Mr. Shin Shiga
Manager, Environment
North Slave Métis Alliance
PO BOX 2301
YELLOWKNIFE NT X1A 2P7

Dear Mr. Shiga:

EA1617-01 Tłı̨chǫ All-season Road: Final Responses to North Slave Métis Alliance's July 14th, 2017 Information Requests

Please find enclosed the Government of Northwest Territories' (GNWT) outstanding responses to the North Slave Métis Alliance's (NSMA's) July 14th, 2017, Information Requests. After the updated Wildlife Management and Monitoring Plan (WMMP) has been released, the GNWT is willing to prepare a table for the NSMA that outlines which sections of the WMMP are applicable to the Information Requests and/or provide further details where the GNWT believes it is necessary to answer the Information Requests.

The GNWT looks forward to continuing this productive discussion with the NSMA on the topic of the Tłı̨chǫ All-season Road.

Sincerely,

Michael Conway
Regional Superintendent
North Slave Region
Department of Infrastructure

Attachment

c Mr. Simon Toogood
Environmental Assessment Officer
Mackenzie Valley Review Board

GNWT responded to the following July 14 NSMA IRs on August 11:				GNWT responded to the following July 14 NSMA IRs on September 8 (highlighted in light green):		
IR#	Issue/Theme	Sub-issue Question #		IR#	Issue/Theme	Sub-issue Question #
1	Increased hunting access to wildlife	1		4	References to Barren-ground caribou	1
		2				2
		3		5	Sensory disturbance - boreal caribou	1
		4		10	Non-native/invasive species monitoring	1
2	DASR Appendix C (traffic)	1				2
		2		11	Borrow pit reclamation	1
		3				2
		4		12	Rare plants and setbacks	1
		5				2
3	Hydrology alternations	1		13	Sensory disturbances to caribou in sensitive periods	1
		2				2
6	Surface blasting mitigation	1		16	Wildlife monitors	1
		2		17	Wildlife attraction to salt	1
		3				2
		4				3
7	Snowbank heights and snow fences	1		19	Wildlife traffic speed enforcement	1
		2		21	Caribou and bison behavioural reactions	1
		3				2
		4		22	Pushing caribou and bison	1
8	Surveys for wildlife features of species at risk	1				2
		2				3
9	Winter road reclamation	1		23	Adaptive wildlife traffic protection during operations	1
		2		25	Aircraft mitigation for wildlife	1
14	Sensitive period for bison	1				2
15	Sensory disturbances on moose and other large mammals	1		27	Critical bison and caribou habitat	1
		2				2
		3		29	Setback distances	1
18	Wildlife traffic protection speed reduction	1		30	Setback distances for salt licks	1
		2				2
20	Caribou traffic protection for large groups	1		34	Boreal caribou habitat availability in Wek'èezhìı portion of NT1 range	1
		2		35	Moose densities that will impact boreal caribou and lack of assessment and mitigation plans for indirect effects of moose on caribou	1
		3				2
24	Bison protection for large groups	1		38	Guidelines for cleaning and inspection to avoid the spread of invasive plant species	1
		2		39	Use of TASR and converted habitat by prey and predators not expected to decrease survival and reproduction of prey	1
		3				2
26	Adaptive management for wildlife	1		40	Risk of wildlife-vehicle collisions predicted to be low; minor changes expected from existing conditions	1
28	Bison setbacks	1				2
31	Setback distances for water crossings	1				3
32	Assessing capability vs. suitability of wildlife habitat	1		44	Uncertainty regarding winter road access and climate change on barren-ground caribou	1
33	Proportion of undisturbed boreal caribou habitat in NT1 range in RFD case	1				2
		2				3
36	Sensory disturbance at key times of the year for caribou, young calves	1		47	Seasonal movement and rut sites maps	1
37	Mitigation strategies for avoiding, minimizing and rehabilitation of impacts to vegetation and topography	1		51	GNWT-ENR Response to Jay Measure 6-6	1
41	Interaction strength between primary pathways and valued components for Bison	1				
42	Performing land clearing during winter to reduce disturbing boreal caribou during sensitive periods	1				
43	Negligible effect on barren-ground caribou due to low presence in Project area	1				
45	Ability of barren-ground populations to rebound in 40-50 years	1				
46	Definitions to predict residual effects to wildlife VCs	1				
		2				
		3				
48	Beverly and Ahiak herd effects	1				
49	Contradictory citation data regarding sensory disturbance distances	1				
		2				
		3				
50	Residual effects on barren-ground caribou	1				
52	Unclear link between effects and mitigation	1				

	TOPIC	COMMENT	RECOMMENDATION/QUESTIONS	GNWT RESPONSES
1.	Increased hunting access to wildlife. Wildlife Management and Monitoring Plan (WMMP), Section 4.1, Page 6, Table 2 Habitat Loss and/or Alteration Mitigation Measures. WMMP, Section 5, Page 19. DASR, Section 4.7 monitoring and Follow-up, Page 4-226.	The WMMP demonstrates that employee training will include a review of wildlife policies (i.e., no feeding, no harassment, no hunting, and no trapping) however, this does not indicate a policy for how transgressions would be handled. The WMMP also indicated that access roads to borrow sources will be closed to prevent recreational users from using the roads in the future. The way in which these roads will be closed to prevent use should be clarified, as hunters may find ways around traditional barriers and other methods of keeping vehicles off site. In the DASR, Golder states that "*options for moving the GNWT-ENR check station to a new location to continue monitoring harvest of caribou and wildlife activity will be explored*". Many studies have demonstrated that human infrastructure and a resulting increased ease of access to new locations by hunters, can be a factor explaining caribou (*Rangifer tarandus*) declines and effects on other species are also expected. For example, Plante *et al*. (2017) evaluated the impacts of various human disturbances, especially those that cause direct mortality (*e.g.*, sport hunting) on Arctic caribou in northern Quebec. These authors used resource selection functions to describe habitat selection of 223 caribou and 87 hunters. They then characterized over 169,000 caribou harvest sites, recorded over 17 years, by the relative probability of co-occurrence between caribou and hunters, the relative probability of occurrence of hunters only, or the characteristics of the landscape (e.g., distance to human infrastructures, elevation, land cover type). These authors demonstrated that caribou were more vulnerable to harvest in areas with good accessibility (near roads) or where caribou were easily detectable (lakes, smoother terrain), despite *relative* avoidance of these features by both caribou and hunters. Another study by Guiliazov (1998) also looked at causes of mortality in	1. How will the employees be managed to prevent violations of wildlife policies (e.g., no hunting) beyond initial training? What will the consequences be for hunting and how will these be communicated to employees? 2. Consider re-organising hunting - related mitigation into one clear location within the WMMP, as it is one of the key issues with road construction. 3. Will increased access/ evidence of hunting by non-personnel or beyond the construction phase, be monitored? How will monitoring of unregulated hunting be completed? How will hunting restrictions be enforced? 4. The GNWT was contemplating moving the ENR check station. Has the GNWT decided whether they will move the ENR check station? If the GNWT decides not to move the existing ENR check station, will they add another one to monitor harvest during road operation? This could affect the conclusions of the wildlife sections of the EA adaptive	1. It is expected that there will be similar corporate policies that are currently in place for the Inuvik to Tuktoyaktuk Highway construction project. The exact details will only be available during the regulatory phase as the preferred proponent (Project Co) has not yet been selected. 2. We will make a note and consider the reorganization of hunting-related mitigation into one clear location within the Wildlife Management and Monitoring Plan (WMMP) when we redraft the document. 3. The draft WEMP that was circulated by the Review Board to parties on August 8, 2017 includes a section on access and harvest monitoring. Please see the WEMP for further details. 4. The draft WEMP that was circulated by the Review Board to parties on August 8, 2017 addresses the ENR check station. Please see the WEMP for further details.

	reindeer within the Lapland Biosphere nature reserve in Russia's Arctic Kola peninsula. This author showed that, in areas surrounding the reserve, illegal hunting facilitated by road access, accounted for approximately 18% of reindeer deaths. We note these studies and their conclusions mainly to emphasize the importance of effective access and access control on preventing overharvest and illegal hunting. While mitigation can be applied to control hunting during construction itself, and personnel may be trained, clear policy is needed. It may also be difficult to control access by roads to off-road locations for the purposes of increased harvest. Increased hunting is likely to remain an important issue in this area beyond construction into the operations phase and by non-personnel.	management, and the presence or lack of an ENR check station should be clearly indicated in the next version of the DASR and WMMP.	
2. Developer's Adequacy Statement Response (DASR), Appendix C	Traffic rate estimates are very important for accurately predicting impacts to wildlife, particularly ungulates. Appendix C provides more information on how Golder arrived at vehicle estimates of 20-40 vehicles per day. There are several key assumptions used in these traffic projections: • That monthly ADT values collected for the Tłı̨chǫ winter road can be used to estimate the monthly vehicles year-round; • That only 8 additional vehicles per day can be expected on the road due to increased access (all-weather road development versus winter road only), population growth, and diversion of air traffic into vehicle traffic; • 9.5 commercial loads are expected per day once the NICO mine is operational; • 9 vehicles per day are expected by Fortune Minerals for the NICO project; and • Estimated traffic rates assume a relatively even distribution of road use by vehicles among months; in reality, some months of year will likely experience more traffic than during other times of the year. Depending on when those peaks are, wildlife could be impacted differently. Some of the assumptions used to arrive at traffic estimates along the	1. Will mine staff that live in Yellowknife be restricted from driving back to Yellowknife on weekends or after their shift ends, for example, or have such vehicles not been considered? 2. Do the traffic estimates included for the NICO mine include vehicles beyond commercial and haul trucks? For example, are pickup trucks used for monitoring, maintenance, and workers included? 3. Based on answers in #2, can the proponent include a second, conservative traffic estimate to illustrate "worst case" scenario traffic rates, and evaluate the impacts of those traffic levels on	1. Rick Schryer from Fortune Minerals has indicated that Fortune intends to discourage mine personnel from commuting from Yellowknife to the mine and back for safety reasons. Any additional mine site questions should be directed to Fortune Minerals. 2. The NICO mine traffic estimates were obtained from Fortune Minerals' environmental assessment (EA0809-004). Rick Schryer has confirmed that NICO mine vehicles used for monitoring, maintenance and on-site workers are not expected to use the Tłı̨chǫ All-season Road on a regular basis and are expected to only operate within Fortune's project footprint and on the mine's access road.

	proposed AWR do not seem conservative. For example, in 2015, 547 passengers per month flew between Yellowknife and Whati. If the majority of these decide to drive rather than fly, this could add more traffic (18 more vehicles per day). Increased road use, population growth and passenger selection to drive rather to fly, however, is only projected to add 8 vehicles all together. Further, it appears that the numbers provided for the NICO project include only commercial loads and haul trucks. The number of vehicles cited (9) does not seem sufficient for a mine when commuting, monitoring and maintenance work, and other tasks using non-haul vehicles need to be considered.	boreal caribou, barren ground caribou, wood bison, and moose? 4. Can the GNWT commit to doing traffic rate monitoring along the road, and to re-evaluating the effects of the road and required mitigation should the number of vehicles exceed the predicted traffic rates? 5. Does the proponent make the assumption that resupply vehicles to Whati will remain the same over time?	3. Based on the answer in #2, it is not necessary to include a second traffic estimate. 4. Yes, traffic monitoring is already expected to be monitored. The draft WEMP that was circulated by the Review Board to parties on August 8, 2017 speaks to adaptive management and a re-evaluation of programs if for instance traffic levels increase. Please see the WEMP for further details. 5. Our calculation from Appendix C of the Adequacy Statement Response (ASR) accounted for the possible increase to resupply vehicles as a result of potential population growth and increased access.
3. Hydrology alterations. WMMP, Section 4.1, Page 7, Table 2 Habitat Loss and/or Alteration Mitigation Measures. DASR Appendix B, Table 2.5, Row 2.4 "Beaver Dam Removal"	In Appendix B, Table 2.4, Row 2.4, Golder states that they will "*remove beaver dams that cause water ponding and the possibility of grade damage due to water seepage or the potential of a grade washout*." Beavers modify stream and wetland morphology significantly by building dams. These dams retain sediments and organic matter in the channel, create and maintain wetlands, alter nutrient cycling and decomposition dynamics, and modify the structure and dynamics of the riparian zone. These changes influence the characteristics of water and materials transported downstream, and ultimately influence plant and animal community composition and diversity of the larger region (Naiman *et al*. 1988). Since beaver dams can have significant impacts on the landscape, the impacts of their removal must be interpreted over broad spatial and	1. Please provide a map showing the current beaver dams that may need to be removed to protect road washout. 2. Please indicate how the impacts of beaver dam removal on surface hydrology and habitat for ungulates such as moose have been considered in the adequacy statement response and provide mitigation details in the WMMP.	1. Appendix B of the ASR describes the typical operations and maintenance activities expected for a gravel highway. As there is no infrastructure currently in place along the TASR, there are no beaver dams that need to be removed and therefore no maps are necessary. 2. Beaver dam removal is in reference to dams that are typically erected in and around infrastructure, which are observed during the operation and maintenance phase of the highway. Typically, as soon as dams or

	temporal scales. Removal of beaver dams will likely change local hydrology, nutrient dynamics, and distribution and movement of species associated with water, including moose. If a dam is destroyed without killing the beaver that built it, it will rebuild the dam, often the same day, using new trees. If a dam and associated beaver are destroyed, other beaver will move into the site to rebuild the dam, which can, over time, lead to the need to kill a large number of beavers, which are also valued by Metis and First Nations. Overall, dam removal can lead to changes that can destroy hunting, trapping, travel, and food /medicine gathering areas, and impacts of beaver dam removal should be assessed where its need is anticipated.		obstructions are observed during regular maintenance inspection, these obstructions are addressed accordingly so that the infrastructure is not affected. Dams and obstructions are not typically in place long enough to have an effect on wetland morphology. The risk to infrastructure requires that these incidents are dealt with well in advance of dams changing local hydrology, nutrient dynamics, etc. Nuisance beaver dam removal or nuisance beaver removal will involve an ENR General Wildlife Permit.
4. References to Barren Ground Caribou. DASR, Table 4.1-2 and Section 4.2.2.2, Page 4-26.	The Bathurst herd numbered approximately 470,000 animals in 1986 and is now down to as low as 16,000 animals (~8,000 breeding cows) in 2015. Calf recruitment has been lower than needed for stable populations and cow survival rates have been poor, which suggest a rapid rate of herd decline. The recently released Bathurst Range Plan document does not appear to have been considered in this DASR, though it is relevant to the assessment. Although the DASR states that the project is outside of the core range of the Bathurst herd, it is still within the seasonal winter and annual range distributions according to the Bathurst Caribou Range Plan: Interim Range Assessment and Technical Methods Report (March, 2017). This report shows that the project site is within the Bathurst Range Planning Area, Area 4 (Page 6, Figure 2), which is part of the winter range that already has the highest level of human land use and road infrastructure; road creation in this area could also cause increased access and disturbance to other areas around it. Caribou occupy winter habitat for the longest period (140 days) relative to other seasons, and this is the season when cows are pregnant and gestating, with higher energetic demands and less calorically rich foods available. This is also the habitat wherein which the Bathurst herd would	1. Will the GNWT be considering the Bathurst Caribou Range Plan, along with information and recommendations therein, when assessing project impacts and cumulative impacts on barren ground caribou? 2. Can Golder comment on the current state of the winter range for the Bathurst caribou, and whether increased infrastructure and development could be linked with the declines in cow survival and calf recruitment seen in recent surveys of Bathurst caribou?	1. The GNWT is considering the intent and general approach proposed in the Bathurst Range Plan Interim Discussion Document in assessing the impacts of the road and planning mitigation and management. GNWT will adhere to the recommendations within GNWT's mandate for Range Assessment Area 4; however, the specific recommendations are continually evolving based on engagement and it is important to note that a plan has not yet been produced. A draft plan will be released in Fall 2017. The total human disturbance for Range Assessment Area 4 (NWT Winter Range – Central) is 14,120 km^2. The TASR, if approved, would

	interact to the greatest degree with infrastructure and human disturbances. Disturbances in winter habitat can lead to reduced female survival and spontaneous miscarriage. Jouko *et al.* (1997) demonstrated that reindeer productivity decreased with the continuing deterioration of winter range. The results revealed that reproduction and productivity of reindeer in the study area are largely regulated by density-dependent factors related to the quantity and quality of the winter ranges. Although the winter season is described by the Bathurst Caribou Range Plan as a season wherein caribou have a" low or very low" sensitivity to disturbance, this does not match what is known about the link between ungulate winter range, pregnancy success, and cow survival. A consideration of the Interim Range Assessment for the Bathurst herd and link between growing winter range disturbances and declining calf recruitment of calves and survival of cows should potentially be considered as part of this assessment.		add approximately 180 km^2 disturbance (1.3% of the current total human ZOI) to Range Assessment Area 4. The TASR disturbance was calculated using the following rationale: • 30 km of the TASR is within Range Assessment Area 4 and would have a total zone of influence (ZOI) of 300 km^2, assuming a ZOI of 5 km on either side of the road. • The seasonal ZOI from the southern portion of the current winter road (60 km long x 1 km on either side = 120 km^2) should be subtracted from the TASR ZOI, as the southern portion of the current Whatì winter road will no longer be used. • 300 km^2 -120 km^2 = 180 km^2 of total disturbance attributable to the TASR. 2. Barrier and Johnson (2012) estimated that the area of unburned lichens within the winter range of Bathurst caribou would support between 240,000 and 480,000 caribou in 2009 when this herd was estimated to be approximately 32,000 animals so the availability of boreal winter habitat is not a limiting factor in the recovery of the herd. Golder (2016) completed a winter range resource selection function model using Bathurst

			collared caribou data from 1996 to 2014, which showed preference for above-tree line areas. This study also showed that 0.8% of the winter range is developed. Adamczewski et al. (2009) completed a review of factors potentially contributing to the Bathurst herd decline and concluded that effect of mining to date has been limited. There is no strong evidence that cow survival or calf recruitment is related to effects from development within the Bathurst caribou herd's range.
5. Statement about sensory disturbance not affecting boreal caribou herd productivity. DASR, Section 4.4.2.2, Page 4-1777.	The DASR states, when referencing sensory disturbances and impacts to caribou, that: "Bergerud *et al.* (1984) contend that there is little to no evidence that sensory disturbance activities affect herd productivity". Thus, noise or visual stimulus from traffic will be periodic and unlikely to result in permanent barrier effects that will reduce survival and reproduction. This paper was written over 23 years ago, and concluded, at the time, that "*there were no examples where physical features of corridors or associated disturbance have affected numbers or productivity of caribou*". It is not surprising that no examples existed as disentangling the underlying processes from observed spatial patterns can be challenging, particularly when spatial patterns originating from several processes co-occur and have confounding effects. Further, it is impossible to disentangle sensory effects from one another (for example, the noise versus visual perception of a vehicle). However, the fact that an anthropogenic feature, with co-existing sensory disturbances associated with it, is avoided beyond the immediate footprint is typically sufficient to propose, using the precautionary principle, that the sensory disturbance plays a role in the avoidance. If the avoidance leads to indirect habitat loss of areas that would normally be preferred, particularly in areas where habitat may be limiting, we can infer that vital rates may be impacted.	1. Has the proponent considered results of studies other than Bergerud *et al*. (1984) for arrival at the conclusion that sensory disturbance does not impact herd productivity? If so, which other studies/results were considered?	1. GNWT notes that Section 4.4.2.2. of the ASR referred to in NSMA IR#5 addresses barren-ground caribou, not boreal caribou. To clarify, the ASR concludes that, for barren-ground caribou, sensory disturbance likely has a lesser effect on energy expenditures and productivity than environmental variables (based on recent modeling), but that there remains a theoretical likelihood that herd-level productivity effects are possible. The NSMA are correct in postulating that disentangling the underlying process would be challenging and likely impossible. As described in the preceding paragraph on the referenced page, the results of energetic modelling completed for barren-ground caribou as part of

	A study by Beguin *et al*. 2013 tested three competing hypotheses to explain the distribution of boreal caribou: 1. Climate-driven selection, which postulates their selection for certain habitat classes as a function of proximity to roads; 2. Road-driven selection, which proposes that boreal caribou adjust their selection for certain habitat classes as a function of proximity to roads, and 3. As additive effect of both roads and climate. The results of this study strongly supported road-driven selection over climate influences, and the study concluded that direct human alteration of the landscape drives boreal caribou distribution. See also the example of aircraft sensory disturbance and its effect on caribou calf survival in the comment "Aircraft mitigation for wildlife"		recent environmental assessments was considered. This includes the conservative cumulative effects assessment of development zones of influence (ZOI) and insect harassment on the energetic balance and residual effects assessments completed the Gahcho Kué Project and Jay Project on Bathurst caribou. A similar analysis was completed for the NICO Project, which occurs in the Bathurst winter range. The results of these show that cumulative encounters with ZOIs have little influence on the population trajectory of Bathurst caribou. Consideration of effects of sensory disturbance and survival and reproduction on boreal caribou are presented in the ASR section 4.4.2.1.
6. Surface Blasting Mitigation; DASR, Table 4.3-1, Page 4-114 and Appendix M- Draft Wildlife and Wildlife Habitat Protection Plan.	The mitigation provided for blasting during road construction includes suspending blasts when caribou and Species at Risk are within a 'danger zone'. Appendix M, the Wildlife and Wildlife Habitat Protection Plan, states that this area will be 500m. The DASR also provides information that suggests that more borrow sites will be needed than originally anticipated, meaning that blasting during construction could impact a wider range of habitats and areas. Boreal and barren ground caribou, bison, and moose are all known to be sensitive to noise. There is limited information on the effects of blast-specific noise on ungulates; however, there are numerous other noise studies from which predictions about the effects of noise at certain thresholds. Reimers and Colman (2006) provided a review of the effects of noise, vehicles and	1. What level of noise (dBA) will be reached at 500 m from the average blast required during road construction? This information is needed to predict the residual impact of the safety zone applied around blasting. 2. Is this noise level known to cause energetic distress to moose, bison, boreal or barren ground caribou (or in the absence of information on these, close taxonomic relatives)?	1. Safety zone around blasting will be determined for each blast by the blast supervisor. 2. While wildlife reaction to stressors has been documented, any resulting energetic costs are based on assumptions as direct measurement is not feasible. Monitoring of caribou suggests that barren-ground caribou resume undisturbed behaviour less than one minute following a disturbance event.

	aircraft on caribou and reindeer. Maier *et al.* (1998) reported that low level overflights by jet fighters 1-1.5 times per day in Alaska, producing Sound Exposure Levels (SEL) of 96-106 dBA, caused caribou to spend more time active and to move greater distances. Other studies of overflights on caribou reported startle responses to overflights at volumes of (115 to 127 dB) (Lawler *et al.* 2005 and Harrington and Veitch 1991). Weisenberger *et al.* (1996) used simulated jet aircraft noise on desert ungulates and reported that heart rate increased following disturbance across a spectrum of noise levels (85-108 dBA).	3. How do the anticipated blast sizes (in dBA) compare to those proposed for use during construction of the Doris North mine and propose Hope Bay Phase 2 project, which uses setback distances of 2.2 (Doris North) and 2.8 km (proposed for Hope Bay based on noise model results) for larger groups, respectively? 4. As the GNWT supported the use of larger danger zone areas for group sizes of > 30 for the Nunavut projects such as Back River and Doris North/Hope Bay, would they be willing to support similar enhanced mitigation for large groups of caribou or other ungulates in association with the Tłı̨chǫ All-Weather Road Construction?	3. While detailed design has not yet been completed, it is likely that blasting for the TASR will be less intense than for Doris North as the TASR is in a relatively flat landscape, on sedimentary rock and in a boreal setting (which will mitigate the propagation of noise). 4. GNWT is open to considering the enhanced mitigation for large groups of caribou or other ungulates in association with construction. This will be considered in the next WMMP, which is expected to be available for review prior to the public hearings.
7. Snowbank heights and snow fences. DASR, Appendix B And WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration	Appendix B provides a list of typical gravel road maintenance requirements. For the winter months, this list includes snow removal, and snow fence installation, inspection, repair and maintenance. Snow fences are typically constructed using pure polymer strand, polymer grid, or polymer-coated steel wire strand (BC Ministry of Agriculture (BCMoA), 2015a). The expected snowfall and wind conditions in the area will determine the required storage capacity of the fence and the distance that the fence must be placed back from the road (BC MoA, 2015b). Snow fence design (height, material, density) will affect the amount of snow drift	1. What snow depths are anticipated along road sides during the winter and shoulder seasons? Will they be less than 55 cm to allow Caribou and Bison calf passage? 2. What evidence suggests that snow cleared crossings every 300 m will be sufficient?	1. The value of providing wildlife crossings in the snow banks is being reviewed. Snow depths may exceed 1.5 metres in forest surrounding the TASR, so snow berms may not provide an obstacle to movement in this environment. 2. The value of clearing snow to provide wildlife crossings is being reviewed,

Mitigation Measures.	accumulation on the windward and leeward sides. In addition to these factors, snow fence design needs to consider wildlife movements. Typical mitigation measures include reducing fence height or using nylon ribbon on top to provide deer and moose a visual height they can safely jump (BC MoA, 2015a). The WMMP mitigation includes a provision that snow banks within the proposed TASR footprint will be kept "low" and escape points will be ploughed out for wildlife crossing every 300 metres. However, the proponent has not provided any information on the anticipated depth of snow berms, or how various snow depths will impact the ungulate species assessed, or committed to snow bank management below those heights. The maximum depth implied by "low" should be clarified to ensure that it remains sufficiently protective for ungulates (such as caribou, bison, and moose) which may be affected by snow banks. Further evidence to support the creation of gaps as crossing points every 300 m was not provided, and it may be prudent to shorten that distance to 100 m. Both movement and direct or indirect mortality of ungulates can be impacted by the creation of unbroken snowbanks along roads. Ensuring that snow banks do not increase mortality risk or inhibit movement is important, as this will cause ongoing impacts to wildlife for the life of the road. As ungulates may preferentially travel along snow-cleared, low traffic roads in the winter due to the relative ease of movement compared to the surrounding landscape, they can be impacted by traffic via: 1. Being struck by vehicles due to not being able to clear the road in sufficient time, 2. Running along the road due to the noise or visual stimuli from an oncoming vehicle heard at a distance, leading to winter exhaustion, indirect mortality or later impacts on reproductive success due to energetic effects during pregnancy; or 3. The animal will attempt to clear the road into deep snowbanks that inhibit their motion and leads to higher rates of predation by wolves and other predators. Crossings of barren-ground caribou, for example, are unimpeded at snow depths of < 0.5 m, but Rescan (2011) found that caribou deflected from	3. If snow bank heights cannot be retained to depths below the minimum known to impact ungulates in the area (50-55 cm), can the GNWT commit to creating frequent gaps in the snowbanks (every 100 m)? 4. For snow fences and guiderails, please provide information about construction materials, height, length of continuous sections and gaps. Are there any anticipated barrier effects?	through the updated WMMP. 3. See responses above. 4. Snow fence and guiderail details will not be available until a preferred proponent is selected for the project. If this information is still required, it should be available during the regulatory phase. Guiderails are expected to follow appropriate Transportation Association of Canada guidelines for safety purposes. At this time, it is not expected that snow fences will be required as no highways in the North Slave region currently utilize snow fences.

	roads when snow berms exceeded 1.6 m. Boreal caribou, likewise, tend to move into areas with lower snow depth to maintain the ease of moving through and feeding in these areas (Fuller and Keith, 1981). Moose are affected at shallower depths, as they adjust their behaviour and move to avoid areas of snow deeper than 90 cm (Peek *et al.,* 1982). While there is limited information on bison's movements, previous studies suggest a general consensus on bison mobility through deep snow (NWT Species at Risk Committee, 2016). In general, 50-60 cm impedes calf movement (Van Camp, 1997; Reynolds and Peden, 1987), while 65-70 cm impedes adult movement (Van Camp, 1975). Studies from 1-25 cm (Rouys, 2003) and 27 cm (Fortin *et al*., 2003) showed no limitations on movement, and 38 cm showed some limitations in movement (Fortin *et al*., 2003). In another study, sites of 127 cm were also avoided (Meagher, 1971). We suggest that the use of 55 cm as the maximum snow depth for wood bison as adults should be expected to be able to move through these depths. Calves may have more difficulty moving through 55 cm of snow, but it is still within their range for movement. Wood Bison are known to travel long distances and frequently use established trails between favoured places, even congregating along roads and becoming traffic hazards in some areas (NWT Species at Risk Committee, 2016). Hence, this species may be particularly susceptible to roads.		
8. Surveys for wildlife features of species at risk. WMMP, Section 4.1, Page 6, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	Habitat loss mitigations include contacting ENR and/or EC if a key wildlife feature of a species at risk is discovered resulting in suspension of activity pending consultation with these agencies. However, it is unclear what methodology for surveying for these features would be used, the search intensity, and how far in advance of construction these surveys would take place. If a method of stumbling upon a feature during construction is used, there is a much higher likelihood of missing these features. Also, some features may not be apparent at one time of year, so surveys would need to be far enough in advance, that they would be present.	1. How will the GNWT determine the presence of key wildlife features? 2. What methodology will be used, and when will these surveys take place?	1. Additional information on this topic will be available in the next version of the WMMP, which will be available for review prior to the public hearing. 2. Additional information on this topic will be available in the next version of the WMMP, which will be available for review prior to the public hearing.
9. Winter road reclamation. WMMP, Section 4.1, Page 6, Table 2 Habitat Loss	The mitigation options in the WMMP include reclamation of the terrestrial portions of the current Tłı̨chǫ winter road (KM 0-60), as it is suggested to offset some of the new habitat loss. However, it is unclear where this	1. Please identify the area within which the proposed reclamation of the current winter road is	1. Please refer to GNWT's response to ECCC IR#8.

and/or Alteration Mitigation Measures and Section 2, page 5, Map 1.	reclamation would be, when it will occur, how it will be completed, and what the end goals are in terms of habitat type and suitability for the ungulate species assessed.	planned in the maps provided. 2. Please provide additional information describing the proposed reclamation of the road. As the habitat and forage requirements of the ungulates in the area are quite different, which of the ungulate species will the restored habitat provide the suitable habitat and forage for? Will reclamation be monitored? When might this reclamation be started, and completed?	2. Please refer to GNWT's response to ECCC IR#8.
10. Non-native/invasive species monitoring. WMMP, Section 4.1, Page 6 and 7, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	It is important that invasive species not be allowed to colonize and spread, as this can impact ungulate forage and habitat over time. Mitigation options for habitat loss state that if non-native/invasive species are identified within the corridor due to construction, a response plan will be prepared. It is unclear how this monitoring will be completed, and how long monitoring will occur for. As reclamation and natural regeneration can be a very slow process it may be necessary to monitor for invasive species for a minimum of five years, or at intervals over a longer period. The WMMP noted that invasive species will be monitored annually during each year of construction and if non-native/invasive species are identified due to construction, a response plan will be prepared. This does not include the operations phase which may also experience invasive species issues. Roads affect both abiotic and biotic landscape components including sedimentation, light, dust, soil water content, soil temperature, drainage, run-off pattern, air and water chemistry (Coffin, 2007; Trombulak and Frissell, 2000). These physical changes can directly influence biotic components, particularly vegetation. Road dust can affect vegetation and	1. Please provide more information about the planned methods for monitoring for invasive species and timeline of monitoring. 2. Please develop a long-term, invasive plant management plan that can help ensure the quality of wildlife habitat into the operations phase. While it may not be feasible to monitor for invasive plants indefinitely, some monitoring during the first five years of operation, (or alternating years for longer) and adaptive management if needed, would help to minimize the risks of the project to wildlife.	1. The feasibility of this option will be considered as the next version of the WMMP is updated. 2. The feasibility of this option will be considered as the next version of the WMMP is updated.

	plant communities growing at considerable distance from unpaved road edges. Dust can cover vegetation and affect photosynthesis, respiration, and transpiration and can lead to introduction of phytoxic pollution into plant tissues through increased adsorption (Coffin, 2007). Although dust effects are often limited to within 20 m of road edges, measurable effects have been observed as far as 200 m on the downwind side (Forman and Alexander, 1998). Road edges also provide conditions that encourage establishment of plants that are adapted to disturbance, including some introduced and invasive plants (Forman and Alexander, 1998). For example, Nitrogen from vehicle exhaust, and resultant nutrient enrichment of surrounding area, was observed to change vegetation within 100 to 200 metres of roads (Forman and Alexander, 1998; Angold, 1997). Road effects resulting in increased nutrient availability and higher pH have been shown to promote colonization of non-native, highly competitive plants in tundra ecosystems. This spread is often exacerbated by slope (Mullerova *et al*., 2011). Introduced plant species can spread and cause harm to natural habitats, out-competing native plant species, and degrading habitat quality for ungulates and other species. Climate model projections show an Arctic-wide end of century increase of 13 Celsius in late fall and 5 Celsius in late spring for a business-as-usual emission scenario (Overland *et al*., 2013). These temperature increases can change ecological conditions significantly, making conditions less severe, and permitting establishment invasive species. Between 2005 and 2010 the number of alien plant species in the NWT increased from 94 to 116. These are mostly found in or near communities, near roads and along disturbed areas such as cut-lines, pipelines and mine sites (NWT, 2015). This trend may correlate with observed trends in climate and human activity. Certain introduced plant species have succeeded in spreading in some Arctic habitats, mostly those already disturbed by human activities (NWT, 2015).		

	The maintenance of roadside vegetation, and monitoring for invasive species beyond the four years of construction and into the operations phase is needed to help ensure appropriate habitat quality for wildlife such as caribou, bison and moose.		
11. Borrow pit reclamation. WMMP, Section 4.1, Page 7, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	Although borrow pits will be closed when they are no longer required, and reclaimed, there is also the need to monitor this reclamation process, which is not indicated here. As discussed in Hugron *et al*. (2011), recovery of borrow pits in the Canadian boreal forest is exceedingly slow. They determined that the borrow pits studied were still undergoing primary succession processes several decades after abandonment. Given that the more recent version of the developer's statement has included up to 13 borrow sites, which is farther north than areas studied by Hugron *et al.* (2011), in areas with slower succession time, sufficient monitoring and reclamation is an important consideration to minimize wildlife habitat loss.	1. Will borrow site reclamation be monitored and modified/enhanced as needed? 2. What are the key details on the reclamation process as it relates to habitat targeted for wildlife?	1. The GNWT will construct, operate, maintain and close pits as per the land use permit and quarry permit conditions and in a manner similar to how existing GNWT borrow sites are managed. A component of the quarry permit includes a detailed Quarry Operations Plan for each pit. This Plan defines what is required in order to close a pit and receive clearance from the Lands Inspectors. An example of an INF QOP is available for the Canyon Creek All-season Access Road (S15E-004). 2. The permitting process for quarries includes the requirement for a Quarry Operations Plan. This Plan outlines the anticipated closure details. The QOP is approved by the Department of Lands and quarries can only be closed after they have received clearance from a Lands Inspector. If a pit has been approved for closure by an Inspector, it is understood that the permit holder has completed all conditions of the permit and is no longer liable for the site. An example of an INF QOP is available for the Canyon Creek All-

			season Access Road (S15E-004). The quarry permit approval process defines which reclamation details are required. The key details of the reclamation process for TASR borrow sources will only be available during the regulatory phase as they will be partially dependent on Project Co.
12. Rare plants, rare communities, community surveying and moose habitat setbacks. WMMP, Section 4.1, Page 7, Table 2 Habitat Loss and/or Alteration Mitigation Measures. WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	The WMMP indicates that setbacks will be used around wetlands, rare plant populations and rare ecological communities. However, it is unclear what the anticipated setback distances will be. Wetland areas are an important feeding site and habitat for moose. A scientifically supported setback distance from wetland areas would help protect moose that may be in the area and mitigate against impacts to moose and moose habitat during construction and operation of the road. While it is beneficial that the project footprint will be surveyed by a qualified biologist/botanist for the presence of rare plant species and communities, it is also crucial for the effectiveness of the survey that the surveys occur at the correct time of year to fully capture and allow for identification of rare plants and communities. For example, where construction activities are indicated within the fall and winter months, pre-construction surveys will not be effective for identifying vegetation.	1. What are the anticipated setback distances for development and construction nearby each of wetlands, rare plants, and rare communities? 2. Can the GNWT commit to conducting rare plant and community surveys at correct time of year (*i.e.*, during the growing season)?	1. Setbacks will be revisited in the next version of the WMMP, which will be available for review prior to the public hearing. 2. The feasibility and parameters of this option will be considered as the next version of the WMMP is updated.
13. Sensory disturbances to Caribou in sensitive periods. WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration	The WMMP indicates that certain aspects of construction, such as blasting, would be ceased when caribou are identified within a ‘danger zone’ (500 m) area year-round. A setback of 250 m is given for winter snowmobiles. While time periods are noted for species such as migratory birds, wherein extra caution and mitigation would be exercised, there did not appear to be any seasonal commitments for other potentially sensitive periods such as caribou calving (May or early to mid-June) or the rut (in late September	1. Would the GNWT please consider extending the ‘danger zone’ during sensitive times of the year? 2. Can the GNWT commit to avoiding blasting during the	1. Additional information on this topic will be available in the next version of the WMMP, which will be available for review prior to the public hearing. 2. The feasibility of this option will be considered as the next version of the

Mitigation Measures. Section 4.2.3, Page 11, Table 5 Caribou-Specific Mitigation Measures. Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	or early October) for boreal caribou. The recommended sensitive period guideline for caribou is from May 15 – Oct. 15 with a setback distance of 10 km for woodland caribou (for water crossings near blasting or seismic activity) (AANDC *et al*. 2012). Although barren-ground caribou are not generally present from may-15 to Oct 15 at the project site, AANDC et al. 2012 guidelines prescribe a setback distance of 1 km during this period for barren-ground caribou (for water crossings). Although there is no general guidance on activities away from water crossings for boreal caribou during sensitive periods. We suggest the proponent work with stakeholders to develop enhanced distance setbacks for sensitive periods. As there is uncertainty associated with the range of the effect of blasting on boreal caribou and how far the danger zone should extend, an adaptive management approach such as monitoring for behavioural responses of caribou at various distances from blasts, and further increasing the calving danger zone if adverse responses are observed, may also be needed. Alternatively, in the boreal caribou specific section of the WMMP, a no blasting policy during the calving season is mentioned as a "possibility". Committing to no blasting during this seasonal period would be much more effective and straightforward to implement, and it would greatly reduce the uncertainty around the effectively of safety zones during this period. A commitment for avoiding blasting during the calving season (and rutting/other sensitive periods) would ideally be included under sensitive periods within this section.	calving period for boreal caribou? (particularly if the answer to question #1 is no)?	WMMP is updated.
14. Sensitive period for Bison. WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	The sensitive period for bison is defined in the guidelines as from Mar. 1 – Jul. 15 resulting in a setback of 0.5km (AANDC *et al*. 2012). However, there is no discussion of the sensitive period for bison with the other species discussed in Table 2 of WMMP.	1. Has the GNWT considered the sensitive period setback for bison?	1. Setbacks and sensitive periods for bison will be revisited in the next version of the WMMP, which will be available for review prior to the public hearing.
15. Sensory disturbances effect on moose and	The WMMP includes some protection against sensory disturbances for ungulates (species at risk and barren ground caribou) and bovids (wood	1. Please define mitigation to minimize sensory disturbance for	1. This mitigation will be considered in the next version of the WMMP which

other large mammals. WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration Mitigation Measures. WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	bison) as construction activities will be temporarily suspended when these species are observed within 500 m of construction activities. This protection would apply to species such as boreal caribou, bison, barren-ground caribou. However, for other species of management concern, such as Moose, which are of importance to local harvesters, would seemingly have no protection. A broad mitigation to suspend construction and/or blasting for all large mammals when observed within a minimum of 250 m should also be used to prevent injury or excessive distress to these important species. Likewise, there are also no setback distances for moose (and other large mammals in general) indicated in Appendix B. In the guidelines for sensitive periods it is recommended for all wildlife and birds, in the general Breeding and birthing seasons to have a setback of 0.25 km (AANDC *et al.* 2012). For example, for moose the rut occurs in late September to mid-October and May is the typical calving season. During these times, a setback of 250 m would be important.	other large mammals that may not be species at risk, but are of management concern. 2. Please include setback distances that would apply to moose (and other large mammals that do not fit under other categories) in the table in Appendix B. 3. Has the proponent considered sensitive periods for other wildlife such as moose?	will be available for review prior to the public hearing. 2. Setbacks will be revisited in the next version of the WMMP, which will be available for review prior to the public hearing. 3. This will be considered in the next version of the WMMP, which will be available for review prior to the public hearing.
16. Wildlife Monitors. WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	Construction mitigation includes wildlife monitors which will be on site to monitor wildlife and manage risks, but the qualifications of such personnel are unclear. The risk of unqualified personnel, missing wildlife or key species features and behaviours is a concern.	1. What are the minimum qualifications for wildlife monitors?	1. It is expected that the qualifications for wildlife monitors will be similar to what was required for the Inuvik to Tuktoyaktuk Highway project.
17. Wildlife attraction to salt. WMMP, Section 4.2.1, Page 10, Table 3 General Wildlife Disturbance, Mortality and Wildlife-Human Interaction Mitigations. DASR, Appendix B, Row 5.5, Stockpiling winter sand.	A number of wildlife mitigation activities have been outlined in the WMMP to limit wildlife attraction to the site, particularly for waste and bears. Another potential issue is the use of road salts, which may attract ungulates such as caribou and moose to the road, or sites where it is used during construction. Many studies have documented the attraction of various ungulates and bovids to road salts including caribou (Brown *et al.* 2000), moose (Grosman *et al*. 2011), elk (Poll, 1989), bighorn sheep (Poll, 1989), as well as white tailed deer and mule deer (Kelting and Laxson, 2010). Modifications to road salting policies have also been suggested as a way to reduce the threat of roads to wood bison (ECCC 2016) although less is known about the attraction of road salts for this species. In the DASR Golder states: "*The stockpiling of winter sand includes … c)*	1. Will the use of road salts be avoided as a mitigation measure to limit the attraction of ungulates such as caribou and moose to the site? 2. Please clarify whether "chemicals" used in this statement are a salt compound (e.g. calcium chloride, sodium chloride, etc.). If these are going to be used, have their impacts as	1. Sodium chloride, an ungulate attractant, is not utilized on gravel highways so its use can be avoided on the TASR. In rare instances, limited amounts of sodium chloride may be necessary to ensure road safety. 2. Sodium chloride is not used on gravel highways. Calcium chloride, an approved dust suppressant, will be used on the gravel road in order to control dust. Calcium chloride is used

	blending with chemicals or freeze drying the aggregate."	attractants been considered/assessed within the DASR (effects assessment)? 3. If salts will be mixed with sand and applied to the road, can the GNWT commit to using other methods for keeping the roads safe, so that they do not attract big game?	on other NWT public highways and has not been known to attract wildlife. 3. Sodium chloride is not used on gravel highways so big game should not be attracted to the road through this pathway.
18. Wildlife traffic protection speed reduction. WMMP, Section 4.2.3, Page 11, Table 5 Caribou-Specific Mitigation Measures. And Section 4.2.4, Page 12, Table 6 Bison-Specific Mitigation Measures.	The WMMP includes mitigation which stipulates that the presence of caribou in areas of construction and access roads will be communicated to other drivers and all construction vehicles will stop or reduce speeds when caribou are within 500 m of the road. Similar to the case noted for blasting, the 500 m 'danger zone' may be too small, resulting in disturbance to caribou beyond this distance. Further, the mitigation could also be more specific; for example, what will speeds be reduced to? At what point would traffic stop? The WMMP also indicated that, when bison are present within 500 m of the road in construction areas, drivers will stop or reduce vehicle speeds. However, this is open to interpretation and drivers may be unsure about how much to reduce their speeds. Wood bison are listed as Threatened in NWT, the Mackenzie subpopulation is already in decline, and there is virtually no probability of dispersal from elsewhere to re-populate this population (NWT Species at Risk Committee, 2016), making this group particularly vulnerable. As vehicle collisions with bison have been identified as one of their major threats to the species (NWT Species at Risk Committee, 2016), we need clear guidance for drivers.	1. What noise levels are expected at 500m from the construction areas and access roads, and Is this noise level known to cause distress to boreal, barren ground caribou or bison? 2. Please clarify this mitigation to set clear limits for drivers and construction vehicles to reduce speeds to a predetermined level (such as 20 km/h) when caribou or bison are within the 'zone' and set another, shorter distance, for vehicles to stop (such as when caribou or bison are within 10 m of the road). Be clear about cases in which vehicles should stop versus reduce speed.	1. The noise levels expected at 500m and what caribou are able to hear is unknown. Noise levels will diminish over space and particularly in a boreal setting due to sound being intercepted by trees. The intent of this mitigation is to reduce disturbance to caribou. 2. Refinement of this mitigation will be considered during the update of the next version of the WMMP, which will be available for review prior to the public hearing.
19. Wildlife traffic speed enforcement.	The WMMP states that "vehicle speeds during construction will be 50 km/h to reduce the potential of caribou mortality due to collisions" and "vehicle speeds during construction will be 50 km/h to reduce the potential of bison	1. How will traffic speeds be monitored and enforced?	1. It is expected that Project Co. will have designated personnel that ensure all workers adhere to all site

WMMP, Section 4.2.3, Page 11, Table 5 Caribou-Specific Mitigation Measures. And Section 4.2.4, Page 12, Table 6 Bison-Specific Mitigation Measures.	mortality due to collisions". A site-wide speed reduction should protect more wildlife, but only if is actually followed. It is unclear how this guideline would be monitored or enforced.		rules, which will include adhering to the posted speed limits. For the Inuvik to Tuktoyaktuk project, traffic speeds were enforced through the contractor's site supervisor as well as any GNWT project staff onsite such as the two designated project officers.
20. Caribou traffic protection for large groups. Wildlife WMMP, Section 4.2.3, Page 11, Table 5 Caribou-Specific Mitigation Measures.	The WMMP mitigation includes work stoppages during periods of high caribou presence should observations indicate a need (e.g. when large numbers of caribou (>10) are in the vicinity of the road alignment or winter access routes). When caribou have moved >500 m from the activity or are no longer visible activities may resume. However, if the majority of caribou are in smaller groups they may not be sufficiently protected by this measure.	1. Based on local information, what proportion of caribou are in groups >10 (during the time of year of construction)? 2. Do typical group sizes recorded for boreal and barren-ground caribou differ during the season of construction? Is it reasonable to use to the same group sizes (>10) for both species? 3. What proportion of animals within the relevant area and season would be protected by this group size trigger?	1. There is currently insufficient information on group size to address this question. The threshold will be revisited through adaptive management processes described in the revised WMMP. 2. Barren-ground caribou group size is smallest in winter. The same group size should be used for both species to avoid complications with discerning them in the field. 3. Based on recent information, barren-ground caribou are not anticipated to interact with the Project. Information on boreal caribou populations in the area is currently being collected (see response to ECCC IR#7).
21. Caribou and bison behavioural reactions. WMMP, Section 4.2.3,	An important mitigation strategy is to report sightings and movements of caribou and bison, including their behavioural responses, to the development activities, which has been included in the WMMP. If behavioural responses are significant and problematic these observations	1. How is behavioural response information to be used by wildlife monitors?	1. Behavioural response information will be collected by the wildlife monitors during wildlife observations. This information will be documented and

Page 12, Table 5 Caribou-Specific Mitigation Measures. And Section 4.2.4, Page 13, Table 6 Bison-Specific Mitigation Measures.	should also feed back into and inform an adaptive management approach; however, no feedback of these behaviour data into adaptive management is noted.	2. Can the GNWT commit to using the behavioural information recorded to inform adaptive management?	included in the WMMP reporting, and any learnings will feed into adaptive management of the proposed mitigation and monitoring. 2. The wildlife observation data sheets solicit information on wildlife behaviour or observations. This information will be reviewed in the WMMP reports and may inform changes to protocols through the adaptive management approach. As the TASR is in a boreal setting, wildlife behaviour can only be visually monitored when they are within the right-of-way (i.e. exposed to activity). Collection of control data on wildlife movement behaviour beyond the ZOI of road construction may be possible through the boreal caribou collaring program. Any learnings will feed into adaptive management of the wildlife mitigation and monitoring.
22. Pushing caribou and bison. WMMP, Section 4.2.3, Page 12, Table 5 Caribou-Specific Mitigation Measures. And Section 4.2.4, Page 13,	The WMMP notes that: "*If it is clear that caribou will likely remain in the development area for extended periods the Wildlife Monitor may gently encourage individual or small numbers of caribou to move away from the area using methods pre-approved by ENR*". The same mitigation is proposed for bison. However, this practice needs further clarification as it has the risk of potential for misuse. The phrase "*will likely remain in the development area*" could easily be misinterpreted and should be replaced with "have been in the development area". This will remove the need to guess how long caribou will be present, and the ushering method can then be used with confidence after some given time interval of excessive loitering at the site. The term "extended periods" also needs further	1. Please consider making this practice more standardized as it has the potential for misinterpretation. 2. Please rephrase this mitigation to change the trigger from guessing future behaviour to using behaviour that has occurred. Would several hours be considered an "extended	1. This can be considered during the revisions of the WMMP, which will be available for review prior to the public hearing. 2. This can be considered during the revisions of the WMMP, which will be available for review prior to the public hearing. 3. ENR is the authority on the NWT

Table 6 Bison-Specific Mitigation Measures. Appendix A: Statutory requirements relevant to wildlife and wildlife habitat, Page 1, Table A – Summary of territorial and federal prohibitions pertaining to wildlife and wildlife habitat.	clarification. As noted in Appendix A, the NWT *Wildlife Act,* section 52, states that "Subject to section 17, no person shall, unless authorized by a licence or permit to do so, (a) engage in an activity that is likely to result in a significant disturbance to big game or other prescribed wildlife; or (b) unnecessarily chase, fatigue, disturb, torment or otherwise harass game or other prescribed wildlife." Mitigation states that pushing methods will be preapproved by the ENR; however, it will be important to avoid chasing or disturbing caribou, making it extremely difficult to move them. The use of this method could violate section 52 of the NWT Wildlife Act.	period"? 3. How will this activity be possible without violating the terms of the NWT *Wildlife Act*?	*Wildlife Act* and will therefore be able to offer expert advice that ensures this activity is possible and not in contravention of the *Act*.
23. Adaptive wildlife traffic protection during operations. DASR, Section 4.2.3.4, Page 4-64. WMMP	It is reiterated throughout the DASR that the Project is unlikely to increase wildlife mortality through collisions because of the low speed limit and low predicted traffic volume. Golder cites that reported vehicle collisions with Mackenzie bison are highest through the late summer and fall seasons (i.e., Aug-Nov). Monitoring wildlife traffic collisions and adaptive management of speed limits may help to mitigate the risk of wildlife injury and mortality during TASR operation. During periods of greater wildlife risk, temporary seasonal speed restrictions or additional wildlife signs may also be effective (Poll 1989) and should be considered in adaptive management for the operations phase.	1. Will the GNWT consider monitoring and adaptive management for speed limits?	1. Yes, please see the draft WEMP that was circulated by the Review Board on August 8 for further information on this topic.
24. Bison protection for large groups. WMMP, Section 4.2.4, Page 13, Table 6 Bison-Specific Mitigation Measures.	Vehicle speeds during construction will be 50 km/h to reduce the potential of bison mortality due to collisions. Work stoppages may be required during periods of high bison presence should observations indicate a need (e.g. when large numbers of bison (>10) are in the vicinity of the road alignment or winter access routes). Activities may resume after these groups of bison have moved >200 m from the activity or are no longer visible. What rationale supports these group sizes and distances?	1. What evidence supports group sizes of >10 as a trigger for mitigation? How often would bison be expected to be in these group sizes in this area? 2. What is the rationale for using >200 m as the distance from Bison, whereby activities may	1. Group thresholds will be revisited in the next version of the WMMP. 2. Setbacks will be revisited in the next version of the WMMP, which will be available for review prior to the public hearing. 3. Setbacks will be revisited in the next

		resume? 3. In another mitigation, it was indicated that bison within 500 m of the road or construction equipment would trigger other protections, so should this be 500 m as well?	version of the WMMP, which will be available for review prior to the public hearing.
25. Aircraft mitigation for wildlife. WMMP, Section 4.2.3, Page 11, Table 5 Caribou-Specific Mitigation Measures. WMMP, Section 4.2.4, Page 13, Table 6 Bison-Specific Mitigation Measures.	Project mitigation indicates that flight paths will be altered as necessary to avoid important areas, especially during sensitive periods (for caribou and bison). But, it is unclear where these paths are and how effective they will be. Although the startle response of caribou may appear to be temporary, flights can have population level consequences. For example, calf survival is negatively correlated with a female's average level of exposure to overflights (Harrington and Veitch, 1992). As Harrington (2001) explains, female caribou are most sensitive to stimuli associated with threats during the calving period. Typically, a female that detects a predator will be better off by moving to a new area. However, if a female mistakes a benign stimulus (i.e., overflight noise) for a predator, the noise becomes a signal to the female and her avoidance movements increase. This movement increases her calf's risk of predation as they are more likely to become noticed the more they move around. This is particularly a concern for boreal environments, where predator density is greater. Potentially adverse impacts can be minimized by avoiding specific areas during the calving period (Harrington and Veitch, 1991). Flight altitude guidelines also suggest that "caribou calving grounds should be avoided whenever possible" (Environmental Impact Screening Committee (EISC), 2012).	1. Please provide a map showing typical flight paths, sensitive areas, and where flight paths may be altered. 2. Will flight paths and altitudes be logged to test the degree of flight path compliance? 3. We note that within the bison specific table, there is a typo where it refers to "Project-related aircraft flights over caribou". This should say bison.	1. This mitigation pertains to flying related to the project. As the project is not currently underway, there are no maps available to show typical flight paths. These details are more appropriate for the regulatory phase. 2. The feasibility of this option will be considered as the next version of the WMMP is updated. 3. Noted.
26. Adaptive management for wildlife. WMMP, Section	There is no adaptive management discussed in the WMMP section titled adaptive management.	1. Please include an adaptive management framework.	1. Additional information on this topic will be available in the next version of

5, Page 17.			the WMMP, which will be available for review prior to the public hearing.
27. Critical bison and caribou habitat WMMP, Appendix A: Statutory requirements relevant to wildlife and wildlife habitat, Page 4,6, Table A – Summary of territorial and federal prohibitions pertaining to wildlife and wildlife habitat.	There are three main protected areas for wood bison in the Northwest Territories: Mackenzie Bison Sanctuary, Nahanni National Park and Wood Buffalo National Park. The Mackenzie bison sanctuary is located south of the project area, but nearby and contains a distinct population that is not yet affected by diseases affecting other bison populations. The designated habitat for wood bison will be studied and defined from 2016-2021 (ECCC, 2016) but would likely be focused on these same areas. Critical habitat for boreal caribou in NWT has been identified over the majority of western NWT, including the project area. Here, the goal of maintaining at least 65% undisturbed habitat has been identified. The Woodland Caribou, Boreal population, is also legally protected on federal land and water within Nahanni National Park Reserve of Canada (NPRC). Specific range plans are still in development (ECCC, 2012). COSEWIC has designated barren-ground caribou as “threatened,” but they have not been federally listed and so critical habitat has not been formally designated. Appendix A of the WMMP includes reference to the *Species at Risk (NWT) Act,* which states that the Commissioner may make regulations respecting the conservation of designated habitat or prohibiting activities that may adversely affect the designated habitat. The federal *Species at Risk Act* also states that “no person shall destroy any part of the critical habitat of any listed endangered species or of any listed threatened species…”. It is unclear from the WMMP if critical habitat areas have been taken into consideration.	1. How has critical habitat for these two species at risk (boreal caribou and wood bison) been considered? 2. Is there any potential for the project to impact, through direct or indirect means, the quality of critical habitats identified nearby for these species?	1. The ASR used a habitat suitability model to quantify direct and indirect effects to boreal caribou following Environment and Climate Change Canada guidelines, which consider critical habitat. For bison, critical habitat has not yet been identified; the habitat suitability model used characterized preferences reported for this species. 2. Direct and indirect to boreal caribou effects by the Project are reported in Section 4.4.2.1 and were predicted to not influence the ability of boreal caribou to be self-sustaining or ecologically effective. Direct and indirect effects pathways for bison are described in Section 4.3.3. Direct and indirect effects pathways for bison were determined to have weak linkage and therefore, the Project is not predicted to significantly influence bison populations.
28. Bison setbacks. WMMP, Appendix B: Timing	Bison setbacks are missing from the table.	1. Will setbacks apply to bison for general development and	1. Setbacks will be re-evaluated in the next version of the WMMP, which will

restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.		snowmobiles, similar to caribou mitigation?	be available for review prior to the public hearing. These details can also be considered during the regulatory phase.
29. Setback distances. WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	Throughout the table numerous different setback distances are given without any references or rationale being provided.	1. What is the scientific rationale for the setback distances used?	1. Setbacks will be re-evaluated in the next version of the WMMP, which will be available for review prior to the public hearing. A number of the setback distances were obtained from the Northern Land Use Guidelines documents (specifically the guidelines for Seismic Operations), and from the Inuvik to Tuktoyaktuk Highway's 2013 Wildlife and Habitat Protection Plan. Flight altitudes were obtained from the EISC guidelines and GNWT guidelines ("Flying Low? Think Again" brochure).
30. Setback distances for salt licks WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	The WMMP indicated a setback distance for mineral/salt licks of 1km year-round from all development activities. However, it is unclear how the presence of salt licks will become known without prior surveying efforts or additional TK information being collected.	1. Have surveys been completed for salt licks, or are they been planned in advance of construction? 2. If locations of salt/mineral licks are known, please include on suitable habitat map(s).	1. GNWT reviewed the "Important Wildlife Areas in the Western Northwest Territories" (GNWT 2012) report (Figure 18) and associated spatial data to assess the presence of mineral licks documented within 10 x 10 km grid cells that overlap with the 35 km buffer used to define the TASR RSA. The closest grid cells with documented mineral licks were >10 km outside the RSA; however, it should be noted that the study area for the above report did not include

			the North Slave region. The GNWT will work with the Tłı̨chǫ Government prior to construction to determine if there is any local knowledge of mineral licks within 1 km of the TASR alignment. GNWT. 2012. Important Wildlife Areas in the Western Northwest Territories. Wilson, J.M., and Haas, C.A. Environment and Natural Resources, Government of the Northwest Territories. Manuscript Report No. 221 2. There are no maps currently available. The GNWT will work with the Tłı̨chǫ Government prior to construction to determine if there is any local knowledge of mineral licks within 1 km of the TASR alignment.
31. Setback distances for water crossings. WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	AANDC (2012) also recommends set backs for water crossings for caribou as they are an important habitat area.	1. Have any water crossings been identified in the project area?	1. Setbacks will be re-evaluated in the next version of the WMMP, which will be available for review prior to the public hearing. These details can also be considered during the regulatory phase.
32. Assessing capability vs. suitability of wildlife habitat. DASR, Table 4.3-	In Table 4.3-1, and throughout the DASR, Golder states that "*the current layout of the Project footprint will minimize the amount of new disturbance by primarily following the existing Old Airport Road route to Whati and*	1. Have the proponents considered Project impacts on habitat capability (potential habitat	1. The Project will permanently remove 2,546 ha wildlife habitat, which will reduce the amount of habitat

1: Pathways Assessment for Wildlife VCs. Figures 4.2-1 through 4.2-5, Habitat Mapping.	*intersecting areas previously burned*." The habitat identified as "nil to low" suitability in Figs. 4.2-3, 4.2-4, 4.2-5 for boreal caribou, barren-ground caribou, and moose, respectively, matches reasonably well with the fire history mapping in Fig. 4.2-1. While the recently burnt areas may currently be unsuitable habitat, this does not account for habitat *capability*. *Suitability* refers to be the ability of the habitat in its current condition to provide the life requisites of a species. *Capability*, on the other hand, refers to the ability of the habitat, under optimal natural conditions, to provide the life requisites of a species, irrespective of current condition. Thus, given that the TASR will be operating indefinitely, the effects of the Project on wildlife habitat may be greater than expected.	suitability in the future), particularly for moose and wood bison, both of which may favor early seral stage vegetation as an important part of their seasonal diets?	capability. There is uncertainty with projecting habitat suitability in the future (i.e., habitat capability) and uncertainty impedes the decision making process for the Project. For example areas currently burned may become suitable habitat in the future or they may be burned again and remain unsuitable. The approach of the ASR was to reduce uncertainty by maximizing effects based on current knowledge of existing conditions so that effects would not be underestimated and increase confidence in assessment conclusions. The approach used was appropriate for meeting the ToR.
33. Proportion of undisturbed boreal caribou habitat in NT1 range in RFD Case Results. DASR, Section 4.4.3.1, Page 4-193.	Golder predicts that construction of the TASR, in conjunction with three Reasonably Foreseeable Developments (RFDs), will still yield 66.6% of undisturbed habitat in the NT1 boreal caribou range (from Base Case of 66.8%), exceeding the minimum threshold of 65% needed for self-sustaining populations. The GNWT (2017) Boreal Caribou Recovery Strategy estimates that severe fires in 2014 and 2015 burned 2.3 million hectares and reduced the percentage of undisturbed habitat in the NT1 range from 69% to 66%. Assuming these estimates are correct, construction of the TASR and RFDs will result in 65.8% undisturbed habitat, only 0.8% above the threshold. This percentage converts to approximately 61,300 ha. According to the latest NWT State of the Environment Report (GNWT ENR 2015), there are an average of 274 fires and 600,000 ha burned every year in the Northwest Territories. The Canadian Wildland Fire Information System shows that the North Slave Region has a moderate fire weather index (fire danger). Additional developments and/or forest fires in the	1. Does the percentage of undisturbed habitat that remains after construction of the TASR and RFDs leave enough of a "buffer" to absorb the effects of additional developments and/or future fires? 2. Will the GNWT consider habitat compensation in accordance with maintaining or exceeding the 65% minimum threshold as outlined in the Boreal Caribou Recovery Strategy?	1. The amount of undisturbed habitat in the NT1 range is primarily influenced by forest fires. For example, 24.4% of the NT1 range is disturbed by fire versus 8.9% for buffered developments. When, where and how large forest fires will be in the future is uncertain as is which and how much of previously burned areas will become suitable again. Given the uncertainty, it is unlikely that RFDs will result in exceedance of the threshold. Uncertainties associated with the ASR are discussed in Section 4.5. 2. The GNWT will not implement habitat

	future could conceivably reduce the percentage of undisturbed boreal caribou habitat below the sustainable threshold.		compensation for effects that are unrelated to the Project.
34. Boreal caribou habitat availability in Wek'èezhìı portion of NT1 range. DASR, Section 4.2.3.1, Page 4-41; Table 4.2-16 for Base Case. Section 4.4.3.1, Page 4-193; Table 4.4-7 for Reasonably Foreseeable Developments (RFD) Case.	In the Wek'èezhìı portion of the NT1 boreal caribou range, Table 4.2-16 of the DASR shows that at Base Case, there is 60.0% undisturbed habitat. Golder reasons that "*the disturbance thresholds identified by ECCC at the NT1 range scale are not necessarily applicable at different spatial scales. This is because patterns of habitat selection are scale-dependent due to varying availability of different habitats across space and time*." Both the federal (EC 2012) and GNWT (2017) recovery strategies identify and accept the 65% undisturbed habitat threshold to support a self-sustaining boreal caribou population. While variation in habitat and population conditions may justify different management decisions, GNWT (2017) states that "*the NWT does not currently have strong evidence to support changing the threshold, and the minimum threshold of 65% disturbance applies to the NWT range*." Furthermore, the NWT recovery strategy estimates only **55%** of undisturbed habitat in Wek'èezhìı as of autumn 2015 due to severe fires in 2014 and 2015. Hence, the Wek'èezhìı portion of the NT1 range is already 5-10% below the cited threshold for supporting a self-sustaining population. The Project is expected to directly reduce the undisturbed habitat by 0.1% (Table 4.4-7). However, we note that indirect habitat loss through potential avoidance of the TASR and adjacent, disturbed vegetation, as well as potential competition with increased moose and bison, will further reduce the amount of undisturbed habitat available for boreal caribou. Both direct and indirect habitat loss may further hinder the boreal caribou recovery plan.	1. Can the GNWT commit to habitat compensation in the Wek'èezhìı portion of the NT1 boreal caribou range, in accordance with the NWT boreal caribou recovery strategy?	1. The GNWT is considering what options would be feasible; however, at this time, it cannot commit to habitat compensation via the reclamation of old linear routes (such as old Hwy 3). The GNWT cannot easily reclaim old linear routes as the public typically has a vested interest in these areas as they utilize the routes for recreational or traditional purposes. Please review the response to ECCC IR#8, which identifies that the Tłı̨chǫ Government has the authority over terrestrial areas previously disturbed by the Tłı̨chǫ winter road.
35. Moose densities that will impact boreal caribou populations in NWT. DASR, Section 4.2.3.1,	Golder cites a study by Bergerud and Elliot (1986) when they state that moose densities of approximately 0.11 moose/km^2 would be required to support wolf densities of 6.5 wolves/1000km^2 to destabilize boreal caribou populations. Golder then describes how moose densities in the North Slave	1. How do the densities of boreal caribou, moose, and wolves compare between the Project area and northern BC in the mid	1. There are no density results for boreal caribou, moose and wolves for the Project area from the mid-1980s. The available information is limited to

Pages 4-45 to 4-46. Lack of assessment and mitigation plans for indirect effects of moose on caribou. DASR, Sections 4.4.2.1, 4.4.2.2, 4.4.2.3.	Region are half this value; hence they conclude that moose populations could not support sufficient wolf numbers to destabilize the boreal caribou population. However, the Bergerud and Elliot (1986) study was conducted in northern BC, which may support higher densities of all, or some of these, species (moose, wolves, and boreal caribou) compared to the NWT. For example, if the location (or time when the research was conducted) of the Bergerud and Elliot (1986) study supported a higher density of boreal caribou than at present and near the proposed AWR, then high numbers of moose and wolves would also be needed to destabilize that particular British Columbia population. The results of Bergerud and Elliot (1986) may, therefore, have no bearing on the impact of moose and wolves on boreal caribou in the project area. as the population dynamics derived from this paper may not be applicable to the Project area. An evaluation of possible effects due to interspecific interactions between moose and caribou is lacking in the DASR. Golder identifies that moose can impact boreal (Section 4.4.2.1, Page 4-172) and barren-ground caribou (Section 4.4.2.2, Page 4-176) by attracting wolves and increasing predation pressure on caribou, and that "*moose may be attracted to regenerating vegetation along the TASR*" (Section 4.4.2.3, Page 4-187), yet there are no formal assessments or mitigation plans.	1980s (location and time period associated with Bergerud and Elliot (1986) study? Could the caribou population around the Project area be destabilized by a potential increase in moose and resulting wolf densities? 2. Please explain the rationale for excluding the assessment of potentially higher moose densities due to the construction of the TASR on the survival and reproduction of boreal and barren-ground caribou due to increased wolf predation pressure.	moose in the North Slave Region where the Project is located and densities ranged from 0.02 to 0.04 moose per km^2 (Section 4.2.3.1). Within the 500 m area of sensory disturbance for boreal caribou on either side of the 94 km Project length, these densities would translate to 2 to 4 moose. Moose abundance in areas adjacent to the Project may increase as recently burned forest regenerates, however, this effect is unrelated to the Project. Wolves that use the Project right of way as a travel corridor may also be susceptible to harvest pressure and may learn to avoid it if not harvested. It is unlikely that a local increase in moose and wolf densities will destabilize boreal caribou at the scale NT1 range, which was the population assessed. The WMMP monitoring program will assist in assessing whether the project has a local effect on moose densities and on caribou survival and reproduction. 2. Use of linear corridors and converted habitat (i.e., younger, more productive forest) by prey and predators leading to decreases in survival and reproduction of prey was assessed as a secondary pathway in the ASR (Table 4.3-1). Please see the

			previous response on boreal caribou. Barren-ground are not expected to interact with the Project given their current low abundance and presence in the Project area since mid-1990s. Interaction with the Project may increase when ranges expand at higher abundance. At higher abundance, barren-ground caribou will be resilient to effects from the Project.
36. Sensory disturbance at key times of the year for caribou, young calves. DASR, Section 4.2.3.1, Page 4-46.	Golder provides background information on how "*sensory disturbance is most detrimental at key times of the year, such as late winter periods, when animals tend to be in poor physical condition, and during the reproductive season (spring/early summer) when caribou are raising young*," and how "*although these effects may seem minor, displacement and increased wariness may affect energetic expenditures and survival*, *particularly for young calves*."	1. Given the knowledge and awareness of when caribou are most sensitive to sensory disturbance, please explain why impacts of sensory disturbance during relevant sensitive seasons were not assessed for ungulates (barren ground and boreal caribou) and bovids (wood bison).	1. Sensory disturbance was considered a primary pathway. Rather than repeating the assessment for different seasons, the assessment considered all seasonal habitats at the same time so that the assessment was inclusive of all seasons.
37. Mitigation strategies for avoiding, minimizing and rehabilitation of impacts to vegetation and topography. DASR, Table 4.3-1, Page 4-112, first Effect Pathway.	For the Effect Pathway of the site preparation, construction, and operation of the TASR on habitat availability, use, and connectivity, the last bullet point of the mitigation plan states that mitigation strategies recommended by the *Northern Land Use Guidelines* "*will be considered*". These guidelines include best practices for avoiding, minimizing, and rehabilitation of impacts to vegetation and topography.	1. Will the GNWT commit to following the *Northern Land Use Guidelines*?	1. It is not possible to commit to following every mitigation within the Northern Land Use Guidelines as they are not all necessarily applicable to this specific project. Thus the guidelines will be considered and their recommendations will be utilized when appropriate. In certain instances, there may be better solutions available so these would be used instead. The specifics will be

			detailed in the next version of the WMMP which will be available for review prior to the public hearing.
38. Guidelines for cleaning and inspection to avoid the spread of invasive plant species. DASR, Table 4.3-1, Page 4-117, third Effect Pathway.	Mitigation plans for minimizing the introduction and spread of noxious and invasive plants are briefly described, but without reference to specific guidelines for how to clean and inspect vehicles and equipment.	1. Please provide a reference to the specific guidelines for controlling the spread of invasive plant species, if available.	1. This can be considered during the revisions of the WMMP, which will be available for review prior to the public hearing.
39. Use of TASR and converted habitat by prey and predators not expected to decrease survival and reproduction of prey. DASR, Section 4.3.2.2, Page 4-122; Table 4.3-1, Page 4-116, first Effect Pathway.	Golder argues that (on Page 4-122) because the proposed TASR footprint will primarily follow the Old Airport Road route and burned habitat, the amount of new linear disturbance will be small relative to existing conditions; and that design features and mitigation measures will have "*negligible net residual effects*" on the survival and reproduction of prey species. Table 4.3-1 for this Effect Pathway (Page 4-116) does not provide information on design features or mitigation measures to address the potential effects on prey survival and reproduction. The DASR also fails to consider that the all-season gravel road may be a more attractive travel corridor than the current winter road, and that the all-weather road may be favoured by some wildlife as a movement corridor year-round. This could result in increased wildlife traffic and predator-prey interactions. In addition, the maintenance of roadside vegetation at an early seral stage can lead to selection of forage vegetation along the edges of roads by predators and/or prey, which can change the population dynamics. Bears, for example, may forage along roads for favored vegetation and for roadkill and garbage, which can bring them into more frequent contact with ungulates and bovids that may also be selecting road verges for vegetation or that are using the road as a travel corridor (Roever *et al*., 2008; Dussault *et al*., 2012; Bastille-Rousseau *et al*., 2011). Dussault, Leblond, and others have measured road impacts on habitat selection by bears and on the	1. Will the TASR result in increased use of the corridor by wildlife for travel (due to its selection for ease of movement) and foraging (roadside vegetation), and could this result in residual shifts in predator-prey interactions? 2. Please clarify the design features and mitigation measures that will result in negligible net residual effects on the survival and reproduction of prey species due to shifts in predator-prey interactions that may occur due to the project.	1. This was assessed as a secondary pathway, which by definition in the ASR (Section 2.2) means the pathway could result in a measurable minor environmental change relative to existing conditions, but would have a negligible residual effect on the valued component (VC) at the population level and is not expected to contribute to effects of other past, previous or reasonably foreseeable developments (RFDs) to cause a significant effect. It is possible that the TASR will provide a better travel corridor for predators, but this will likely be balanced by the increase in traffic volumes and possibly harvesting on the route which would act as a deterrent for wolf use of the road (e.g. see Muhly et al. 2011). Muhly, T. B., Semeniuk, C., Massolo, A., Hickman, L., & Musiani, M. (2011). Human activity helps prey win the

	vitality rates of caribou through indirect predator-prey dynamics. They determined that when caribou calves occupied areas with few deciduous trees, they were more likely to die from predation if the local road density was high (95% of predation was by black bear). Mature coniferous stands, and roadsides offer relatively high vegetation biomass consumed by black bears, increasing the likelihood of predator interactions and calf mortality. Given that less than 50 per cent of the calves survived more than two months, there can be strong fitness consequences for a caribou cow's inability to select safe habitats, and potentially population level sufficient amounts of safe habitats are not available. Leblond *et al*. (2013) similarly showed that adult caribou that established their home range in areas with high road densities had a much higher probability of dying by predation throughout the year. This is likely because roads increase the efficacy of wolves in their search for large prey (100% of adult predation was by wolves).		predator-prey space race. *PLoS One*, *6*(3), e17050. 2. As Table 4.3-1 indicates, the mitigation is the design of building the road along existing linear disturbance, which is used by wildlife and people in the Base Case. There are also other existing trails (linear features) present in the study area during the Base Case. While it is anticipated that individuals will be affected by changes in predation rates, the Project is not anticipated to cause population-level effects.
40. Risk of wildlife-vehicle collisions predicted to be low; minor changes expected from existing conditions. DASR, Section 4.3.2.2, Pages 4-121 to 4-122; Section 4.2.3.4, Page 4-64.	On Page 4-121, Golder cites GNWT-DOT data for reported collisions involving animals from 2010-2014: a total of 113 collisions, 95% of which occurred on highways, 5% in communities, and none in rural areas. The existing Old Airport Road is a winter use (rural) road. However, the proposed Tlicho All-Season Road will be available for use year-round, overlapping with migration times; and will experience increased traffic (DASR, Appendix C). Thus, a higher probability of wildlife-vehicle collisions may be expected compared to other rural roads, particularly if they are winter-only roads. On Page 4-64, Golder cites 270 reported collisions involving bison in a 27-year period between 1989-2015 (Mackenzie Bison Management Plan) – an average mortality rate of 10 bison/year. From the 113 reported collisions mentioned above, 65% (73) involved bison – an average of 14 bison were killed per year from 2010-2014. In addition, on Page 4-64 Golder cites an average of 22 bison killed in vehicle collisions per year on Highway 3 since 2005. While the data sources are not the same, these results indicate a 1.4-	1. Is the predicted risk of wildlife-vehicle collisions on the TASR considered low because it is considered to be a "rural" road? Are the other rural roads used for comparison generally winter roads only, or are they all weather roads? 2. Could higher traffic on the TASR relative to the existing Old Airport (winter/rural) road, and the fact that the road will be used year-round, result in "highway"-type wildlife mortality rates?	1. The risk is low because the predicted traffic volume of up to 40 vehicles (assumed in the Project Case but predicted for the RFD Case) is low (i.e., up to 1.7 vehicles per hour), the speed limit is 70 km per hour, which is less than for highways, wildlife densities are low regionally and the Project intersects 60% burned habitat, which is avoided by key VCs such as caribou. 2. The change in traffic volume relative to existing conditions will increase as this is the intention of the Project. However, predicted traffic volume and speed are less than Highway 3.

	2.2x increase in road mortality rates in recent years. Unless the population of bison is increasing proportionally, such that the ratio of population growth: mortality remains the same, increasing collisions with bison will further contribute to population decline.	3. Please provide data on bison population abundance *vs.* bison-vehicle collisions over time, if this information is available.	Traffic volume and speed are key variables influencing collision risk. 3. Both population size and the number of vehicle collisions on Highway 3 over time for bison are illustrated in the Mackenzie Bison Management Plan (Draft Version 7). This document suggests that the number of collisions varies from year to year for unknown reasons, but that there seems to be an increase over time.
41. Interaction strength between primary pathways and valued components for Bison. DASR, Table 4.3-2, Page 4-127.	All Project effects on bison are expected to be weak interactions in Table 4.3-2. However, the anticipated interaction strength for the following three effect pathways noted within this table are inconsistent with knowledge of bison movements and behaviour with respect to roads: 1. Altered movement patterns, including any changes to interactions with other caribou herds. 2. Increase in public access could affect wildlife survival and reproduction through vehicle strikes, and/or legal and illegal hunting. 3. Use of linear corridors by bison may lead to range expansion and affect moose and caribou habitat. From the Wood Bison Species Status Report (GNWT SARC, 2016): Wood bison may establish trails along human-made linear disturbances, such as roads, and will use them continuously over long periods of time. Bison do not avoid roads unless there is heavy hunting pressure; they will graze on early seral stage roadside grasses and sedges. Hence, we would expect an interaction for bison for the pathway #1 noted above. Wood bison easily become habituated to human presence and infrastructure and have a tendency to congregate along roads, often	1. Please explain why the TASR effects on bison are considered to be weak, considering wood bison are often found to travel and forage near roads.	1. Bison use the existing Old Airport route in the Base Case. The ASR acknowledges some bison will use the ROW of the Project. The assessment is made at the population scale. The amount of moderate to highly suitable habitat surrounding the Project is low, which is a result also supported by Traditional Knowledge.

	becoming a traffic hazard. (See comment and question above re: bison-vehicle collision predictions) Hence, we would expect an interaction for bison for the pathway #2 noted above. The Mackenzie population of wood bison has been expanding north toward Whati in recent years, possibly due to new road and trail construction. As the wood bison's range begins to overlap with other species, they may compete with boreal caribou for slow-growing lichens, and with moose for willow. Hence, we would expect an interaction for bison for pathway #3 noted above.		
42. Performing land clearing during winter to reduce disturbing boreal caribou during sensitive periods. DASR, Section 4.4.2.1, Page 4-171; Appendix B, Tentative Construction Schedule	Golder proposes to minimize Project effects on boreal caribou during sensitive periods, *e.g.* calving and post-calving, by performing land clearing procedures primarily during the winter. All blasting work in the tentative construction schedules in Appendix B of the DASR begin in mid-January, when the length of day at northern latitudes is very short. Darkness may inhibit Golder's mitigation measure of restricting blasting to when caribou and bison are >500 m away (TASR WMMP, Tables 5 and 6).	1. Can the GNWT confirm that wildlife monitors will be able to see animals in the dark at the proposed mitigation distances?	1. This mitigation can be refined in the next version of the WMMP, which will be available for review prior to the public hearing.
43. Negligible effect on barren-ground caribou due to low presence in Project area. DASR, Section 4.4.2.2, Page 4-175; Section 4.2.3.2, Page 4-47; Appendix G, Bathurst Annual Density map.	Golder argues that the TASR will have minimal effect on barren-ground caribou because the Regional Study Area is outside of both Bathurst and Bluenose-East herd core ranges, and individuals have not been seen in the Project area since the late 1990s, when there was a peak abundance of barren-ground caribou. The annual density map of the Bathurst herd in Appendix G shows that as of 2015, the 100% Utilization Distribution is outside of the RSA. However, the Project area is within the historical annual home range. Mitigation plans need to consider the Bathurst caribou recovery plan and future range expansion into suitable habitats. Caribou numbers are at all time lows, and should they recover, we need to anticipate range expansions into historic range, and the need for retaining sufficient capable habitat.	1. How does the TASR fit into the GNWT's Draft Bathurst Caribou Range Plan?	1. The Bathurst Caribou Range Plan considered the TASR and the NICO Project in the future development scenario forecasting.
44. Uncertainty regarding winter road access and	Golder acknowledges the uncertainty of predicting the effects of the TASR on winter access roads and hunting of barren-ground caribou. They predict	1. Please define "temporary" in the context of this statement, and	1. The Project is an all-season road that will provide access to winter roads

climate change on barren-ground caribou. DASR, Section 4.4.2.2, Page 4-181.	that the TASR will result in a 10-14 day earlier opening and closing of the winter roads, which would allow hunters to access wintering caribou, but then posits that "*earlier access for trucks with snowmobiles may be temporary*" due to climate change. Golder also argues that Bathurst caribou begin their migration to northern calving areas in mid-April, so longer winter road access past mid-April may not increase harvest. As mentioned above, if population recovery and range expansion of Bathurst caribou occurs in the future, there may be more implications of increased winter road access.	with regard to the rate of climate change. i.e., Will climate change alter the earlier winter road opening/ connections quickly enough to render this impact negligible to current caribou herds? 2. How long does it take to impact caribou populations at their current population sizes, and given their trajectories, if this effect of earlier opening and closing of winter roads did occur? 3. Please provide predictions for the effects of increased road access on barren-ground caribou harvest with and without climate change and the period over which increased road access could be expected before being circumvented by climate change.	north of Whatì that connect to Gamètì, and Wekweètì. Warming trends already documented are forcing the construction of winter roads to occur later in the year. The increasing cost of building and maintaining winter roads will become prohibitive because the operational season will become shorter over time if warming trends continue. This renders the effect of improved access to trucks to transport snowmobiles on these winter roads as a temporary effect. 2. If population recovery and range expansion of Bathurst caribou occurs in the future than Bathurst caribou will be at higher abundance and more resilient to effects from harvest. 3. Projections of increased harvest with future climate change scenarios will depend on variables with a high degree of uncertainty, thus represent only what "might" happen and not "will" happen. For example, variables may include caribou distribution and abundance, whether harvest restrictions currently in place will be maintained or relaxed, human population sizes, and the cost and feasibility of winter access road construction and operation.

45. Ability of barren-ground populations to rebound in 40-50 years. DASR, Section 4.4.3.2, Page 4-199.	Golder states that "*caribou begin to use post-fire areas 40 to 50 years later when lichens are available, so habitat loss from fire is temporary and reversible.*" In NWT between 1989-2016, the Bathurst and Bluenose-East barren-ground caribou populations declined by 96% and 89%, respectively, and the declines are believed to be continuing (Porcupine Caribou and Barren-ground Caribou Species Status Report, GNWT SARC, 2017).	1. Given the current population trajectories for barren-ground caribou in the NWT, will impacts that exacerbate population decline allow for rebound in this time frame?	1. Barrier and Johnson (2012) estimated that the area of unburned lichens within the winter range of Bathurst caribou would support between 240,000 and 480,000 caribou in 2009 when this herd was estimated to be approximately 32,000 animals so the availability of boreal winter habitat is not likely to be limiting. Traditional Knowledge (PR#28) indicates there has been little to no regular interaction between barren-ground caribou and the Project since the mid-1990s when barren-ground herds were near peak abundances. Direct and indirect effects to barren-ground caribou habitat by the Project are likely only to be realized by barren-ground caribou when they are in much greater abundance and more resilient.
46. Definitions to predict residual effects to wildlife VCs. DASR, Section 4.6.1, Table 4.6-1, Page 4-209.	In Table 4.6-1, Golder categorizes the Duration criteria as Short-term, Medium-term, Long-term, and Permanent. Long-term is described as "within a defined length of time during operation". It is unclear what the defined length of time is, and whether the definition is species-specific. The Magnitude of impact may be underestimated if the analyses used the proposed 500 m setback distance (WMMP, Tables 5 and 6). As mentioned elsewhere, Golder is aware of sensory disturbance distances of up to 9 km (for logging operations) affecting boreal caribou (Page 4-41).	1. Please provide more information about how Residual Effects Analyses were conducted. 2. Please define "long-term" duration for each species (boreal caribou, barren-ground caribou, moose, bison), since the self-sustainability of a population may be dependent on time. 3. Please re-assess the magnitude of effects using greater setback	1. Section 2.3 of the ASR provides the general approach to residual effects analysis. It is unclear what additional information is being requested. 2. The classification of a residual effect as long-term depends on the operational period of the development or effect under consideration. For example, future mines may operate for a defined period (e.g., 20 to 30 years) until resources are extracted in

		distances.	completion. At closure or post-closure the residual effect may be reduced or no longer present (e.g., mining is no longer an activity). The classification of duration was considered specific to each VC. As Table 4.6-1 indicates, the effects of the Project were assumed permanent because the TASR will have an indefinite operational period. 3. For boreal caribou, the ASR followed Environment and Climate Change Canada's guidelines on critical habitat mapping, which specifies indirect effects quantified from development using a 500 m buffer. Use of a larger buffer may reduce the amounts of critical habitat below the 65% threshold but will be inconsistent with methods prescribed by ECCC and will not change that the Project contributes very little to cumulative development effects to boreal caribou in the NT1 range.
47. Seasonal movement and rut sites maps. DASR, Section 5.2.10, Page 5-13; Appendix G.	Golder provides maps of suitable habitat and traditional knowledge data of habitat (if available) for boreal caribou, barren-ground caribou, moose, bison in Appendix G. It would be very informative to help evaluate the impact of the TASR if seasonal habitat use/movement data and rut sites of these species were provided.	1. Please provide seasonal habitat use/movement and rut sites on maps, if data are available.	1. Please see our response to ECCC IR#7 for further details on the data we currently have available.
48. Beverly and Ahiak herd effects. DASR, Section 5.4.3.2, Page 5-49.	Golder states that "*Tłı̨chǫ harvesters stated that increased development in the barren-grounds have disrupted caribou migration into the Whatì area, which is a concern since they now have to travel further north towards*	1. Has the GNWT considered possible impacts on the Beverly/Ahiak herd from this	1. The assessment of effects focussed on the Bathurst and Bluenose east herds, which has the greatest degree of

	Grandin Lake and Gamètìto be able to hunt barren-ground caribou (p. 38 PR#28; PR#97 IR 2). The GNWT (PR#7 page 5-10) anticipates that a Whatì community access road will extend the winter road season to Gamètì and Wekweètì by approximately 4 weeks, which may also extend access to barren-ground caribou habitat for non-Tłįchǫ harvesters." Disruption of migratory routes of Bathurst and Bluenose-East herds may force them to come into the contact with the Beverly/Ahiak herd, as some collared Beverly/Ahiak caribou have been shown to overwinter in the area near Wekweètì.	project?	overlap with the Project, and is subject to higher levels of harvesting and cumulative effect potential than the Beverly/Ahiak herd.
49. Contradictory citation data regarding sensory disturbance distances. DASR, Section 4.1.3.1, Page 4-5; Section 4.2.3.1, Page 4-41; Section 4.4.2.1, Page 4-171.	Golder cites multiple sensory disturbance distances for wildlife throughout the document, ranging from 5 km for mammals (Page 4-5); 4 km for boreal caribou around an active mine site, and 9 km around active logging operations (Page 4-41). Given these numbers, the key boreal caribou habitats identified by TK approximately 5-10 km west of the Project (Page 4-171) may be affected by the project.	1. Please clarify which sensory disturbance distances Golder feels are most appropriate for boreal and barren-ground caribou, moose, and bison. 2. Are the numbers from Point 1 the most conservative values in the DASR? 3. How have the above values been used to assess sensory disturbance and to inform mitigation?	1. For boreal caribou, a 500 metre buffer was applied to developments per the Environment and Climate Change Canada guidelines for critical habitat mapping. Indirect effects for all other VCs were assessed qualitatively. 2. The approach used was appropriate for meeting the Terms of Reference (ToR). 3. The updated WMMP will describe the proposed mitigation.
50. Residual Effects on Barren-ground Caribou DASR, Section 4.5.2.2, page 4-217	Golder concludes that "incremental and cumulative changes to measurement indicators from the Project and other developments should have no significant adverse effect on self-sustaining and ecologically effective barren-ground caribou populations." Mackenzie Valley Environmental Impact Review Board (MVEIRB), in its Report of EA for the Jay Project, concluded that Bathurst caribou are not a self-sustaining and ecologically effective population, and that any adverse effect on this population should be considered significantly adverse. The	1. Please explain how Golder believes that effects classification of the Project should be different from that of the Jay Project, as judged by the MVEIRB and the GNWT Minister of Lands.	1. Similar to MVEIRB comments on the Jay Project, the ASR also indicates that the Bathurst caribou herd may not be self-sustaining or ecologically effects at the Base Case (Section 4.2.3.2). However the Project will not contribute to existing significant effects. The Project may contribute effects during a future scenario when

	GNWT Minister of Lands approved and signed the recommendations by the MVEIRB, including the board's conclusion that the Jay Project would have significant adverse effects on Bathurst caribou due to the herd's current perilous status. Golder agrees in DASR that there would be residual adverse effects on Bathurst caribou from various sources. Given that Bathurst caribou is not a self-sustaining and ecologically effective population, Golder conclusion in DASR contradicts with the recent finding by the MVEIRB and the GNWT Minister of Lands.		this herd is more abundant and more likely to interact with the Project. However, when this scenario is occurs, barren-ground caribou will likely have recovered their ability to be self-sustaining and ecologically effective and be more resilient to cumulative effects.
51. GNWT-ENR Response to Jay Measure 6-6	On May 18, 2017, GNWT-ENR submitted "Caribou Management Measure 6-6" to the MVEIRB. Measure 6-6 was a result of the Dominion Diamond Ekati Corporation's Jay Project Environmental Assessment. The Measure directed GNWT-ENR to: A) Investigate and report on the causes for the current population change; B) Complete and implement an interim management plan for the Bathurst caribou herd; and C) (develop a) Interim Strategy for the Recovery of the Bathurst caribou herd Although GNWT-ENR promises that it "will continue to ensure that measures and recommendations directed at GNWT by the Review Board related to mitigating significant impacts on the Bathurst herd are met", NSMA observes a number of initiatives where the GNWT-ENR has fallen short. For example, the Wolf Management Feasibility Assessment is well behind recommended schedule by the Wekeezhii Renewable Resources Board. Similarly, the Bathurst Caribou Advisory Committee progress is slow. The NSMA only this week (July 11, 2017) received meeting minutes for the meeting that was held in March of 2017. This delay significantly impacts the momentum needed to move this important plan forward. The Bathurst Caribou Range Plan, on the other hand, may be on schedule to be completed, but there is no articulation about the implementation	1. GNWT-ENR, please explain in what ways you intend to overcome challenges you are facing that are preventing you from meeting directions and recommendations by the co-management boards in a timely manner.	1. The GNWT is committed to meeting the directions and recommendations issued by co-management and regulatory boards. The GNWT works closely with co-management partners and Aboriginal Governments in order to meet many of the recommendations issued by co-management boards, and for some initiatives like the wolf feasibility assessment and the Bathurst Advisory Committee, the GNWT is only one of multiple organizations involved. Collaborative approaches require an investment of time and effort from all involved parties. The GNWT is committed to the co-management approach as an informed and engaged public is necessary for an effective process.

	mechanism, without which the plan will have no effect. It appears to NSMA that, despite best efforts, GNWT-ENR has fallen short of meeting directions and recommendations that are made by various co-management boards (e.g. WRRB and MVEIRB) over the years.		
52. Unclear link between effects and mitigation. Socio-Economic Effects. Table 5.3-1. Page 5-18.	Golder identifies that a land use plan for public lands in the Wekeezhii Management Area (WMA) would mitigate potential impacts on time spent for traditional activities and consumption of country food. At present, GNWT has not set scope of the land use plan. Without clearly knowing what the land use plan will contain and achieve, it is unclear how the linkage is made between the said effects and mitigation.	1. Please clarify how a WMA land use plan would mitigate potential effects on time spent on traditional activities and consumption of country food.	1. The land use plan would identify areas set aside for traditional land use, such as the Cultural Heritage Zones identified in the Tlicho Land Use Plan.

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