring the TASR, game cameras will provide important information about relative use by caribou and other wildlife species, especially predators. Assessment of tracks and collared animal data are especially important in assessing residual impacts within the ZOI and the effectiveness of offsets.</p> <p>Golder Response: refer to our previous comment about monitoring objectives, scale and methods. Appreciate that monitoring would require an adaptive management approach and would compliment existing GNWT-ENV caribou / wildlife monitoring programs.</p>
WRRB (Randi Jennings)	5-9	Prioritizing Offsets	This section [5.4] is a little confusing to read as it doesn't separate offset measures from support measures. I suggest having two sections. It reads as though you are comparing offset measures to support measures when in reality you are comparing offset measures against one another, and support measures against one another.	<p>Section 5.4 (and others) in the final draft HOP was revised to make this clearer.</p>

WRRB (Randi Jennings)	5-12	Prioritizing Offsets	I suggest better explaining how priority was assigned. This table [5-3] suggests it should be based on the residual effects metrics. ie. if it supports all three it would be high priority, if it supported only one it would be moderate etc. But it seems like priority was assigned based more on community feedback. Maybe a footnote to the table or something would be sufficient, so the table can still stand alone.	Table 5-3 was reconfigured in the final draft HOP to better reflect comments received from reviewers.
WRRB (Randi Jennings)	5-12	Next Steps	<i>"An operational implementation plan should be developed for the work."</i> Who will develop these? Time line?	The details of the Operational Implementation Plan have not been finalized. It would benefit any plans to include the WRRB and all participants of the Corridor Working Group in the preparation of a plan. As this plan would include specific measures to implement offsetting for the Tłıchǫ ASR, the Operational Implementation Plan should be developed once final designs are issued, but in advance of construction.
WRRB (Randi Jennings)	5-13	Next Steps	<i>The approach to finalize the Habitat Offset Plan and determine the total residual effects for offsetting is as follows.</i> When will this occur?	At the time the final draft HOP was written, no designs were available for the Tłıchǫ ASR. Designs are underdevelopment, and once finalized, the approach identified in the final draft HOP can be started.
WRRB (Randi Jennings)	5-13	Next Steps	<i>Their decision on how to allocate effort in offsetting will be based on the future Boreal Caribou Range Plan, future territorial policy planning for caribou offsetting, consultation direction, and a practical approach in consideration of funding and implementation constraints.</i> The Boreal Caribou Range Plan will not be ready for minimum 2 years... will the allocation of offsetting not be determined until then as well?	Planning for the Boreal Caribou Range Plan is expected to be underway, with a framework in place that outlines major concepts. It is anticipated that this framework will be complete enough to help ensure no major conflicts in the two planning documents arise. Offsetting is considered a priority measure in most caribou herd plans in other jurisdictions and would likely be consistent with any range plan developed here. Golder Response: Framework was developed in 2019 following the draft offset plan. Recommend the GNWT 2019b Range Planning Framework is referenced within the Final Offset Plan in particular in reference to the WRRB comment.
NSMA (Shin Shiga)	NA	Offsets	Offset area and options should be determined by effectiveness, not administrative convenience. NSMA maintains that the offset plan include areas outside of the Wek'èezhìi area, given that caribou live in a much broader range than the Wek'èezhìi and the impacts of the TASR will occur beyond its boundary limits. Further details in regards to the rationale for designating the Wek'èezhìi as the offsetting area are lacking in the draft CHOP and should be reviewed with a view to expanding the range if need be.	There is no evidence that residual behavioural disturbance effects of the Tłıchǫ ASR will extend further than the ZOI (i.e., 500 m buffer), much less beyond the boundary of the Wek'èezhìi Resource Management Area. Indirect behavioural disturbance effects of the project use a 500 m buffer from the project footprint (consistent with other projects potentially affecting caribou), and the decision to focus on the Wek'èezhìi Renewable Resource Area aligns with the NWT Recovery Strategy for Boreal Caribou (CMA 2017) and the outcomes of the Corridor Working Group. Typically, offset measures are applied to regions nearby to the proposed project footprint and usually apply to direct habitat loss rather than including potential behavioural disturbance within a ZOI. Discussion related to justifying the decision to focus on the Wek'èezhìi was incorporated into the final draft HOP. Golder Response: As per offset conservation principals outlined by IUCN (2016) and EC 2012a, the default location of an offset should be as close as possible to the impacted site, however, if a more distant site is deemed more appropriate under the circumstances, it should still have comparable or greater value to caribou. To date in Canada, proponents' have attempted to implement offsets within the impacted caribou range, and when there is insufficient area available to restore within range or where a offset location that is agreed upon with the land manager and in an area of protection, restoration is implemented at a higher ratio when in a different caribou range from the impact (Barker 2017)

NSMA (Shin Shiga)	5-4	Reforestation	<p>Although reforestation may be an appropriate solution for offsetting in the boreal caribou range plan, it is a long-term solution. As described in section 5.2.2 ("Reforestation") of the draft CHOP, reforestation does not yield short-term effects: <i>"the positive effects are not immediate and will take a minimum 10-15 years on suitable growing sites to begin to be functional as offsets for security cover and mortality reduction, and potentially greater than 80 years for reforestation of lichen forage for caribou."</i></p> <p>The effects of reforestation would likely not occur in time to benefit the boreal caribou, which are experiencing major declines and extirpations on a rapid time scale. It should, therefore, not be considered an offset option.</p>	<p>Reforestation is proposed as an offset for several reasons. In the short term, it will provide a means of reducing the time required to provide security cover for caribou. In the absence of linear corridors to restore, it is proposed as a means of achieving the desired offset ratios for the new road. It is acknowledged that habitat restoration in burned areas will take a longer time for it to become effective forage habitat. This is not contested; however, fire affected areas are the primary threat to caribou in habitats near the Tłıchq ASR. Reduced forage, and in particular, reduced security cover and habitat fragmentation are equally important disturbance to caribou. The consideration to include reforestation into the final draft HOP is the result of discussions with the Corridor Working Group and an understanding of the threats to caribou in relation to the Tłıchq ASR. A further consideration is that most offset plans do not include areas of potential behavioural disturbance such as those within the ZOI, where forage and security are not lost. As a result this plan requires significantly larger offset areas, as the majority (approximately 54%) of calculated loss is due to inclusion of habitat offsets from the ZOI.</p> <p>Golder Response: Having a >1:1 ratio for direct habitat loss (i.e., permanent road footprint at a recommended 4:1 ratio) factors in a time lag to reach functional habitat. At this high of a ratio, as compared to other offset plan examples, this multiplier also captures uncertainty in the offset measure. I.e., more habitat will be restored than disturbed from the Project residual effects to account for the known time lag and uncertainty of the offset measure.</p>
NSMA (Shin Shiga)	5-6	Offset Support Measures	<p>NSMA reiterates our concerns that "Offset Support Measures" listed in Section 5.3 are not genuine offset options and should not, therefore, be counted as an offset. Furthermore, research experiments, and collar monitoring are also not genuine offsets.</p>	<p>The final draft HOP clarifies what offset measures should be focussed on.</p> <p>Golder Response: research, particularly in an area such as the NWT NT1 range where there are a lot of data gaps in fire polygons/intensity, and caribou use/population metrics, can in fact compliment an offset program plan.</p> <p>Agreed, monitoring is not an offset.</p>
NSMA (Shin Shiga)	1-4	Restoration of Linear Disturbance	<p>Section 1.3 ("Offset Planning") suggests that CHOP is <i>"proposing novel approaches to habitat offsetting due to the relatively undisturbed boreal caribou (todzi) habitat and lack of legacy linear features available for restoring as offsets in the Wek'èezhìi Management Area."</i></p> <p>NSMA insists that novel approaches are not necessary. Linear disturbances exist to the southwest of the project, restoration of which will significantly offset the project impact (i.e., reducing mortality rates of young and adult caribou through decreased predator hunting efficiency rates).</p>	<p>See comment above related to focussing on the Wek'èezhìi Resource Area for the final draft HOP.</p> <p>Golder Response: refer to comment above in regard to Location. An offset, if deemed comparable or greater in value to caribou may be an option for implementation. However, a higher ratio of the residual effect would need to be considered as you move further away from the impact site.</p>
NSMA (Shin Shiga)	NA	Use of Language referring to Indigenous Consultation	<p>The draft CHOP does not use inclusive language and proper acknowledgement of the people this project affects. For instance, in describing the importance of this project, both the Executive Summary of the draft CHOP states boreal caribou are <i>"vital to survival of First Nations people in the area where the project is proposed"</i>; Métis people are excluded in this statement. The broader "Indigenous" term should be used. Similarly, Section 5.2 ("Proposed Offset Options") describes how the selection of potential offset options <i>"reflect the feedback from First Nations consultations"</i>; Section 5.4 ("Prioritizing Offsets and Decision Framework") states <i>"Feedback from the First Nations consultation clearly indicated that fire disturbance was an important impact on caribou..."</i></p>	<p>The final draft HOP uses more inclusive terminology as recommended here. Exclusive language in the draft HOP was not intentionally eliminating reference to Métis, rather following terminology (whether correct or not) founded in Measure 6-3</p>

NSMA (Shin Shiga)	NA	Recommendations	<p>Recommendations</p> <ol style="list-style-type: none"> 1. The limitation of offsetting to within the Wek'èezhì Management Area should be discontinued; 2. Temporal scope should be included in the decision-making framework. Offsetting options that provide immediate improvement should be valued much high[er], and longer scale programs should be scored lower (or not be considered at all); 3. Experimental program[s], such as reforestation, should be scored lower than proven approaches, such as restoration of linear disturbance; 4. Cost estimates should be provided for each option to provide a sense of feasibility; 5. Respectful and fair consideration of NSMA's concerns is imperative, rather than eliminating any reference to Métis; 6. Where NSMA's concerns are not accommodated, rationale for why the decision not to accommodate the NSMA be provided in writing. 	<p>This recommendation has been addressed above.</p> <p>Offsetting options that provide immediate improvement to habitat (i.e., linear feature restoration) are valued higher in the final draft HOP; however, the focus remains within the WRMA for reasons outlined above. This recommendation should be considered for range planning.</p> <p>Reforestation is not considered experimental. It is a practice that occurs throughout western Canada and is based on long-established scientific-based research. It is understood that the NWT, like Yukon, poses certain challenges to reforestation; however, recommendations in the final draft HOP to work with the GNWT Forest Management Branch and develop an Operational Implementation Plan will help guide any silvicultural practices applied. Monitoring of the effectiveness of reforestation is an essential component of the operational offset plan.</p> <p>Cost estimating is not appropriate at this time, as the designs for the road are not yet finalized and the intentional overestimation of area to be offset would inflate any costs.</p> <p>Exclusive language in the draft HOP was not intentionally eliminating reference to Métis, rather following terminology (whether correct or not) founded in Measure 6-3.</p> <p>Rationale has been provided herein.</p>
ECCC (Jean-Francois Dufour)	Executive Summary	Protected Areas	<p>Other offset support measures directly relate back to the TASR project. The linkage with PAs [protected areas] is not as obvious here, given PAs have been in development for years, prior to the TASR project, and part of a larger conservation network plan. This relates to the concept of "additionality" in ECCC's Operational Framework for Use of Conservation Allowances (2012): "Conservation allowances should provide ecological protection beyond what would be provided under a business-as-usual scenario". I'd recommend removing this support measure from the Offset Plan. It's not necessary (i.e. no value added) given other options and support measures in the Plan and also shouldn't be discussed in the context of justifying, offsetting or lessening the effects of the TASR project. It is more relevant at the range level.</p>	<p>It is agreed that protected areas and long-term habitat protection from development are an important piece of caribou range planning. As such, they should be integrated with any approaches used for offsetting such as potential areas for fire protection or enhanced recovery from fire with reforestation. Wording in the final draft HOP has been revised to focus more on restoration within proposed protected areas, while maintaining wording to recommend increasing protected areas within the WRMA. As this was identified as an important value to elders and hunters during the Workshops, it was decided to keep some of this wording in place.</p> <p>Golder Response: Agree with ECCC on the additionality principal of incorporation of Protected Areas in the decision framework around locating offset sites (in line with response above). Lack of agreement with ECCC that Protected Areas are of no value added within the Final Offset Plan.</p>

ECCC (Isabelle Duclos)	2-2	Impacts	<p><i>"The proposed two-lane gravel Tłjchq ASR will be a relatively low impact road (projected use of 20 to 40 vehicles per day and speed limits of 70 km/hr) with minimal disturbance and is not expected to be a barrier to caribou movement (GNWT-INF 2016)."</i></p> <p>This is presented as a fact, not as an INF opinion. I would suggest to delete since many groups will disagree with this statement.</p>	<p>There is no evidence to suggest that the Tłjchq ASR will have a large impact on the environment. Compared to similar roads in similar settings, it is likely that the Tłjchq ASR will be a low impact road. Until research or studies suggest differently, the proposed road should be considered 'relatively' low impact based on its location, size, and anticipated use (including posted speed limits). Monitoring to assess actual residual impacts from the road on the ZOI and assessing the effectiveness of offsets should be a major component of an Operational Implementation Plan. Use of an updated habitat model will also guide refinement of areas of concern for impacts and for offset restoration.</p> <p>The wording in the final draft HOP has been revised and references provided to support the statement.</p> <p>Golder Response: The language and assessment used in the EA should be kept here (as done so by GNWT-INF) for consistency and for alignment with assessed residual effects.</p> <p>Monitoring to assess residual effects from the road and effectiveness of the offset seem misplaced to be discussed within the operational implementation plan. Consider adjustment of the WMMP to capture monitoring. Monitoring objectives, timelines, performance measures and costs will need to be considered by GNWT and could be consulted on under the Framework for Boreal Caribou Range Planning (GNWT 2019b).</p> <p>Golder Recommendation: It may be helpful in the Final Offset Plan to prepare a diagram that shows what inputs and feedback, and what the steps will be, in preparation of the implementation plan. This would capture the elements of the decision framework for what offsets will be selected and how areas will be selected. It may help to provide as a visual understanding for reviewers and collaborators.</p>
ECCC (Jean- Francois Dufour)	3-2	Quantify Residual Effects	<p><i>"The proposed Tłjchq ASR is considered a low impact linear disturbance, as it replaces an existing linear winter road and projected non-commercial traffic volumes are estimated at 20 to 40 vehicles per day at reduced speed limits".</i></p> <p>It's not the current Whati winter road, it's an older one. Only portions are considered an anthropogenic disturbance based on ECCC RS [resource selection] CH [critical habitat] spatial files and ENR (2016 edits), only the ends near the communities count towards anthropogenic disturbance.</p>	<p>The wording in the final draft HOP has been revised to reflect this comment. The disturbance resulting from the proposed Tłjchq ASR will be primarily along an existing road/trail. Whether those are currently considered in ECCC mapping or not does not change the statement that the new alignment will replace an existing road/trail. As a linear corridor is cleared and in place, some impacts such as increased predator access would likely already be occurring, regardless of whether areas are mapped as disturbed by ECCC and ENR.</p> <p>Restoring habitat to protect caribou is the primary focus of the final draft HOP. The focus is not to recover habitat mapped by ECCC (i.e., those disturbance footprints visible at 1:50,000 scale Landsat imagery ignore important linear features that may actually create more threat to caribou than larger features by providing improved cover for predators or hunters).</p> <p>Golder Response: Agree with GNWT-INF response above. The EC Landsat imagery does not capture the existing baseline conditions for the Project, or for potential offset areas.</p>
ECCC (Isabelle Duclos)	3-2	Quantify Residual Effects	<p><i>"A 500 m ZOI buffer has conservatively been accounted for in the potential residual effects of the Tłjchq ASR, although no direct effects are anticipated in this area."</i></p> <p>No direct effects on habitat; but could have an effect on caribou.</p>	<p>No direct effects on caribou or their habitat are anticipated within the 500 m ZOI as a result of the Tłjchq ASR. It is understood that indirect effects of the road may result in effects on caribou. Potential residual behavioural effects are not total, but reflect a gradient of temporary, varying responses to disturbance. Habitats within the ZOI still have the same forage and security value but may be used for less time or less often as a result of road activity.</p> <p>Golder Response: Agree with GNWT-INF response. Clarity on how residual effects are quantified in the Final Offset Plan will address this comment.</p>

ECCC (Jean-Francois Dufour)	3-2	Quantify Residual Effects	<p><i>"A 500 m ZOI buffer has conservatively been accounted for in the potential residual effects of the Tłıchǫ ASR, although no direct effects are anticipated in this area. The proposed Tłıchǫ ASR is considered a low impact linear disturbance..."</i></p> <p>Low impact to boreal caribou? Based on what monitoring information from NT1? Again seems a bit speculative without monitoring to support. Or is this based on a national road classification system?</p>	<p>The wording in the final draft HOP has been revised and references provided to support the statement. Monitoring is necessary to refine the ZOI residual impacts, however, professional judgement from experience gained on projects in other areas suggests that impacts will likely be low as security cover and forage habitats remain in the ZOI and levels of road activity are low relative to studies where impacts are observed. Monitoring with measures such as collared caribou, track surveys and remote cameras will allow adaptive management and refinement of the description of residual impacts within the ZOI.</p> <p>Golder Response: As noted within CER 2020, ECCC has no existing framework to offer an alternative approach particularly around an offset ratio. During the Project Application Case assessment, the EC (2012b) formula for thresholds was used to calculate the Project indirect habitat effects. The 500 m buffer is being used for Final Offset Plan for consistency with EC (2012b).</p> <p>Our understanding from Environment Canada's (2011) Science Report, is that EC interprets the 500 m buffer as the lost habitat area in addition to direct habitat loss that affects caribou demography (calf recruitment). There is no clear focus on sensory disturbance as much as fragmentation and spatial configuration of disturbances on the landscape which subsequently increases predation risk. As per EC (2011), "Only two of the six disturbance configuration metrics tested had a significant effect on caribou calf recruitment, after controlling for the percentage anthropogenic disturbance buffered by 500 m: edge density, a surrogate for quantifying the changes in the permeability of the landscape to predators, and the nearest-neighbour distance between disturbance patches, a surrogate measure of landscape connectivity. These two metrics of disturbance configuration were incorporated into the subsequent analysis to identify the relationship between population (recruitment) and habitat conditions" (pg 23).</p> <p>Although the distance at which caribou reduced use around disturbance has varied (e.g., Sorensen et al. 2008, Vistnes and Nellemann 2008, Dyer et al 2001) Environment Canada did run the analyses with different buffer widths but found disturbance models with minimum 500m (fire + buffered anthropogenic) were better at explaining variation in caribou recruitment, so 500m was selected as a minimum approximation of zone of influence.</p> <p>There is no evidence to use a different approach and we highlight for ECCC that the existing condition of the habitat was used within the Application Case assessment and in the quantification of residual effects for the purpose of the final Offsets Plan.</p>
ECCC (Jean-Francois Dufour)	3-2	Quantify Residual Effects	<p><i>"The proposed Tłıchǫ ASR is considered a low impact linear disturbance, as it replaces an existing linear winter road and projected non-commercial traffic volumes are estimated at 20 to 40 vehicles per day at reduced speed limits (70 km/hr projected)."</i></p> <p>The approved Fortune Minerals mine, north of Whati, will eventually be using this road for commercial purposes. I'm pretty sure as part of the EA it was included in the predicted traffic volumes.</p>	<p>The final draft HOP was based on potential effects of the proposed Tłıchǫ ASR. Cumulative effects assessment is part of the environmental assessment process, which was developed without the benefit of having detailed designs of the road with which to evaluate project effects.</p> <p>Golder Response: The final habitat plan must be based on Project Residual Effects. The draft HOP is NOT based on the residual effects as assessed within the Adequacy Statement Response.</p>

ECCC (Jean-Francois Dufour)	3-2	Quantify Residual Effects	<p><i>"For example, the existing Old Airport Road is estimated to be 8 m wide (approximately 75 ha) and is an existing linear disturbance on the land."</i></p> <p>Based on what? Only the ends are considered existing anthropogenic disturbances based on ECCC RS [resource selection] CH [critical habitat] layers and ENR (2016 edits) dataset.</p>	<p>It is unclear why the focus of this question is based on the limitations of qualified anthropogenic disturbance. The focus is not to recover habitat mapped by ECCC (i.e., those disturbance footprints visible at 1:50,000 scale Landsat imagery ignore important linear features that may actually create more threat to caribou than larger features by providing improved cover for predators or hunters), but rather to develop a plan to offset for disturbed caribou habitat. If a linear feature can be restored, that will provide immediate value in terms of reducing predator risk to caribou.</p> <p>Golder Response: Golder supports GNWT-INF response. The Project assessment relied on Tłı̨chʔ TK studies and maps for existing trails (used by hunters, access, predators), rather than focusing only on disturbance mapped by ECCC. This offset plan is linked to the Project Residual Effects.</p> <p>Note that the EC methodology was used in the assessment. Since assessment was completed, monitoring of the existing trail confirms use by predators, humans and caribou (and presence) of the existing trail. (Golder 2019a)</p>
ECCC (Jean-Francois Dufour)	3-2	Quantify Residual Effects	<p><i>"However, opportunities to restore the trail where the proposed all-season road deviates from that alignment will be considered for offsetting because restoring linear features provides a quick return to effective habitat (i.e., sections of the Old Airport Road that will not be followed by the Tłı̨chʔ ASR will be targeted for offsetting, after consultation with First Nations to determine the level of use in the area). Areas of the Old Airport Road that can be restored will count towards offsetting, including the old road's 500 m ZOI buffer in areas where it does not overlap with the Tłı̨chʔ ASR."</i></p> <p>Should only consider "recognized" anthropogenic disturbances (i.e. identified systematically over the NT1 range) for restoration. Or else efforts won't get captured as caribou habitat gains or additions at the NT1 scale, but will help with other project effects. [see Figure 3-1] Again, if these "red areas" are not "recognized" anthropogenic disturbances, efforts to restore them will not be recognized in any reporting on the status of caribou habitat.</p>	<p>The objective of the final draft HOP is not to gain improvements in ECCC's method of counting caribou disturbance, but rather to focus on effects on caribou as a result of the proposed road and develop effective habitat offset measures for them.</p> <p>Golder Response: Fully support GNWT-INF response, and mitigation to restore portions of the trails that will become redundant anthropogenic footprint within a caribou range following commencement of road operations.</p>
ECCC (Jean-Francois Dufour and Isabelle Duclos)	3-5	Determine Offset Options	<p><i>"We used collared-caribou data shared by GNWT-ENR to help assess suitable candidate areas for reforestation based on recent caribou use. The data were representative of individuals that were recorded around the Tłı̨chʔ ASR and illustrated point-locations of individuals over two years, and "movement paths" were derived to infer general movement and habitat use by the individual wearing the collar. While we recognize limitations of these data, they inform a general understanding of an individual caribou's movement on the land, and patterns of use can be detected from the data set."</i></p> <p>What is the assessment suitable candidate areas based on? Is the absence of caribou use considered a priority area for reforestation? Presumably if caribou are already using or moving through these areas then restoration there should be less of a priority if the goal is to increase their distribution/occurrence and diminish fragmentation over the landscape.</p> <p>Limitations of these data are significant. Should identify areas based on TK [traditional knowledge].</p>	<p>The assessment of suitable candidate areas was based on recent collar data and Traditional Knowledge gathered during the Workshops. Understanding the limitations of the collar data (e.g., they are recent and only provide a 'snapshot' in time) the final draft HOP clarifies that the candidate areas are conceptual. The intention is to identify areas where wildfire has fragmented habitat on the landscape, ground-truth those areas, and look for opportunities (from an ecological perspective) to improve habitat connectivity by increasing the rate of forest recovery from fire. The candidate areas in Figure 5-1 of the final draft HOP amount to almost three times the area needed for offsetting, even at the overestimated scale presented in the final draft HOP. Restoration of burned areas still used by caribou is proposed in order to reduce short term predator risk and increase security habitat, especially between existing patches of occupied caribou habitat.</p> <p>Once detailed designs are finalized and the total area required for offsetting is determined, candidate areas can be identified, ground surveys can be conducted, and work can begin.</p> <p>Golder Response: Agree with GNWT-INF response. Would add that habitat restoration priority area selection in other jurisdictions has focused on improving the habitat intactness within areas of known caribou use to reduce predation risk from anthropogenic features (e.g., Golder 2018 for British Columbia and use of TK; ABMI Restoration Priority Area selection using 'best bang for buck' methodology (Dickie 2018).</p>

ECCC (Jean-Francois Dufour)	3-6	Prioritizing Offsets	<p>"Because traditional offsetting by restoring only legacy linear features is not immediately available for this project, habitat restoration (e.g., reforestation) was identified as the secondary offsetting option, combined with additional measures to support offsetting, with the goal to increase the effectiveness of habitat restoration offset measures (Section 5.2)."</p> <p>Shouldn't this be the "main" option now, if the other is not available? Previous wording was clearer.</p>	<p>The final draft HOP clarifies that restoring legacy linear features is the first priority in the plan. Reforestation is the second priority. Finer scale mapping and ground-truthing may identify more legacy linear features available for restoration than are currently mapped. The final draft HOP includes recommendations to develop an Operational Implementation Plan that is intended to locate previously unmapped legacy linear features and ground truth them to determine their suitability for restoration. Conversations with Indigenous groups will be an important step in this process.</p> <p>Golder Response: It may be helpful in the Final Offset Plan to prepare a diagram that shows what inputs and feedback, and what the steps will be, in preparation of the implementation plan. This would capture the elements of the decision framework for what offsets will be selected and how areas will be selected and how collaboration with Indigenous groups fits in. It may help to provide as a visual understanding for reviewers and collaborators</p>
ECCC (Jean-Francois Dufour)	3-6	Quantify Residual Effects	<p>"We propose initial mapping be undertaken prior to the finalization of this offset plan to identify suitable areas for linear feature restoration that have not already been identified (Section 5.5). Any new areas identified should be vetted by the Tł̓ch̓q Government and Wek'èezhii Renewable Resource Board and any affected First Nation to ensure the proposed areas are not important traditional trails."</p> <p>Again, it depends what impacts this is attempting to compensate for... if for habitat loss, it should be a "recognized" anthropogenic disturbance or else it won't count as a habitat gain but would address other project effects.</p>	<p>See related comments above.</p> <p>Golder Response: It appears this comment is reflecting on Equivalency of the impacted site to the offset site. It is important to note that the Wek'èezhii Management Area, which has been determined through engagement to be the focus of offset measures for the Project, may not contain enough similar sites to apply habitat restoration. It is not an appropriate comment for ECCC to state that unless 'recognized' anthropogenic disturbances are restored that a habitat gain would not occur or that a NNL from the Project cannot be achieved. We would direct ECCC to Robichaud and Knopff (2016) who summarize offset options and considerations for boreal caribou as well as challenges with implementation in a jurisdiction such as Alberta with extensive anthropogenic footprint available for restoration.</p>
ECCC (Jean-Francois Dufour)	3-6	Prioritizing Offsets	<p>"Reforestation was selected as for the secondary focus for offsetting because it directly addresses the current, primary threat to boreal caribou (t̓d̓zi) in the Wek'èezhii Management Area."</p> <p>Perhaps some editing is required throughout sections 3.2.2 - 3.2.4 for consistency on what's the preferred option and why. It's a bit confusing. For e.g. Legacy is the best, but not an option, but we'll look into it anyways. Here reforestation is "secondary" but addresses the "current and primary threat to caribou in the WMA". It's also deemed doable... so why isn't this the main option being brought forward. It feels as though there are other underlying factors influencing choices but not clearly stated or inconsistent.</p>	<p>Wording in the final draft HOP has been revised to be clearer. This sentence remains; however, clarification is made as to why restoring legacy linear features is considered the first priority. In general, the first priority for offsets is to restore existing habitat before any new habitat is lost. As such, legacy areas that can be restored through measures that immediately reduce predation will always be a priority over longer term measures that may take years to be fully effective or are not effective before the new disturbance takes place.</p> <p>Golder Response: Agree with ECCC to more clearly articulate Quantification of Residual Effects and the decision framework for offset area and offset type, selection in the Final Offset Plan.</p>
ECCC (Jean-Francois Dufour)	5-2	Quantify Residual Effects	<p>[In Table 5-2 Tł̓ch̓q ASR Proposed Habitat Balance Table, referring to the total area of borrow sources (1,489 ha)] Accounts for the difference in area and proposed offset area totals from previous version. Why the significant increase? Larger pits or more of them required?.</p>	<p>Areas were recalculated to include the area of all 21 potential borrow pits and the ZOI buffers associated with them (a request made by contributors to the Corridors Working Group). Because the final project build-out will likely only require 13 borrow pits, previous versions of the HOP had only included 13 borrow pits and their buffers. Project designs were not available at the time the final draft HOP was written, so in a conservative effort, the maximum total disturbance area was considered in the plan.</p> <p>Golder Response: Our understanding is that some of the borrow sources will be from existing borrow pits. Any disturbance that existed prior to the Project will have a pre-existing ZOI. The difference between the existing disturbance footprint and existing ZOI prior to construction and the Project footprint and additional Project ZOI should be calculated. For borrow pits, these would be considered a temporary disturbance that will be reclaimed over time as part of Project mitigation (needs to be quantified base don inputs from INF). Refer to NGTL 2020 Figure 4-1 example provided.</p>

ECCC (Jean-Francois Dufour)	5-4	Quantify Residual Effects	<p><i>"Initially, we will focus our attention on sections of the Old Airport Road that will not be developed into the Tłı̨cẖo ASR and along the Highway 3 corridor."</i></p> <p>See earlier comment about it should provide a "habitat gain" ie a recognized anthropogenic disturbance.</p>	See related comments above.
ECCC (Jean-Francois Dufour)	5-9	Prioritizing Offsets	<p><i>Section 5.4 Prioritizing Offsets and Decision Framework.</i></p> <p>It's confusing here too. I understand what the intent is, better than during earlier sections, but its mostly because of sections 5.2.1 and 5.2.2. Everywhere else in the Plan it's unclear and confusing what the priority/focus is. A bit of rewording in these sections would make it easier for the reader.</p>	Wording in the final draft HOP has been revised to be clearer. Clarification is made as to why restoring legacy linear features is considered the first priority, reforestation is the second priority, and the remaining actions are 'proposed support measures'.
ECCC (Jean-Francois Dufour)	5-10	Protected Areas	<p><i>"K'ichii (Whitebeach Point) was identified by First Nation participants as a potential area for consideration as a protected area."</i></p> <p>See earlier comment re PAs. This area in particular is already in the process for establishment (has been for years), no "additionality" and more appropriate to address at the range level, not project level. Unless we're talking about improving the habitat in the PA... to accelerate or improve caribou use.</p>	<p>Working in the final draft HOP has been revised to include habitat improvements in this area. Throughout the Workshops, this area was repeatedly identified as culturally significant and important to protect for caribou. Similar to the approach of identifying remaining forest patches as priorities for fire protection, protected areas would assist in providing security of habitat from future development disturbance. Reforestation of habitat in a potential protected area could be a priority if it provided longer term security for caribou.</p> <p>Golder Response: Golder recommends that it's not only the action of setting aside a protected area that can serve as an offset. Other actions, including improving the habitat quality in protected areas through restoration of legacy anthropogenic footprint (e.g., Refer to Barker 2017 for a summary of NGTL examples within Dillion Wildland Area in Alberta), buying back tenure or relinquishment of tenure (refer to Golder 2014) or other potential improvements such as shoreline restoration (to important spring forage cover for calving caribou) within an existing or proposed protected area should not be dismissed and would add to reaching NNL by contributing to the ADDITIONALITY, DURATION and ACCOUNTABILITY offset principles by securing ecological protection into perpetuity. This offset action would need to be considered in the offset ratio, as the offset would be of a greater value then an offset that may be impacted or lost over time.</p>
ECCC (Jean-Francois Dufour)	5-13	Restoration	<p><i>"Investigations into currently unmapped, additional legacy linear features that may exist along Highway 3 should also be explored and any unidentified features should be mapped."</i></p> <p>Will not be considered a habitat gain at the NT1 scale.</p>	<p>Restoring habitat and reducing predation risk to protect caribou is the primary focus of the final draft HOP. The focus is not to recover habitat measured at the NT1 scale (i.e., those disturbance footprints visible at 1:50,000 scale Landsat imagery ignore important linear features that may actually create more threat to caribou than larger features by providing improved cover for predators or hunters).</p> <p>Golder Response: agreed with response that footprints visible at 1:50,000 scale Landsat imagery ignore important linear features from an ecological perspective that create disturbance via predation risk or hunters.</p>

Table 3 – Concordance of comments on the Final Boreal Caribou Habitat Offset Plan for the Tłı̨chų All Season Road.

The following table reflects the comments on the final draft report made by the Collaborators Working Group, including Government of the Northwest Territories Department of Infrastructure (GNWT-INF), Department of Environment and Natural Resources (GNWT-ENR), Tłı̨chų Government (TG) and the Wek'èezhii Renewable Resources Board (WRRB); as well as, North Slave Métis Alliance (NSMA) and Environment and Climate Change Canada. Comments addressed here are those that were more than editorial in nature or made direct recommendations for changes in text.

Organization	Page Reference	Topic	Comment	Response
Tłı̨chų Government				
Tłı̨chų Government (Michael Birlea)	Phone conversation	Traditional Land Use	Will the existing trails and roads that intersect quarries be restored or reclaimed to a passable condition following quarry development?	There is currently no requirement for this detail in restoration. Recommendations have been made that all existing trails affected by the quarries be reinstated to a condition where vehicles traveling along the trail can traverse the pit. This may require regrading the slope to improve the crossing.
Tłı̨chų Government (unknown author)	1-2	Implementation Plan	Identify key principles based on the Indigenous knowledge shared to date that will be used develop the spatial analysis for the implementation plan. Spatially identify and quantify the linear features that are potentially available for restoration within the Wek'èezhii Management Area in this plan and refine this approach in the implementation plan.	Key principles based on Indigenous knowledge was incorporated throughout the Habitat Offset Planning. Concepts that influenced the planning included fire management, areas to focus restoration efforts, and priorities identified during engagement meetings. To support the finalization of the Habitat Offset Plan, the work to identify specific areas for restoration was begun. An implementation framework was developed that included a recommendation to share the potential offsetting locations with all affected Indigenous communities and receive their input.
Tłı̨chų Government (unknown author)	1-3	500 m ZOI	Consult with communities regarding the degree of avoidance / impacts to habitat around the road. As a precautionary approach, recommend using a more conservative estimate initially to reflect a likely higher zone of influence around the road. Revise estimated zone of influence based on data from monitoring (Indigenous knowledge-based and radio collars from GNWT). Adjust habitat loss estimate accordingly and revise offsetting plan once these data are available, preferably within 3 years of the commencement of road operations. Correlate avoidance with periods of high road use, if road use data are available.	The Zone of Influence (ZOI) was determined early in the consultation process and follows territorial and federal ZOI buffers. The recommendation to review the ZOI in three years is supported but will not affect the offsetting plan.
Tłı̨chų Government (unknown author)	1-3	500 m ZOI	<i>"The Old Airport Road is an existing cleared area of road and because it is used currently used by vehicles and wildlife, including predators (Golder 2019), the Old Airport Road has an existing 500 m ZOI."</i> Disagree that the zone of influence will be the same where the Tłı̨chų ASR and the Old Airport Road overlap. The ASR will have higher traffic use and year-round usage - the zone of influence will likely be higher. This increased loss should be incorporated into the habitat offsetting calculation.	The Zone of Influence (ZOI) was determined in the consultation process after it was determined that the ZOI would require offsets. The 500 m ZOI follows territorial and federal ZOI buffers. The Old Airport Road is an existing corridor that is used by humans and predators, as evidenced by game cameras deployed by Golder Associates pre-construction.
Tłı̨chų Government (unknown author)	1-7	Offset Options	Wildfire restoration efforts may not be effective for improving caribou use of the area. A key potential future effect of the construction of the Tłı̨chų ASR is the risk of a proliferation of roads extending out from the TASR. Increase weighting on other options for offsetting – e.g., habitat protection measures that prevent further incursions. Develop in concert with an access management plan to prevent further additional unintended impacts (e.g., increased access for non-Tłı̨chų harvesters into important harvesting areas). Consider restoration in areas in the southern part of the NT1 as a higher priority.	The Residual Effects of the Tłı̨chų ASR were evaluated in the Developer's Adequacy Statement Response (Golder 2017 ¹). Residual effects are changes in habitat availability, changes in habitat distribution, and survival and reproduction. Wildfire was the highest priority for offsetting as identified by members of Whati and Behchokò during consultation workshops. Wildfire restoration was

¹ Golder Associates Ltd. (Golder). 2017. Adequacy Statement Response for the Tłı̨chų All-Season Road Project. EA1617-01. Prepared for the Government of the Northwest Territories. April 2017. Available at: <https://reviewboard.ca/registry>

Organization	Page Reference	Topic	Comment	Response
				<p>included in the Habitat Offset Plan as a direct response to community members concerns during the consultation workshops.</p> <p>Preventing further incursions are the top priority and are recognized in the form of restoring linear features within the Tłıchq ASR and Highway 3 corridors. Consultation with Indigenous community members will be essential in determining which linear features should be prioritized.</p>
Tłıchq Government (unknown author)	3-5	Quantifying Impacts	<p><i>“the existing Old Airport Road was considered as existing disturbance with an existing ZOI”</i></p> <p>All impacts from the Tłıchq ASR should be included in the offset calculation. This approach may underestimate the additional habitat lost in moving from an existing seasonal right of way to a more regularly used all season road. The impacts are particularly concerning during specific seasons (e.g., calving seasons, which would not have been an issue previously). This impact has not been adequately considered.</p> <p>As above, the entire length of the TASR should be the basic unit for calculating the offsetting requirements, with an appropriate buffer width that incorporates a precautionary approach (i.e., wider than 500 m).</p>	<p>This comment is related to the Developer’s Adequacy Statement Response (Golder 2017) phase of the project. Residual effects of the Tłıchq ASR have already been determined and are habitat availability, habitat distribution, and survival and reproduction. The existing corridor has been shown to be used by predators and humans.</p> <p>The Zone of Influence (ZOI) was determined early in the consultation process and follows territorial and federal ZOI buffers.</p>
Tłıchq Government (unknown author)	3-5	Residual Effects Calculation	<p>Paraphrased from Section 3.3.2 – 4 Quantify Residual Effects of the Project: <i>“Areas within the ZOI were included in the offset calculation if they were selected by caribou based on the RSF”</i>.</p> <p>The 65% undisturbed threshold is applied at the range level. All habitat within the range is considered important (whether it is selected for or not by boreal caribou). Therefore, all habitat should be equally weighted in the offsetting ratio. This approach is very concerning as it downplays the importance of habitat that is not preferred for feeding but is nonetheless important for caribou in terms of predator avoidance.</p> <p>All habitat that is lost should be offset at the same ratio across the board. It is not appropriate to downgrade the offsetting ratio for habitat that has higher or lower use based on the RSF. This approach must be revised to include all habitat lost within the ROW and zone of influence, regardless of the habitat class as determined through the RSF.</p>	<p>Evidence collected from collared caribou were differentiated into selected and non-selected habitats. Habitats were considered selected if they were more likely to select the habitat (for every life requisite) than not. The 65% undisturbed threshold is applied at a coarser scale (i.e., a territory-wide metric) than the Habitat Offset Plan considers and finer scale metrics (i.e., the RSF) are appropriate for a conceptual, indirect effect that may or may not be realized.</p> <p>Areas not selected by caribou will be offset at a ratio of 1:1.</p>
Tłıchq Government (unknown author)		500 m ZOI	<p>Disagree that the zone of influence will be the same where the Tłıchq ASR and the Old Airport Road overlap. The ASR will have higher traffic use and year-round usage - the zone of influence will likely be higher.</p> <p>This increased loss should be incorporated into the habitat offsetting calculation.</p>	<p>The ZOI is a sensory disturbance that will not result in physical effects on habitat and was already in place when the Old Airport Road was the primary source of travel. The 500 m buffer aligns with Environment and Climate Change Canada’s policy for setting ZOIs on linear features.</p>
Tłıchq Government (unknown author)		Offset Ratios	<p>A ratio of 4:1 may address some ecological concerns (e.g., timelag for habitat recovery) but not adequately consider all aspects that should be integrated into the offsetting ratio (e.g., cultural importance, rarity of the habitat).</p> <p>Given the value of the habitat and the uncertainty of offsetting measures, a higher offsetting ratio may be appropriate. We recommend identifying an appropriate offsetting ratio based on input from Tłıchq knowledge holders, and reviewing recent recommendations put forth by ECCC in relation to the</p>	<p>Four times as much area will be restored as will be disturbed. The 4:1 ratio has been discussed with territorial regulators and has been discussed early in the habitat offset plan process and rationale was provided. Having a >1:1 ratio for direct habitat loss (i.e., permanent road footprint at a recommended 4:1 ratio) factors in a time lag to reach functional habitat. At this high of a ratio, as compared to other</p>

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			proposed NGTL 2021 pipeline in the Little Smoky Range.	offset plan examples, this multiplier also captures uncertainty in the offset measure and rarity of habitat (which may be considered not rare, as the Wek'èezhìi region has not experienced the same types of impacts as other caribou ranges in nearby jurisdictions). It is unclear in the comment how higher offsetting ratios can be quantified to benefit culturally important values. The Little Smoky range is a distinctly different area with significantly different levels of disturbance to woodland caribou habitat. The Little Smoky range is a highly fragmented and highly disturbed (human-caused disturbance) caribou range when compared to the Wek'èezhìi region, which has very little disturbance comparatively.
Tłı̨chǫ Government (unknown author)	3-5	Offset Ratio	<i>"Direct disturbance was offset at a 4:1 ratio, indirect disturbance was offset at 2:1 for habitat selected by caribou, and 1:1 for habitat not selected by caribou"</i> All habitat within the zone of influence must be considered lost and the same offsetting ratio should be applied.	Habitat within the ZOI will not be lost and the effect is conceptual and indirect as compared to the direct effects that will occur within the project footprint.
Tłı̨chǫ Government (unknown author)	3-2	Increased Protected Areas	Table 3-2: <i>"Modified to prioritize restoring habitats in protected areas to provide permanency of the offset (which increases the value of the offset), but continues to be an Option Support Measure"</i> Increase the emphasis on habitat protection to avoid additional incursions into caribou habitat. Over the long term, this approach would likely result in maintaining intact habitat in the area	Habitat protection has been discussed as an option throughout the Habitat Offset Plan. See ECCC comment below also.
Tłı̨chǫ Government (unknown author)	3-3	Offset Area Available	At this stage, the offset plan should provide a summary of the potential areas for offsetting, to quantify the area potentially available to offset the impacts of the road. Further analysis could be conducted in the implementation plan to confirm the final locations for offsetting.	The Implementation Framework (Appendix E) provides summaries of available vs required offsets. Candidate locations are expected to be shared with Indigenous collaborators to acquire input and comment on potential offsetting locations.
Tłı̨chǫ Government (unknown author)	3-3	Reforestation of Fire-Disturbed Areas	The efficacy of this approach is uncertain: can active restoration speed up the development of suitable habitat for boreal caribou following wildfire? Prioritize protection above wildfire restoration. Given the uncertainty with this approach, require a higher offsetting ratio for treatments in wildfire areas.	It is understood that this option has some uncertainty. Monitoring success and including GNWT-ENR in the process will be important to determine the efficacy of the approach. Linear and polygonal feature offsetting is expected to be the primary option to focus offsetting work.
Tłı̨chǫ Government (unknown author)	4-2	Indigenous Collaboration	We request that the consultant address the question of whether a discussion was held on the offsetting ratio itself, and what the feedback was from community members. If this aspect of offsetting has not been adequately addressed through the consultation conducted to date, hold another workshop with elders / knowledge holders to review this plan and specifically the offsetting ratio, to determine if enough habitat is being restored to offset the impacts of the road	The discussion of offsetting ratios was had during the community engagement; however, because the concept of offsetting is new to NWT and many participants to the Habitat Offsetting Plan, most of the effort has been to describe the purpose and rationale for offset ratios.
Tłı̨chǫ Government (unknown author)	5-1	Effects Description	Offsetting calculations must include areas that have been burned by wildfire as habitat that will be lost as a result of the TASR.	Burned areas have been included in the offset calculation.

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Tłıchq Government (unknown author)		Offset Ratios	<p>A 4:1 ratio is the minimum multiplier that is appropriate for a species at risk. There is uncertainty with respect to the approach that is being proposed for offsetting (i.e., restoring wildfire areas). A higher offsetting ratio may be appropriate.</p> <p>Review recent recommendations from ECCC regarding a proposed pipeline (NGTL 2021) in the Little Smoky range to determine if any of the considerations applied in that case should be integrated into this offsetting ratio.</p> <p>In particular, consider: a) habitat lost for a species at risk; b) the importance of including all habitat lost in the calculation, regardless of the suitability of the habitat (i.e., do not use a lower offsetting ratio for indirect habitat loss based on the RSF); c) uncertainty with respect to the efficacy of the proposed offsetting measures (wildfire restoration); d) the timelag.</p>	<p>The 4:1 ratio aligns with the majority of the offsetting that has been completed in recent history. The Wek'èezhìi region is unlike the Little Smoky region in that linear disturbance is uncommon in the and wildfire has disturbed the majority of caribou habitat; whereas, linear features are the primary disturbance in the Little Smoky region.</p> <p>Restoration of linear features provides the most reliable method to restore caribou habitat while directly addressing the residual effects of the Tłıchq ASR. It is expected that all of the offsetting for the Tłıchq ASR will be completed on linear and polygonal (e.g., old quarries or landings) features.</p>
Tłıchq Government (unknown author)		Offset Ratio / Effects Assessment	<p>The relative intactness of the NT1 range in this area supports a lower offsetting ratio than would be required in other contexts, but the calculation makes assumptions about some key aspects of the impacts from the road that are not supported by our current understanding of boreal caribou ecology (including: inadequately considering the increased impacts of an all season road vs. a seasonally used existing linear feature; inappropriately using a reduced offsetting ratio in the zone of influence; further downgrading unselected habitat in the zone of influence, which ignores the importance of the condition of the entire range; considering habitat that is impacted by fire as disturbed and therefore not including it in the accounting system as habitat lost, despite the fact that disturbance from a fire and a road are not equivalent). The 4:1 offsetting ratio may not be adequate given that boreal caribou are a species at risk, and there is uncertainty about the efficacy of the proposed offsetting measures. However, a consideration of the current condition of the range (i.e., less than 35% undisturbed habitat) is also important.</p> <p>Revise the approach used to calculate the total area required to offset based on the concerns and perspectives identified above. Review the approach taken by ECCC relative to the proposed NGTL 2021 pipeline in the Little Smoky to integrate the most up-to-date perspectives on how offsetting for boreal caribou should be calculated. Incorporate cultural considerations into the offsetting approach. Integrate a consideration of how total habitat disturbance in the vicinity of the TASR is impacted by the development of the road. Considering the condition of the range, an increased focused on habitat protection to avoid further incursions is recommended.</p>	<p>Relevant Indigenous governments and their elders and harvesters were consulted during in the habitat plan process, and the collaboration resulted in a strategy that was incorporated into the final Tłıchq ASR Habitat Offset Plan. Much of the data, such as the RSF and a quantification of actual impacts, were not available until we were partially way through our process.</p> <p>The impacts of the change from a seasonal road to an all-season road were evaluated in the Developer's Adequacy Statement Response (Golder 2017). The habitat offset plan follows territorial and federal recommendations for determining the appropriate zone of influence, including considering the Old Airport Road as having an existing ZOI.</p> <p>Burned areas are no longer considered existing disturbance because they will regenerate over time. Instead, results of the RSF (which has only recently become available) that was developed by ENR using collared caribou locations was used to differentiate between selected and non-selected habitat.</p> <p>Having a >1:1 ratio for direct habitat loss (i.e., permanent road footprint at a recommended 4:1 ratio) factors in a time lag to reach functional habitat. At this high of a ratio, as compared to other offset plan examples, this multiplier also captures uncertainty in the offset measure and rarity of habitat (which may be considered not rare, as the Wek'èezhìi region has not experienced the same types of impacts as other caribou ranges in nearby jurisdictions).</p> <p>The Little Smoky region is significantly different than the Wek'èezhìi region, where in northern AB and BC there is significant, cumulative effects of linear feature disturbance, and may not necessarily be consistent with those perspectives held in the Wek'èezhìi region. Indigenous and cultural considerations were incorporated into this</p>

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				offsetting approach, and the approach to determine offset ratios aligns with ECCC and other habitat offset plans published in time to consider through this process.
Tłı̨chǫ Government (unknown author)	5-5	Legacy Linear Features	Ensure an Indigenous led approach to restoration work and ensure that culturally appropriate techniques and methods are used, and a culturally appropriate restoration standard is identified as the ultimate end goal of restoration. Tłı̨chǫ direction on how and where restoration is carried out, how the monitoring work is done, and what adaptive management approaches should be engaged	Indigenous organizations will be involved in the implementation of the Tłı̨chǫ ASR Boreal Caribou Habitat Offset Plan. Indigenous engagement and collaboration will be key to achieving the desired result. A scientific approach will support that success.
North Slave Metis Alliance (NSMA)				
NSMA	3-2	Offsets Considered	NSMA would like to see some cost estimates	Estimates will be developed in the Implementation stages. Literature exists that discusses estimated costs for projects in adjacent jurisdictions like Alberta, BC, and Yukon; however, it is important to recognize that offsetting for the Tłı̨chǫ ASR will occur in a region of Canada where these techniques are untested, so effectiveness trials may be valuable to determine the best approach (and costs) from an ecological perspective.
	3-3	Offsetting	<p>As stated in previous correspondence, we believe that:</p> <ul style="list-style-type: none"> Offsetting options that provide immediate improvement should be valued much higher, and longer scale programs should be scored lower (or not considered at all). Experimental program, such as reforestation, should be scored lower than proven approaches, such as restoration of linear disturbance. <p>Therefore we expect that habitat offsetting will mostly be done through the restoration of linear features and supplemented (to a much lesser extent) with reforestation efforts.</p>	Habitat offsetting will focus on the restoration of linear and polygonal features such as old quarries or landings. Reforestation was provided as a secondary option until there was more certainty around the scope of residual impacts of the Tlı̨chǫ ASR and the mitigation measures that would be implemented to avoid and minimize residual effects. With the residual effects of the project better understood (although without as-built design, they cannot be accurately quantified) and offset ratios applied, GNWT can identify opportunities for restoration of linear features as a primary target.
	5-6	Reforestation as Priority 2	<p><i>"Offsetting using reforestation should only be considered if all possible linear features have been restored and the total offset area required for the Project (Section 5.2) has not been achieved"</i></p> <p>This is a great sentence and we are in support. That said, as stated previously, we recommend that the limitation of offsetting to within the Wek'èezhì Management Area should be discontinued. There are many unused linear disturbances in the Deh Cho region to the south that could be restored to great benefit to the caribou</p>	Ideally, offsetting occurs within the region where the residual effects occur. The residual effects of the Tłı̨chǫ ASR will affect boreal caribou that interact with the Tłı̨chǫ ASR; therefore, it is appropriate to focus restoration efforts in the region that those caribou live, recognizing benefits may be realized in regions across NT.
	5-9	Indigenous Engagement	<p><i>"The Effectiveness Monitoring stage will focus on long-term monitoring of the offsetting work."</i></p> <p>How will communities (including NSMA) be included in monitoring efforts?</p>	Indigenous communities should be engaged prior to implementation of the Habitat Offset Plan to determine how communities will be included in both offsetting and monitoring efforts. Incorporating Indigenous knowledge will be key to successful offsetting.
Environment and Climate Change Canada (ECCC)				
ECCC (Jean-Francois Dufour)	Executive Summary Page ii	Protected Areas	<i>"Priority locations for linear feature restoration should first investigate protected areas to provide permanency of the offset"</i>	The final Tłı̨chǫ ASR Boreal Caribou Habitat Offset Plan addresses protected areas and provides recommendations on how to improve permanency and incorporate offsets into protected areas.

Organization	Page Reference	Topic	Comment	Response
			If permanency is the main concern, we should be looking to add areas to existing protected areas, rather than restore habitats within.	
ECCC (Jean-Francois Dufour)	1-2	Implementation Plan	The Implementation Plan is a key component to assessing the adequacy and effectiveness of this Habitat Offset Plan. Operational details of the plan such as confirmation of the amount and where activities will take place (“equivalency”), when the conservation benefits/gains are set to begin (“timing”), who is being committed to conducting the activities and having approvals from the land management authorities in place (“accountability”) add the necessary clarity and certainty for the plan to be successful.	The final Tłıchǰ ASR Boreal Caribou Habitat Offset Plan includes an appendix that outlines the framework to complete the Implementation Plan. In this appendix, GNWT-INF clarifies the framework for equivalency, timing, and accountability. These details will be developed in preparation of the Implementation Plan.
	3-2	Offsetting in Protected Areas	<p>Table 3-2 “Focus should be on restoring habitat in existing or proposed protected areas and areas where habitat selected by caribou has been fragmented by fire.”</p> <p>No additionality to this option, these habitats are not under threat, and if this is identified as a management priority in these PAs, the respective management plans will address it and allocate resources accordingly. Efforts should be prioritized outside of PAs, however areas adjacent to protected areas might be worth considering</p>	The final Tłıchǰ ASR Boreal Caribou Habitat Offset Plan addresses protected areas and provides recommendations on how to improve permanency and incorporate offsets into protected areas.
	3-2	Increased Protected Areas	<p>Table 3-2 “prioritize restoring habitats in protected areas to provide permanency of the offset (which increases the value of the offset”</p> <p>If permanency is the concern, adding an equivalent area (i.e. # of ha) to existing Protected Areas should be the preferred approach, not enhancing habitat within. There is no guarantees on protecting the offset investment anywhere when restoring habitat given the threat of a forest fire.</p> <p>Adjacent habitats to protected areas would also provide more permanency given the unlikelihood of a proposed development. This could be assumed based on the extra scrutiny during regulatory processes and extra investments required in mitigating and monitoring project effects making most projects risky for investors and likely financially unviable.</p>	The final Tłıchǰ ASR Boreal Caribou Habitat Offset Plan addresses protected areas and provides recommendations on how to improve permanency and incorporate offsets into protected areas.
	3-4	Increased Protected Areas	Need more details on which PAs are up for consideration. “Already underway” and in some cases have been underway for >10 years and no clear date on establishment. If permanency is the concern, only “existing” PAs at this time should be considered, as there are no guarantees that proposed PAs will materialize or that boundaries won’t substantially change prior to establishment. Timing of when offsetting measures will take place and become a conservation benefit is a key consideration.	The final Tłıchǰ ASR Boreal Caribou Habitat Offset Plan addresses protected areas and provides recommendations on how to improve permanency and incorporate offsets into protected areas. Acknowledging the benefit of focussing restoration work in Protected Areas is part of GNWT-INFs commitment, but is not a priority for restoration work. The primary offsetting option is restoring linear and polygonal features.
	3-4	Implementation Plan	<p>“An Implementation Plan will be required to identify specific areas, describe specific restoration treatments based on site limiting factors (e.g., mounding or tree planting), personnel, and timelines to implement this Final Plan.”</p> <p>Should be required for plan approval. Too many details are still outstanding to determine whether the plan is adequate and will be effective.</p>	The final Tłıchǰ ASR Boreal Caribou Habitat Offset Plan includes an appendix that outlines the framework to complete the Implementation Plan. Commitments and timelines have been incorporated into the Habitat Offset Plan and the Implementation Plan Appendix. Commitments by GNWT are discussed in the

Organization	Page Reference	Topic	Comment	Response
			What sort of agreement/commitment/guarantee is put in place and by who to ensure the Implementation Plan remains a priority, is well-funded, and delivered in a reasonable time frame? This Habitat Offset Plan mentioning a forthcoming Implementation Plan is not sufficient.	Appendix to implement the plan and a schedule to complete the work is provided.
	5-4	Construction Restoration	<p><i>"If the borrow sources are restored to effective habitat for boreal caribou following construction, then no offsetting would be required for the footprint (4:1 ratio) and the ZOI of the borrow source (1:1 ratio), effectively reducing the offset requirement to zero."</i></p> <p>This doesn't account for the restoration time lag and the actual removal of suitable habitat in the meantime. Agree that the disturbance is not as permanent as the road and borrow sources that will continue to be used, but these other borrow sources will still need to be accounted for somehow in the offset calculation as it might take 80 yrs to restore them to effective caribou habitat.</p>	Following the mitigation hierarchy (1. Avoid, 2. Reduce, 3. Restore, 3. Offset), offsets are only required for residual effects of the Tłıchq ASR. GNWT-INF has committed to Restore all of the quarries following construction and the footprints of the quarries are no longer considered residual effects of the Tłıchq ASR.
Environment and Natural Resources (ENR)				
GNWT - ENR (Laurie McGregor)		Implementation Plan	ENR has concerns that many details are being left to the Implementation Plan. If the feasibility, cost, and location of potential offset options are not evaluated before the Caribou Habitat Offset Plan is submitted to the WRRB the GNWT may encounter difficulty if we rule out some of the current options if they are found to be unfeasible.	A framework for the Implementation Plan was developed as Appendix E of the Habitat Offset Plan. The framework discusses the feasibility of offsetting (identifies constraints) and proposes timelines for offsetting. The final Tłıchq ASR Boreal Caribou Habitat Offset Plan has been updated to include a summary of available offset areas and locations.
GNWT - ENR (James Hodson)		Caribou Habitat Value	The background on boreal caribou in the NWT should acknowledge the findings of the RSF study, which they have used to calculate the offset area. Specifically, the RSF study found that boreal caribou select or even prefer recent burns at some times of year, whereas the offset plan characterizes all burned habitat <40 years old as being avoided.	Burned areas are included in the offset calculations in the final Tłıchq ASR Boreal Caribou Habitat Offset Plan and the final plan acknowledges the findings of the RSF. Burned habitat is now included in the disturbance calculation because burned areas are different than human disturbance and they will regenerate over time.
		Existing Disturbance	Provide a map and quantify the additional linear disturbances that was mapped within the 500 m buffer around the TASR alignment. This would help to provide an idea of how much linear disturbance might be available to restore just within that area.	Existing linear features were mapped within a 10-km buffer of the Tłıchq ASR and Highway 3. The data were provided to GNWT-ENR and areas available for offsetting were summarized in the final Tłıchq ASR Boreal Caribou Habitat Offset Plan
		Offset Calculations	The method for calculating the offset area seems reasonable and generally consistent with offset plans from other jurisdictions, but the numbers in Table 5-2 are hard to follow. They should match the descriptions of the roads in the table to the different parts of Figure 3-2 which illustrate how the calculations were done, and which offset ratios apply to which areas. AE should also provide maps similar to Figure 3-2 for the entire alignment so that people can visualize how the offset area was calculated for the whole project.	The final Tłıchq ASR Boreal Caribou Habitat Offset Plan has been updated to resolve this comment.
			It was unclear why restoration of existing linear features that are within the 500 m buffer of the TASR alignment wouldn't count as offsets. Couldn't restoration of those lines be counted, but maybe at a lower ratio than areas restored outside the ZOI (e.g. each ha restored would count as ½ ha towards the total offset area)? Otherwise, where's the incentive for GNWT to restore features inside the ZOI, even if it might benefit caribou?	Restoration of linear features within 500 m of the Tłıchq ASR are important to restrict human and predator movement along those linear features. These areas are included in the final Tłıchq ASR Boreal Caribou Habitat Offset Plan.

APPENDIX D - A FRAMEWORK FOR IMPLEMENTATION

REPORT

Tłıchǫ All-Season Road Implementation Framework

Appendix D

JUNE 2021

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1 INTRODUCTION

1.1 Project Background

The Government of Northwest Territories - Department of Infrastructure (GNWT-INF), in partnership with the Tłı̨chǫ Government, is constructing the Tłı̨chǫ All-Season Road (ASR, or the Project). The Project is a 97-km, all-season road that will connect the community of Whatì to Highway 3, approximately 30 km southwest of Behchokò. The Project is in the Wek'èezhìi Management Area and traverses a portion of the NT1 boreal caribou (tòdzı) range.

Through the permitting process, the Mackenzie Valley Environmental Impact Review Board (MVEIRB) issued its Report of Environmental Assessment and Reasons for Decision (EA1617-01) and approved the Project subject to several measures. One condition of approval for the Project is offsetting for residual effects on boreal caribou (tòdzı) and their habitat from building and operating the Project (Measure 6-3). Residual effects of the Tłı̨chǫ ASR have been identified as:

- Changes in **habitat availability** and potential changes in habitat use (e.g., direct habitat loss, avoidance due to sensory disturbance);
- Changes in **habitat distribution**, including the effects on wildlife movement and habitat connectivity (e.g., habitat patches and barriers to movement); and
- Changes in **survival and reproduction**.

The GNWT-INF prepared a **Boreal Caribou (tòdzı) Habitat Offset Plan** for the Wek'èezhìi Land and Water Board (WLWB) (Associated 2020), which included collaboration with GNWT-ENR, Tłı̨chǫ Government, Wek'èezhìi Renewable Resource Board (WRRB, Yellowknives Dene First Nation (YKDFN), and North Slave Métis Alliance (NSMA), and consultation with Environment and Climate Change Canada (ECCC). As the first habitat offsetting plan for boreal caribou (tòdzı) in Northwest Territories, consultation for the Habitat Offset Plan focused on a common understanding of goals, options for offsetting, and consensus on the overall approach. The Habitat Offset Plan recommends restoring existing linear features within the Wek'èezhìi Management Area, and if more area is required to meet offsetting commitments, reforestation of fire-disturbed areas to accelerate reforestation as a secondary approach. Ancillary offsetting options (e.g., increased protected areas) are described in the final Habitat Offset Plan.

1.2 Habitat Offset Plan to Implementation Framework

The final Habitat Offset Plan recommends preparing an **Implementation Plan** before physical works to restore boreal caribou (tòdzı) habitat. The Implementation Plan will be an extension of the Habitat Offset Plan and will provide more specific details and prescriptions for implementing habitat offsetting that were not available until after the road was constructed and mitigation had been implemented (i.e., residual effects could be confirmed). This Appendix provides a **framework for the Implementation Plan** to further scope its content, including the purpose and goals of habitat offsetting (Section 2), timelines for development of the plan and offsetting (Section 3), and a proposed outline for the Implementation Plan (Section 4). Figure 1-1 presents a flow diagram of the proposed Implementation Plan execution.

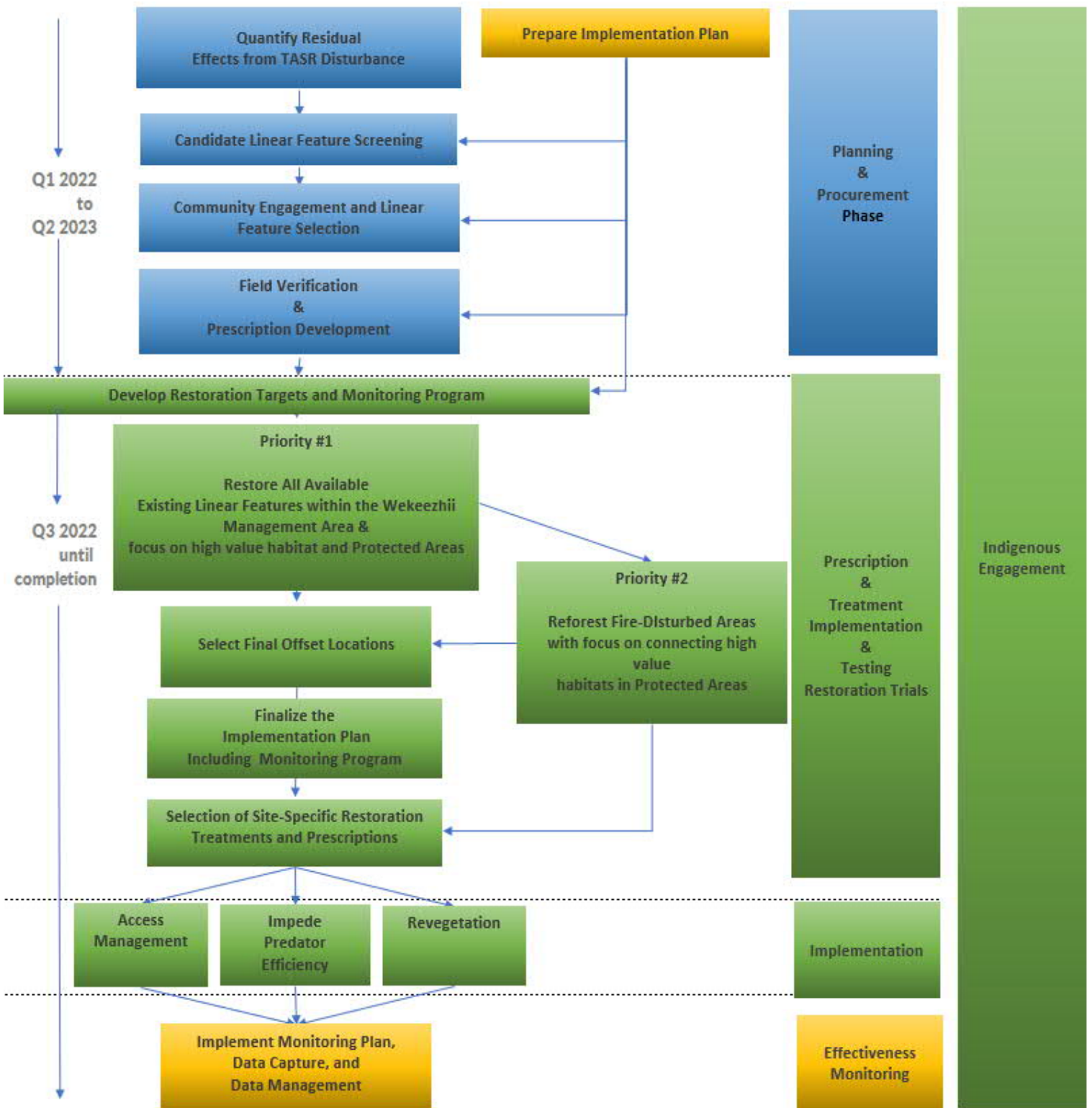


Figure 1-1
Implementation Plan Framework Execution

Offsetting for caribou is new and experimental in the Northwest Territories (NWT), and challenges and further considerations are discussed in Section 5. It is necessary to assess the effectiveness of mitigation, restoration, and offsetting measures to determine which approaches work best in restoring boreal caribou (t̄q̄dz̄ı) habitat and compensating for the residual effects of the T̄ł̄ch̄q̄ ASR. Monitoring will be supplemental to the offsets implemented and will include the development and monitoring of performance targets for:

- Assessing and detecting changes in use of offset areas by predators;
- Assessing survival and growth of shrubs, trees, and lichen in restored areas;
- Continuing to monitor caribou habitat use through GPS collar data or camera trap surveys; and
- Assessing use of offset areas by alternate prey (e.g., bison and moose).

The proposed decision framework (Figure 1-1) proposes actions for proceeding with offset selection areas and developing site-specific treatments to determine which habitat restoration measures will be most successful under various ecological site conditions. The treatments should include an adaptive management framework to monitor how restoration targets are being met.

Detailed planning and long-term monitoring should include the following:

- Pre-treatment inventory of the site-limiting factors, current vegetation cover and accessibility status of linear features to understand restoration potential and the development of site-specific prescriptions for site preparation (mounding, ripping), tree bending, planting, tree felling, roll-back of coarse woody debris and/or fencing.
- Identification of permafrost areas where mounding and planting may not be ecologically feasible.
- Inspection of restoration measures such as tree bending by pulling adjacent trees across the linear disturbance, bar mounding by creating a single mound across the linear disturbance width, and angle slicing by creating an angled ditch across the linear disturbance width, before widespread application.
- Implementation of a variety of habitat restoration treatments in each prescription area.
- Development of a monitoring program that includes field validation of habitat restoration treatment success including planted/natural regeneration tree survival assessments, vegetation response plots, and wildlife use assessment. The use of photo boards, remote cameras, wildlife tracking, GPS collars and fecal pellet counts support this.
- Adaptive management based on the results of monitoring different restoration prescriptions, using the most successful approaches based on monitoring results. Documenting problems with unsuccessful prescriptions will provide valuable information for future habitat restoration programs in NWT.
- Incorporation of a phased approach to determine which treatments are most effective and successful. Research trials that test some of the unknown assumptions related to restoration in NWT may be an informative method to determine this.

2 PURPOSE AND GOALS

The purpose of this **Implementation Framework** is to provide guidance for developing the Implementation Plan and recommends timelines to do so. The primary goal of the Implementation Framework is to provide the steps and considerations necessary to effectively reduce the predicted potential effects of the Project on boreal caribou (t̄q̄dz̄ı) and their habitat. This specifically is defined as immediately providing functional restoration of existing linear disturbances so that predator movement efficiency is reduced. A secondary goal is to achieve ecological restoration in the longer term such that habitat values for caribou are restored for forage, security, and long-term sustainability.

Restoration of linear disturbances can achieve functional restoration of habitat for boreal caribou by placing barriers that slow predator movement. These actions will also deter continued human use, which will promote natural succession to revegetate the linear disturbances. Active ecological restoration (e.g., substrate preparation followed by tree or shrub planting) are longer-term measures in NWT than other jurisdictions in Canada and have an unknown time period until habitats are considered ecologically restored for boreal caribou.

The Implementation Framework identifies a general outline of a plan with restoration approaches suitable for the Tłı̄chq ASR, and identifies the treatments considered and steps necessary to plan the implementation of those treatments (Section 4). Included is a brief description of monitoring required to determine the effectiveness of the treatments (Section 6.6). The framework also considers treatment options that might be applicable in other areas of the Wek'èezhìi Resource Area, such as setting aside certain areas as temporary protection if sufficient linear disturbances are not available for offsetting restoration.

The following Implementation Framework clarifies key pieces of information that are required to meet the offset commitment and to execute the Habitat Offset Plan. The Implementation Plan will ultimately include the following elements (further outlined in Section 6):

- Quantified residual effects of the Tłı̄chq ASR once as-built areas are available, and the final disturbance of the Project are confirmed;
- Identified potential areas where linear disturbances can be restored, screening candidates for operability, financial feasibility, and Indigenous support;
- Prioritization of where (i.e., which linear disturbances or burned areas specifically) offsetting work should be completed, considering community use and ecological values;
- Presentation of where site-specific treatment prescriptions (e.g., mounding with seedling planting) to confirm the operational offset area, resources needed, budget, and schedule;
- Confirmation of the procurement process for implementing the offsetting work;
- Development of site-specific treatment prescriptions (e.g., mounding with seedling planting) to confirm the operational offset area, resources needed, budget, and schedule; and
- Establishment of performance targets, effectiveness monitoring, and adaptive management that will benefit the offsets.

The Implementation Plan will include strategies to overcome challenges, which are discussed in Section 5, and will need to clarify the schedule for planning and implementation, which is discussed in Section 3 of this framework.

3 TIMELINES

Measure 6-3 requires provision of expected timelines for offsetting. This Implementation Framework identifies some of the key steps necessary to provide detailed timelines for restoration activities for the Tłı̄chq ASR Project. GNWT-INF will be required to develop detailed timelines in collaboration with GNWT-ENR to determine the desired approach.

The steps for GNWT-INF to complete and establish detailed timelines for implementation are as follows (Table 3-1):

1. Determine the ultimate disturbance footprint of the Tłı̄chq ASR route that incorporates the restoration measures to restore habitat following construction. Calculate the residual effect of the Tłı̄chq ASR on boreal

caribou (ṯḏzi) habitat. **This will be completed by Q2 of 2022** or as soon as construction and restoration are completed and will include a final quantification of offsets necessary.

Continue to collaborate with the Ṯj̱cẖ Government and WRRB, and consult with ECCC, NSMA, YKDFN, and any other affected Indigenous group during the planning, development, and implementation of an operational Implementation Plan. Through collaboration with Indigenous groups and other stakeholders, develop a list of final linear and polygonal disturbances that will have restoration treatments applied. Develop a descriptive list of candidate linear disturbances for offset restoration and develop a decision framework with ecological and social criteria (i.e., performance measures) to prioritize or rank restoration actions for specific footprints or disturbed areas. Approximately 670 ha of candidate linear disturbance and 29,076 ha of existing ZOI are currently available candidates for treatment within 10 km of Highway 3 and the Ṯj̱cẖ ASR (Figure 5-1); screening should begin with these linear disturbances. **This will begin in Q2 of 2022 and be completed in Q3 2022 to allow consultation and implementation to begin in Q3 2022.**

2. Work with GNWT-ENR to review and implement the offset actions and monitoring needed to evaluate the efficacy of restoration in the proposed candidate areas. The collaboration should include discussion on site assessment criteria or any necessary consultation to finalize an operational Implementation Plan for restoration of existing linear disturbances and reforestation of fire-disturbed areas. **This will be completed in Q2 2022 to allow consultation and the beginning of Implementation Plan development in Q3 2022.** A detailed schedule for implementation would be provided within the operational Implementation Plan.
3. **The Ṯj̱cẖ ASR Implementation Plan will be completed by November 2022 (Q4 2022).** The Implementation Plan should be revised as needed to respond adaptively to monitoring results. Should linear restoration be deemed to not be effective, other offsetting options would be explored as necessary to meet the functional restoration goals of the Final Habitat Offset Plan.
4. Acquire and germinate appropriate seed from conifer trees and use seedlings in any planting proposed. Include Indigenous support wherever necessary to collect seed or advise on techniques. Seedling planting or aerial seeding may be used to promote germination. Seeds may need to be collected from specific locations in NWT to ensure that the seedlings planted are physiologically adapted to the short growing season and cold climate of the region in NWT they will be planted. Seeds may require between 18 and 20 months before they have germinated and grown to an acceptable size for planting. **This will commence in Q1 2023 to ensure seedlings have enough time to grow for planting in Q1 2024/2025.**
5. **Begin offsetting based on the Ṯj̱cẖ ASR Implementation Plan in Q3 2023** or as soon as site conditions allow.

**Table 3-1
Proposed Timelines for Preparing Implementation Plan**

Action	2021				2022				2023				2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Develop Implementation Plan																								
1																								
2																								
3																								
4																								
Implementation																								
5																								
6																								
												Ongoing Restoration Until Completion												
Construction Complete																								

4 IMPLEMENTATION PLAN OUTLINE

This section provides an example outline that may be suitable for the Implementation Plan. In this section, approaches used for linear restoration in Alberta have been adapted, as Alberta is the jurisdiction with the most advanced implementation of linear restoration for caribou (An Operational Plan for Linear Restoration, Alberta Government 2018). The following headings and information are suggested components for the Implementation Plan, and this template is not intended to function as the final Implementation Plan.

PROPOSED IMPLEMENTATION PLAN OUTLINE

A.0 PLAN SUBMISSION

{Insert company name} has developed this linear restoration treatment plan in accordance with the Government of Northwest Territories restoration for caribou and the requirements identified in {Insert RFP reference}. This plan provides a comprehensive description of the proposed project, treatment prescriptions, and other considerations for operational implementation.

Describe any disclaimers on the information provided in this plan.

Signature of Person Responsible for this Plan: _____

Name: _____

Position: _____

Contributing professionals to the development of this plan are identified in Table 1.

Table 1: Professional Sign-off

Name of Professional	Professional Certification	Signature

B.0 INTRODUCTION

B.1 Background

GNWT-INF is committed to managing natural and human disturbance to provide adequate caribou habitat to ensure a healthy and sustainable boreal caribou population across their NWT range that offers harvesting opportunities for present and future generations. Restoring legacy linear features is an important strategy to recover boreal caribou habitat. Restoration of legacy linear features is one of the tools GNWT may use to increase undisturbed and effective caribou habitat and reduce predation rates on caribou.

B.1 Linear Restoration Program Overview

Describe the linear restoration program. A program typically covers the entire caribou herd range and is a multi-year effort.

B.2 Project Area Overview

Insert a general description of the planned project. Include geographic location, distance to nearest town(s), land use planning region, management classes, and natural sub region.

Map 1: Project Overview Map



B.3 Habitat Restoration Goals

Indicate the goal(s) that the project intends to meet and provide a clear understanding of the value of an operational plan in achieving objectives. Multiple objectives may be included in the plan. Table 2 is an example of a goal to sustain caribou populations.

Table 2: Example Habitat Restoration Goal and Objective*

GOAL #1	ENSURE A HEALTHY AND SUSTAINABLE BOREAL CARIBOU POPULATION ACROSS THEIR NWT RANGE			
Objective	Linear disturbance has been successfully restored to a natural forest trajectory or reduced human and predator access and movement efficiency.			
Indicators of Success (example)	Restoration programs and locations have been selected based on relevance to caribou and contribute to efforts to restore large tracts of caribou habitat.	Where advanced regeneration is not evident, treatment prescriptions have addressed site-limiting factors and have established vegetation resembling the adjacent habitat.	Where advanced regeneration is already present, and to the degree feasible, the advanced regeneration has been protected.	The treatments that have been prescribed should effectively limit human and predator movement on the landscape.
Actions Taken to Meet the Objective	<i>Describe actions taken in the operational plan to meet the indicator listed above.</i>	<i>Describe actions taken in the operational plan to meet the indicator listed above.</i>	<i>Describe actions taken in the operational plan to meet the indicator listed above.</i>	<i>Describe actions taken in the operational plan to meet the indicator listed above.</i>
Probability of Achieving the Goal	<i>Describe actions taken to increase the probability of the goal being achieved.</i>	<i>Describe actions taken to increase the probability of the goal being achieved.</i>	<i>Describe actions taken to increase the probability of the goal being achieved.</i>	<i>Describe actions taken to increase the probability of the goal being achieved.</i>

* Adapted from An Operational Plan for Linear Restoration, Alberta Government 2018.

B.4 Treatment Plan Summary

Provide a brief summary of the treatment plan.

Table 3: Treatment Plan Summary*

ITEM	DESCRIPTION
Restoration Segment/Site	{Insert segment name}
Prescribed Action	Treatment: {Insert type proposed} Advanced Regeneration: {Insert surveyed regeneration} Project Exclusion: {Insert}
Site Preparation Activities	Mound <input type="checkbox"/> ; Scarify <input type="checkbox"/> ; Rip <input type="checkbox"/> ; Inversion <input type="checkbox"/> ; Other <input type="checkbox"/> {Describe other activities}
Revegetation Activities	Plant <input type="checkbox"/> ; Seed <input type="checkbox"/> ; Natural Regeneration <input type="checkbox"/> ; Other <input type="checkbox"/> {Describe other activities}
Total Seedlings Required	{Insert total number and species of trees to be planted, including ecological appropriate cultivar type}
Linear Deactivation Activities	{Brief description of activities}
Treatment Timing Considerations	{Brief description of considerations for treatment timing (season)}

* Adapted from An Operational Plan for Linear Restoration, Alberta Government 2018.

C.0 APPROACH TO OPERATIONAL PLANNING

The operational plan follows the goals and objectives of the NWT Boreal Caribou Recovery Strategy. An example of one goal and its objectives is provided below.

Goal

- Ensure a healthy and sustainable boreal caribou population across their NWT range that offers harvesting opportunities for present and future generations.

Objectives

- Ensure adequate habitat across the NWT range to maintain a healthy and sustainable population of boreal caribou.
- Ensure recovery obligations for protecting critical habitat and maintaining a self-sustaining population are met or exceeded in NWT.

Core Indicators of Success

- Restoration programs and locations have been selected based on relevance to boreal caribou and contribute to efforts to restore tracts of important habitat.
- Advanced regeneration in offset areas has been achieved. If advanced regeneration is not present on linear disturbance, apply treatments that address site-limiting factors such as permafrost and establish vegetation based on the adjacent habitat.
- Where advanced regeneration is already present, protect and enhance regeneration.
- Treatments limit predator and human access and provide security for resident caribou.

C.1 Scope

Planning is the first step in the restoration framework to provide the best opportunity to achieve the goals and objectives of boreal caribou recovery. The operational plan is focused on the development of efficient and effective linear restoration and deactivation strategies to address line-specific limiting factors within the offsetting boundaries. Following planning, Treatment Implementation, Quality Control, Survival Assessment, Establishment Surveys and Effectiveness Monitoring are the key components to ensure successful restoration in offsetting.

C.2 Statement of Work

The operational plan will demonstrate a clear statement of work. For example, the work may:

- Clearly demonstrate how the core indicators of success will be achieved;
- Identify site-limiting factors impeding natural regeneration of the lines such as permafrost or flooding;
- Outline proposed treatment types by line segment, including site preparation, seedling requirements, and woody material or fencing placement;
- Identify areas where access management measures (e.g., woody materials, fencing) are needed to reduce human and predator use;
- Provide a treatment and access plan; and
- Provide a list of regulatory and approval requirements to consider for implementing the proposed plan.

C.3 Summary of Activities

Insert the project's intended (and/or completed) major activities. These may include, but are not limited to:

- An initial desktop analysis & preliminary plan.*** *Using a variety of datasets, site-limiting factors were identified and assigned preliminary treatment strategies to lines to address the factors. Access requirements were also considered.*
- Overflight confirmation.*** *Complete an aerial reconnaissance of treatment lines and potential access routes to determine current ecological condition and availability for offsets.*
- Reiteration of treatment & access planning.*** *Using monitoring, treatment prescriptions and access plans will be refined. Areas requiring further ground confirmation will also be identified.*
- Targeted ground visit.*** *A site visit was completed to confirm treatment and access prescriptions. Treatment prescriptions and access routes were finalized during the targeted ground visits.*
- Final operational planning.*** *The operational plans were finalized with ground data and observations for submission to GNWT-ENR.*

C.4 Project Timeline

Insert a high-level project timeline. Consider including:

- *Project Initiation*
- *Field Visits*
- *Final Plan Submission*

C.5 Key Data Inputs

Identify the data inputs used to create the operational plan of the project.

Table 4: Key Data Inputs

DATA INPUTS		
Category	Data Layer	Data Source
Administrative	•	•
Environmental Considerations	•	•
Field Verification	•	•
Landcover	•	•

D.0 TREATMENT PLAN

D.1 Treatment Line Determination Process

Describe the treatment line segment determination process used to identify:

1. *Advanced Regeneration*
2. *Project Exclusion*
3. *Treatment*

Include a map depicting the treatment line segment prescriptions assigned.

Map 2: Treatment Line Segment and Prescription



D.2 Site Limiting Factors

Indicate the site-limiting factors identified and, if necessary, explain what they are. Site-limiting factors may include, but are not limited to:

- *Anthropogenic Activity*
- *Permafrost*
- *Browsing*
- *Soil Compaction*
- *Wet Areas*
- *Nutrient Availability / Peat Bog*
- *Competing Vegetation*
- *Light*
- *Moisture Retention*

D.3 Treatment Line Prescriptions and Deactivation Strategies

D.3.1 Deactivation Treatments

Indicate the ways in which human access and predator movement will be restricted in the offset area. When lines are prescribed for deactivation, describe the deactivation treatments prescribed for addressing the identified site-limiting factors and explain why they are the preferred methods for deactivation. Describe the total length of each treatment and percent of linear disturbance receiving treatments.

Deactivation treatments can include:

- Rollback & Coarse Woody Material & Fencing*
- Tree Felling*
- Tree Tipping*
- Intersection Blocking*
- Mounding*
- Hand Felling*
- Not Required*

Include a map depicting the deactivation treatments that were assigned.

Map 3: Deactivation Treatments



D.3.2 Site Preparation Treatments

When linear disturbances are prescribed for site preparation, describe the site preparation prescribed for addressing the identified site-limiting factors, and explain why they are the preferred methods.

Examples include:

- A. Mounding*
- B. Scarification*
- C. Inversion*
- D. Ripping*
- E. None*

Table 5: Prescription Table Example *

LINE ID	SITE TYPE			ACTION		LEADING SITE LIMITING FACTOR	PROPOSED TREATMENT	LEADING CWD APPLICATION
	Upland (kms)	Lowland (kms)	Treatment (kms)	Advanced Regeneration (kms)	Project Exclusion (kms)			
1	1.6	0.3	1.0	0.5	0.4	Soil Compaction	Mounding/Ripping/Plant/Seed	Tree Tipping

* Adapted from An Operational Plan for Linear Restoration, Alberta Government 2018.

D.4 Treatment Prescription Data

Table 6: Ecological Data to be Collected for Treatments*

FIELD NAME	DESCRIPTION	FIELD VALUES	VARIABLE TYPE
Line Segment	Updated unique line segment	Identifier	Numeric
Action	Field describing high-level treatment call	Treatment	Description
		Advanced Regeneration	
		Exclusion	
Moisture Regime	Moisture regime as captured through ecosite phase	Xeric	Description
		Subxeric	
		Submesic	
		Mesic	
		Subhygric	
		Hygric	
		Subhydric	
		Hydric	
	"Not Available"		
Site Type	Site type as identified by the planner during field verification and/or desktop review. Should be applied to all lines, except project exclusions.	Upland Dry	
		Upland	
		Transitional	
		Lowland Treed	

		Lowland Low Density Treed "Treatment Not Required"	
		"Not Available"	
Site-Limiting Factors	Concatenated field of multiple sites limiting factors identified through field verification	Anthropogenic Activity	
		Browsing	
		Soil Compaction, Game Trail	
		Wet Areas	
		Nutrient Availability	
		Competing Vegetation	
		Light	
		Moisture Retention	
		None	
		"Not Available"	
Site Preparation	Site preparation prescription	Mounding	
		Scarification	
		Inversion	
		Ripping	
		None	
Revegetation Treatment	Revegetation prescription	Plant	
		Seed	
		Natural Regeneration	
		None	
Tree Species	Tree species assigned where planting or seeding revegetation treatment has been prescribed. SW (White Spruce) SB (Black Spruce) LT (Larch/Tamarack) P (Pine) FB (Fir) Other (describe)	P	
		SW	
		SB	
		LT	
		FB	
Seed Zone Planting Density Seedlings	Seed Zone ID Trees per hectare prescribed Estimated number of seedlings required		
		description	
		description	
Line Deactivation	Line deactivation required to limit predator and human movement	Yes	Description
		No	

Deactivation Treatment	Prescription for line deactivation, if required	Rollback & Coarse Woody Material	Description
		Tree Felling	
		Tree Tipping	
		Intersection Blocking	
		Mounding	
		Hand Felling	
		"Deactivation Not Required"	
Coarse Woody Material Application	CWM application required	Yes	Description
		No	
Treatment Modifier	Alternative sub-treatments	Spaced Piles	Description
		Trapper Access	
		Bar Mounds	
Treatment Modifier	Alternative sub-treatments	Spaced Piles	Description
		Trapper Access	
		Bar Mounds	
Line Width	Line width identified by the planner	Metres	
Shape Length	Length of the line segment	Metres	

* Adapted from An Operational Plan for Linear Restoration, Alberta Government 2018.

D.5 Revegetation Treatments

When linear disturbances are prescribed for revegetation treatments, describe the revegetation treatments prescribed for addressing the identified site-limiting factors and explain why they are the preferred methods. Examples may include:

- A. Plant
- B. Seed
- C. Natural Regeneration

D.6 Seed & Seedling Requirements

D.6.1 Seed Zones

Indicate the seed zones in the project area.

D.6.2 Seedlings

Summarize the total number of seedlings required for the project. Distinguish among the various species required.

Table 7: Seedling Estimates

SEED ZONE	SEEDLING TYPE					Total
	Pine (P)	White Spruce (Sw)	Black Spruce (Sb)	Larch/Tamarack (Lt)	Fir (Fb)	
1 (describe)						
2 (describe)						
Total						

D.6.3 Seed

If necessary, summarize the amounts of seed and prescribed application rate required. Summarize the amount by species as well.

E.0 ACCESS PLAN

E.1 Access Constraints and Considerations

Describe the restrictions and constraints on access routes and proposed treatment lines.

E.2 Linear Disturbances Access Plan

Describe the possible linear disturbances considered for offsetting. Indicate the intended closures and any permissions/consultation that need to occur. In addition, indicate any linear disturbances that are confirmed as inaccessible during field verification or potentially inaccessible based on seasonality or other conditions.

E.3 Lay-down Area(s)

Temporary lay-down areas will be needed during operations. They will be used to park vehicles, store equipment while not in operation, and store various supplies such as signage and tools.

Describe the potential lay-down area(s) location(s) and the approval(s) required for use of the area. Provide a site layout plan.

F.0 REGULATORY REQUIREMENTS, APPROVALS, & SAFETY

Provide a complete list of the regulatory requirements and their critical dates. Consider what mechanisms or legal tools are available to protect restored areas from re-disturbance from human use.

F.1 Land Use Conflicts

Provide a Conflicts summary of dispositions, boundaries, and interest holders.

F.2 Watercourse Crossings

Refer to Best Management Practices for Watercourse Crossings. Identify any crossings that will occur on treatment linear disturbances and on potential access routes within the offset boundaries.

F.3 Other

Provide a description of any other additional land use considerations in the offset area. These can include traplines, hunting areas, cultural areas, historic trails, cabins, areas of special interest, and other land uses.

F.4 Environmental Considerations

Identify if the offset area overlaps any sensitive species habitat, including rare plants. Provide a table identifying Species at Risk within the offset area, the rating, and the source of that rating.

F.5 Stakeholder Engagement

Summarize the stakeholders within the project area.

F.6 Safety Requirements

Describe the safety requirements of the project and how they will be addressed. Provide a site-specific safety plan.

PROPOSED IMPLEMENTATION PLAN OUTLINE END

5 CHALLENGES AND CONSIDERATIONS

Challenges in moving forward with a detailed operational implementation plan include important discussions and decisions based on:

- Achieving consensus with Indigenous groups on which linear features to restore, which:
 - requires an engagement strategy with interested Indigenous groups in the coming year; and
 - requires having candidate linear features selected in advance of meetings to identify traditional use trails that are not available for restoration.
- Determining who will do the implementation and monitoring work for offsets (e.g., a procurement process, capacity building in NWT).
- Planning when offset work will be implemented. Seasonal timing is critical to ensure accessibility and increased seedling survival during implementation.
- Deciding on feasibility and how offsetting work be done. For example, if linear features are remote, will machinery be used, or manual site preparation and planting be completed.

Implementation of offsetting in the NWT, and specifically for the Tłı̨chų ASR project, has unique differences from other nearby jurisdictions, such as in Alberta, BC, and Yukon. A significant positive difference is that existing linear disturbances are not the major source of habitat disturbance in the Tłı̨chų ASR project area (i.e., the Wek'èezhì Resource Area). However, restoration of existing linear disturbance is still considered the priority for offsetting to protect boreal caribou because of the potential impacts of linear disturbances fragmenting habitat and enhancing predator and human access and movement efficiency.

In NWT, linear disturbances in the proximity of the Tłı̨chų ASR project (i.e., within 10 km) exist (Figure 6-1) but are not as extensive in area as other jurisdictions. Many linear disturbances may either have advanced regeneration (often with shrubby species) or are actively used for hunting and other travel access by Indigenous residents. As a result, the existence of linear disturbances in the Tłı̨chų ASR area does not mean all are available for restoration activities or usable as an offset for caribou without a process of consultation, coordination of multiple governments or agencies, and decisions regarding priorities for the identified areas.

An additional complication is that many of the linear disturbances that may be suitable candidates for offsetting are not yet mapped or documented (e.g., within ECCO or NWT Cumulative Impact Monitoring Program databases). The process of identifying potential linear disturbances for restoration is ongoing during the development and submission of the Habitat Offset Plan and could continue into the future.

In the development of the Habitat Offset Plan, early concerns arose in that insufficient linear disturbance may reduce the ability to achieve compensation goals for the Tłı̨chǫ ASR. This resulted in the discussion of new and experimental approaches to offsets, including reforestation in areas disturbed by wildfire and by human-caused disturbances. Further information regarding the offsets considered for the Tłı̨chǫ ASR can be reviewed in the Tłı̨chǫ ASR Boreal Caribou Habitat Offset Plan (Associated 2020).

In other jurisdictions with high levels of human-caused linear disturbance, the priority has been to functionally restore linear disturbances by making them less usable to predators of caribou. This type of restoration for offsets usually entails a combination of short-term physical barriers to predator movement and sight, such as bent/hinged trees, tree felling, site preparation including scarification, ripping or mounding, tree planting, and fences. Long-term measures that restore dense conifer cover are achieved through tree planting, which serves as a visual and physical barrier to predators, while not creating forage habitat for alternate prey (which natural regeneration of shrub cover often does).

The Tłı̨chǫ ASR Boreal Caribou Habitat Offset Plan recommends short-term restoration methods to reduce predator use linear disturbances and recognizes that long-term approaches such as reforestation are untested and have greater uncertainty due to short growing/planting seasons, permafrost complications, and greater overall costs in NWT. The objective of the Habitat Offset Plan is to provide offsetting that is effective both in the short-term and long-term, so the implementation of experimental approaches should be used to determine what the most operationally feasible and cost-effective measures are under different conditions, including ecological restoration of habitat and reforestation.

The procurement of seeds or seedlings that are appropriate for planting in NWT will take time to gather, germinate, and store. As such, seeds should be collected as early as Q2 2022 and germination should begin as soon as possible to ensure a sufficient seedling stock if planting will be used in restoration. Including Indigenous community members may be valuable in reducing costs and ensuring the correct species are collected to meet the objectives for the Implementation Plan.

Offsetting for boreal caribou is founded on assumptions that must be tested in NWT. Uncertainty in using ecological restoration to achieve quality habitat for boreal caribou includes assumptions about outcomes (e.g., tree seedlings planted during reforestation will respond faster than natural seedling regeneration) and in timelines necessary to achieve those outcomes (e.g., the pace of growth and survivorship of planted tree seedlings). Assumptions are also made on the methods recommended to restore boreal caribou habitat. For example, based on success in other jurisdictions, measures that provide short-term blockage of visual line-of-sight and restrict physical access by predators will be effective. Using features such as fences, wood piles, hummocks, and even shrub growth are expected to provide functional restoration (i.e., these features reduce predator movement efficiency and predation rates on caribou). Applying offsets for boreal caribou in NWT is inherently experimental, and therefore it is important to establish measurable monitoring goals for both the treatments selected and the response and impacts on caribou and predators.

An example of confirming assumptions about methods recommended to restore boreal caribou habitat is reforestation. Procuring seeds and seedlings suitable for planting may be difficult in NWT. To improve seedling survival, seeds from tree species that grow in the Wek'èezhì Resource Area should be collected and germinated in advance of planting. Consideration of trees species selection and procurement of a nursery to germinate seeds will

need to be completed in advance of tree planting seeding and will need to be considered as a key milestone within the implementation plan schedule.

For implementation of offsets to be successful, to reduce costs as much as possible, and for the potential use of some of these offsetting approaches to be useful in other areas of the NWT, several issues need to be addressed:

- No existing regulatory framework or registry currently exists that the Tłıchǫ ASR offsetting can be tracked within (e.g., treatments completed, monitoring, and rate of success). GNWT will need to update their processes to manage data from Tłıchǫ ASR Habitat Offset Plan Implementation for effectiveness decisions and application elsewhere.
- Offsetting targets, in terms of reducing predator movement efficiency or boreal caribou habitat selection, need to be monitored in restored areas, and effectiveness of different tree planting approaches needs to be assessed for time to reach effectiveness as a visual/physical barrier. Monitoring predator movement on untreated lines may serve as study controls to document if treatments are effective relative to a natural setting. Monitoring of collared caribou may assist in assessing the effectiveness of habitat use by caribou after various treatments, but boreal caribou response to offsets needs to be monitored under a specific program dedicated to assessing the quality of offset performance.
- Costs of physical blockage of linear disturbances and tree planting need to be established specifically for NWT and logistics costs related to working in roadless areas (such as some wildfire areas) assessed.
- Implementation of the Tłıchǫ ASR Caribou Habitat Offset Plan requires a combination of office, desktop, and field work before the plan can be finalized. The priority for the Habitat Offset Plan is to identify existing linear disturbance to determine which linear disturbances are available for restoration.
- Consultation with Indigenous users may help identify candidate linear disturbances that are suitable for restoration by removing those candidates that will have continued use by Indigenous residents. Desktop work may include identifying areas that have the greatest current caribou use or appear to be potential connectivity areas among habitats used by caribou.
- Field assessment is needed to identify the best measures for functional and ecological restoration. For example, based on the topography, determining where visual barriers best be erected and how many are needed will help to improve the accuracy of cost estimates. Field assessment will help determine areas for long-term restoration approaches, such as mounding and tree planting, and will include the documentation of the condition of existing regeneration (e.g., species, height, effectiveness as a barrier to predators, use by alternate prey).
- Regardless of measures implemented, monitoring of linear disturbance use by predators, alternate prey, and boreal caribou is recommended before and after implementation. Monitoring may include a combination of remote wildlife cameras, winter track surveys, or activity of collared animals in the area. Field assessments will also inform the determination of budgets for visual and physical barriers, mounding, planting and monitoring. Ideally, an experimental approach to different planting and mounding trials will provide a range of costs (and recommendations based on successes) that will assist in recommending similar measures elsewhere in NWT and provide a range of costs per hectare or linear km for offsetting in the future.

Addressing these issues throughout the offsetting process will result in potential cost savings by focusing restoration efforts where they will be most beneficial, selecting treatments that will be the most effective, and avoiding re-work to meet target objectives.

6 NEXT STEPS FOR IMPLEMENTATION PLANNING

The Implementation Plan will require planning and action by GNWT and Indigenous groups that will be included in the implementation work. The following sections outline the required actions to:

- Accurately quantify the amount of offsetting required (Section 6.1);
- Identify potential linear disturbances that are available for offsetting (Section 6.2);
- Include Indigenous knowledge to identify specific linear disturbances for offsetting (Section 6.3);
- Develop site-specific prescriptions for the offsetting (Section 6.4); and
- Identify site-specific targets to assess the efficacy of the offsetting (Section 6.5).

Section 6.6 outlines the planning, data collection, and information management systems that need to be developed to ensure that the work completed in the Implementation Plan is evaluated and documented for future offsetting projects that may occur in NWT.

6.1 Quantify Residual Effects from TASR Disturbance

Residual effects are those effects that remain after avoidance and mitigation have taken place for the project. Offsets are required to compensate for actual disturbance that remains after post-construction mitigation. To accurately confirm offsetting commitments and provide an operational Implementation Plan for offsetting, it is essential that the actual residual disturbance remaining (i.e., after the road is built and as-built disturbance footprint is available) be calculated. To confirm these calculations, surveys on disturbed vs restored/reclaimed areas should be conducted to update the habitat balance table to as-built conditions.

Based on the maximum potential residual effect that needs to be offset and not accounting for any project-related restoration, approximately 2,846.4 ha of habitat is required for restoration of the Tłıchq ASR. Once the final habitat balance table accounts for the residual effects of the Tłıchq ASR, the quantity of offset area required can be confirmed.

6.2 Candidate Linear Disturbance Screening

The Habitat Offset Plan focuses on restoring linear disturbances as an offset measure, and through the development of the plan, it is clear that linear disturbances provide an important service (e.g., for hunting, travel, harvesting) to Indigenous peoples in the region. The Implementation Plan will be an extension of the Habitat Offset Plan and Traditional Knowledge shared to prepare the Habitat Offset Plan will be used in the development of the Implementation Plan. Further Indigenous collaboration will be required in the development of the Implementation Plan to help identify specific linear disturbances that are available for offsetting.

Potential candidate areas for linear restoration have been identified if they are:

- Within 10 km of the Tłıchq ASR or Highway 3 (Figure 6-1);
- Habitat historically or currently occupied by caribou;
- Habitat selected based on the current Resource Selection Function (RSF) boreal caribou habitat model;
- Potential connectivity zones between selected and not selected boreal caribou habitat areas based on the RSF model);
- Minimal conflicts based on consultation or ortho-imagery interpretation (e.g., apparent wood harvesting operations); and

- Linear disturbance already mapped by ECCC (preferred, but non-ECCC mapped linear disturbances still would have a 500 m buffer for potential disturbance offset).

To date, 670 ha of linear disturbances including 29,076 ha of associated ZOI have been mapped in the Wek'èezhì Resource Area, with others yet to be mapped. Figure 6-1 illustrates linear features mapped to date, not including the 500 m buffer associated with them. Table 6-1 presents summaries of commitments presented in the Final Caribou Habitat Offset Plan.

Table 6-1
Offset Commitments and Area of Candidate Linear Feature Disturbance Mapped

Feature Type	Total Net Residual Impacts	Offset Commitment ¹	Opportunity for Offsetting ²
Road	508.8 ha	2,034.8 ha	670 ha (existing roads)
ZOI	618.4 ha ³	811.6 ha	29,076 ha (existing ZOI)
	1,127.2 ha	2,846.4 ha	29,746 ha

¹ Refer to Tables 5-2 and 5-3 in Final Caribou Habitat Offset Plan.

² Estimated to date with recent digitization and requires confirmation that these are appropriate for restoration.

Offsetting using reforestation of fire-disturbed areas to accelerate reforestation from natural regeneration timelines should only be considered if all candidate linear disturbances have been restored and the total offset area required to compensate for residual effects of the Tł̨chq̨ ASR cannot be achieved. More planning will be required to establish implementation of reforestation for linear disturbances (e.g., no standards exist that can be followed). This may include identifying candidate areas based on value to caribou and operational feasibility, reforestation prescriptions, and trials to confirm that the approach will be successful.

6.3 Community Engagement & Linear Disturbances Selection

Once candidate linear disturbances have been identified, consultation will be required to determine the degree to which Indigenous users value and use each linear disturbance. Linear disturbances that are proposed for restoration should be presented to representative community members with maps, photographs, or any other information available to help community members clearly identify the area being discussed. This engagement should be in the form of a community meeting and occur following any GNWT screening in Q2 2022 and prior to finalization of linear disturbances selected for restoration.

Lac La Marte

Marian Lake

Rae

Edzo

Great Slave Lake (north arm)

Tlicho ASR Corridor

Highway 3 Corridor

Hwy 3




-  Existing Linear Disturbance
-  Existing Polygon Disturbance
-  Mapping Boundary

Figure 5-1 disturbance.mxd / 3/19/2021 / 11:45:57 AM



PROJECT NO.: 2018-2330.030.209

DATE: March 2021 N

DRAWN BY: DA

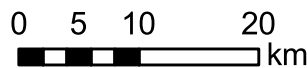


FIGURE 6-1: MAPPED EXISTING DISTURBANCE WITHIN 10 KM OF TLICHO ASR AND HIGHWAY 3

Government of Northwest Territories
Department of Infrastructure

Tłı̨chų All-Season Road

6.4 Field Verification & Prescription Development

After candidate linear disturbances are screened and identified as a restoration candidate, field verification and assessment of the linear disturbances is required. Factors such as the regeneration status of the existing linear disturbance, the ecological feasibility of restoration, the prescribed type of restoration treatment, and limiting factors of the site (e.g., permafrost, compaction, game trail) would be assessed. Preliminary plans outlining specific objectives for each prescription and how they would be implemented at specific sites would be described. Measures such as controlling access (humans), reducing predator movement efficiency, preparing the site, planting seedlings, or seeding may all be prescribed.

Based on mapping of linear disturbances to date, all offset areas can be accounted by restoring existing linear disturbances. The disturbances would then benefit from reduced human use, which would promote natural succession in some instances.

To successfully restore existing linear disturbances, the following key questions need to be answered:

- What are the site limiting factors?
- Are the sites accessible to ground-based work?
- What is the natural regeneration status of the disturbed area being currently used for human access?
- What vegetation species are present, what height and density is natural regeneration (i.e., does it function to prevent visual or physical access by predators)?
- Are there adjacent trees of suitable height that might be bent or felled for use in piles to act as visual and physical barriers?
- What is the topography of the area, and how many barriers of what height are required to adequately reduce movement efficiency for predators along the linear disturbance?

Based on drainage, soil characteristics, and permafrost presence, is soil disturbance (e.g., mounding, ripping) appropriate and can trees be planted as a viable approach for long-term restoration, or do alternatives need to be considered?

Based on the answers to the above questions, each linear disturbance will be separated into segments, based on site-limiting factors and ecological condition. Each segment will have a site-specific prescription developed that recommends functional and/or ecological restoration activities, including the following for implementation:

- Controlling access of humans (e.g., mounding, gates, barriers, signage).
- Installing visual and physical barriers to predators (e.g., 0.5-1.0 m high piles, fences, tree bending, mounding every 100-200 m).
- Preparing the site (e.g., ecological enhancement such as mounding to improve tree survival and growth, movement barriers from felled and piled trees, bending trees, soil scarification to reduce compaction).
- Planting conifer seedlings in suitable sites in densities that will provide visual and physical barriers to predator movement.
- Seeding more remote suitable sites with conifer seeds to advance natural regeneration.

6.5 Develop Restoration Targets

It is important to define targets for when restored linear disturbances become functionally restored. Measurable targets and the data collected can provide valuable insight into future offsetting projects in NWT. The short-term

measurable objective will be reduction in human and predator use along linear disturbances. For example, determining if human and predator use has been reduced can be measured in several ways:

- **Is predator movement reduced/eliminated along the linear disturbance?** This may be a measure of monitoring predator use on the lines before and after treatment, or by assessing line-of-sight along the linear disturbance from a height of 1.5 m after prescriptions are in place compared to before restoration.
- **Are the number of people, predators and caribou using the linear disturbance reduced from before restoration prescriptions?** Use of remote cameras and track count or pellet count surveys may be used to document changes in movement along the linear disturbances after restoration.
- **Are seedlings surviving and growing in replanted areas?** Measure the percent survival of seedlings and document any sources of mortality; adapt planting prescriptions as needed. Establish permanent sample plots to measure rates of growth due to replanting trees.

In addition to the physical habitat measures that are used as restoration targets, several other monitoring attributes can be measured to improve data capture, including:

- Caribou presence near or on the restored linear disturbances.
- Predator and alternate prey on or near restored linear disturbances.
- Using data from collared caribou and wolves, and comparing wolf presence/non-detection near restored linear disturbances vs non-restored linear disturbances.

6.6 Monitoring Plan, Data Capture, and Data Management

Monitoring the successes or limitations of restoration treatments will provide valuable information to GNWT for implementing adaptive measures, if necessary, and inform future offsetting projects. Monitoring, including the development of data capture standards and data management, will help to determine if the offsetting measures proposed are effective in restoring disturbed land into functional caribou habitat. In the longer term, documenting which linear disturbances have met a “restored” status will provide support for ECCC to remove some disturbances from the NT1 range and reduce the total area of disturbed boreal caribou habitat in NWT.

The Implementation Plan will include a detailed monitoring plan that documents the implementation and effectiveness of offset measures to address the residual effects of the Tłı̄ch̄o ASR on boreal caribou, specifically changes in boreal caribou habitat availability, changes in habitat distribution, and changes in survival and reproduction. The monitoring would be expected to measure both wildlife (predator, prey, caribou) response and vegetation response from restoration treatments for implementation as well as effectiveness. The monitoring plan will need to have a scientifically defensible design, which should include a paired design and sufficient replication to allow for statistically comparable results. The installation of permanent sample plots (PSPs) during the initial implementation work will allow for re-measurement over time. PSPs should include a representative sample of each treatment with a control for that treatment immediately adjacent (i.e., online) and within the same site conditions and disturbance it is being compared against. Monitoring timelines should consider short-term re-measurement (1-3 years after implementation) to detect treatment successes and long-term re-measurement (at year 5 and year 10) to determine if vegetation growth is following the expected trajectories to meet a restored status as effective boreal caribou habitat. Restored status will be determined once the residual effects of the Tłı̄ch̄o ASR have been reversed.

The development and implementation of a before-and-after-control-impact (BACI) design will help to detect variations in wildlife use of restored linear disturbances. Both ground plots and remote sensing would be beneficial to monitoring

vegetation responses to various treatments. The BC Boreal Caribou Habitat Restoration Monitoring Framework¹ will provide a good basis for developing a monitoring plan that meets the desired objectives.

6.7 Procurement Phase

Measure 6-3 requires a description of any resources provided to Indigenous peoples to support their involvement in the drafting of the final plan and for involvement in the implementation of the plan. Based on sites selected, prescriptions and monitoring required, budgets will be developed identifying costs of completing the offsetting described in the Implementation Plan. After selection of specific areas for restoration and plans for prescriptions for each area, personnel and equipment will be assigned to the work. Priority should be given to Indigenous peoples who are familiar with the region and can provide specific support in future monitoring programs following implementation. Procurement of appropriate experienced crews and equipment will be clearer during the development of the operational Implementation Plan.

¹ Golder Associates Ltd. 2015. Boreal Caribou Habitat Restoration Monitoring Framework. Prepared for BC Oil and Gas Research and Innovation Fund. Report number 1529986-001-R-Rev0. 59 pp.