

MACKENZIE VALLEY HIGHWAY PROJECT

DEVELOPER'S ASSESSMENT REPORT

Mandate commitment of the 19th Legislative Assembly

October 2023

VOLUME 2

Assessment of Key Lines of Inquiry

Government of
Northwest Territories

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8.0 SUMMARY OF KEY LINES OF INQUIRY

This chapter is the first of four that address the two key lines of inquiry (KLOI)s for the environmental assessment of the Mackenzie Valley Highway Project (the Project). The KLOIs are described in the Terms of Reference (ToR) for the Developer's Assessment Report (DAR) as issued by the Mackenzie Valley Environmental Impact Review Board ([MVEIRB], 2015).

The four chapters address the KLOIs as follows:

- Chapter 8 summarizes the findings of the assessment of the KLOIs of:
 - Local social and economic considerations
 - Caribou, moose and harvesting
- Chapter 9 details the socio-economic impact assessment.
- Chapter 10 details the assessment of potential effects on caribou and moose.
- Chapter 11 details the assessment of potential effects on culture and traditional land use, including harvesting.

The KLOIs reflect the interconnectedness of multiple aspects (valued components [VCs]) of the biophysical and human environment. Chapters 9, 10 and 11 provide a detailed assessment of VCs most related to the KLOIs. This chapter provides a summary; whereas the reader is referred to those chapters for detailed assessments of potential effects of the Project and predicted significance of effects on each of the VCs.

8.1 Introduction to the Summary of Key Lines of Inquiry

The ToR requires the KLOIs to receive the most attention and analyses in the DAR, as they reflect the topics of greatest concern. The KLOIs reflect interconnected topics identified to the MVEIRB during their scoping meetings held in 2013 as important to Indigenous Governments, Indigenous Organizations and other parties affected by the Project.

The Project fulfills part of the Government of the Northwest Territories' (GNWT's) vision to create a road connection to the Arctic coast (see Section 1.1). The purpose of the Project is to provide the needed infrastructure to support an improved quality of life and lower cost of living for territorial residents in the Mackenzie Valley and the expansion and diversification of the territorial economy. The Project will create a permanent all-season highway from Wrigley (Pehdzéh Kì N'deh), hereafter referred to as Wrigley, in the Dehcho Region, to the communities of Tulita (Tulít'a), hereafter referred to as Tulita, and Norman Wells (Tłegóhł), hereafter referred to as Norman Wells, in the Sahtu Region of the Northwest Territories (NWT). The Project includes construction of new highway to connect existing and planned infrastructure such as the Canyon Creek All Season Access Road, Prohibition Creek Access Road, Great Bear River Bridge, and existing bridges along the Mackenzie Valley Winter Road (MVWR) to create a continuous, 321 km extension of Northwest Territories Highway #1.

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8.0 Summary of Key Lines of Inquiry

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The summary of the local social and economic considerations KLOI is guided by ToR Section 7.2.1 (MVEIRB, 2015), which identifies specific topics to be addressed in the assessment. Related to socio-economic conditions in affected communities, topics to be assessed, include but are not limited to:

- Drug and alcohol use and related social changes
- Public safety
- Changes in demand on and capacity of social and public infrastructure
- Employment and education needs and opportunities
- Maximizing local and Indigenous participation in employment and business opportunities

Five VCs were selected to assess the effects of the Project on the above socio-economic conditions outlined in the ToR. The detailed assessment of the effects of the Project on these VCs is provided in Chapter 9:

- Assessment of Potential Effects on Human Health and Community Wellness (Section 9.5)
- Assessment of Potential Effects on Education, Training and Skills (Section 9.6)
- Assessment of Potential Effects on Employment and Economy (Section 9.7)
- Assessment of Potential Effects on Infrastructure, Services and Institutional Capacity (Section 9.8)
- Assessment of Potential Effects on Non-traditional Land and Resource Use (Section 9.9)

The caribou, moose, and harvesting KLOI is guided by the ToR Section 7.2.2 (MVEIRB, 2015). The KLOI requires assessment of the effects on the Project on:

- Caribou and moose
- Other harvested resources
- Harvesting and harvesting areas

As these topics are interconnected, the assessment of the effects of the Project on several VCs contribute directly to the KLOI. The detailed assessment of the effects of the Project on these VCs is provided in the following chapters:

- Assessment of Potential Effects on Caribou and Moose (Chapter 10)
- Assessment of Potential Effects on Culture and Traditional Land Use, Including Harvesting (Chapter 11)
- Assessment of Potential Effects on Fish and Fish Habitat (Chapter 17)
- Assessment of Potential Effects on Vegetation and Wetlands (Chapter 18)
- Assessment of Potential Effects on Wildlife and Wildlife Habitat (Chapter 19)
- Assessment of Potential Effects on Birds and Bird Habitat (Chapter 20)

This summary chapter introduces the reader to the key findings of the assessment of the KLOIs. Detailed methodology and results following the assessment methods provided in Chapter 4 are presented in each of the chapters that follow.

8.2 Summary of Local Social and Economic Considerations Key Line of Inquiry

Engagement was conducted with representatives of Indigenous Governments, Indigenous Organizations and other affected parties (including Elders, youth, women), health care providers, educators, emergency service providers, leadership, and representatives from economic development and land corporations, in order to gather information and discuss potential socio-economic effects of the Project. Engagement provided opportunities to gather input on existing socio-economic conditions, share information about VCs, and gather feedback and information about potential project effects, including concerns about potential adverse effects and potential benefits of the Project.

The assessment concludes that the Project will lead to positive effects in the areas of human health and community wellness, employment and economy, and education, training and skills, provided that measures are put in place to maximize benefits and assist in community readiness.

There are also anticipated to be low magnitude residual adverse effects across all five of the VCs, even after mitigations are applied and with an adaptive management plan and monitoring framework in place. Most residual effects will not result in long-term adverse changes in socio-economic conditions and will not be significant. There are two exceptions. The assessment of effects of the Project on public safety and social pressures (which includes drug and alcohol use and misuse), indicate that the residual adverse effects will be significant, given the seriousness of the effects and how they exacerbate existing concerns and problems. When looking at how the Project might interact cumulatively with other projects and activities that are planned or reasonably foreseeable, it is predicted that most cumulative effects will be not significant, with the exception of public safety and social pressures, which are anticipated to be significant.

Overall, even though there are two residual adverse effects identified as significant, most of the residual adverse effects of the Project on the socio-economic environment are identified as not significant. The GNWT will develop and implement follow-up and monitoring activities, including the development of a well-being adaptive management plan, that will support the development of measures to address the adverse effects of the Project.

The sections below provide a summary of effects of the Project on the areas identified in the ToR as part of the local social and economic considerations key line of inquiry.

8.2.1 Assessment Areas

The assessment of potential effects of the Project on socio-economic VCs are not necessarily bound by or limited to a highly localized spatial location. Some potential effects of the Project are instead more appropriately determined at a community level or examined by the potential effects on certain segments of the population. Therefore, the spatial boundaries used to assess effects of the Project on socio-economic VCs, including residual and cumulative effects, includes communities within representative regions surrounding the Project.

- **Local Assessment Area (LAA):** The LAA is established to assess the potential direct, indirect and induced effects of the Project on the socio-economic environment for the communities to be directly connected by the Project. The LAA for socio-economic VCs consists of the communities of Wrigley, Tulita and Norman Wells.
- **Regional Assessment Area (RAA):** The RAA is established to assess the potential direct, indirect and induced effects of the Project on communities in the Sahtu Region that are outside of the LAA. The RAA includes the communities of Fort Simpson, Fort Good Hope, Délı̄ne and Colville Lake.

8.2.2 The Project Will Affect the Availability of Drugs and Alcohol

The potential effects of the Project on social pressures, which includes availability of drugs and alcohol will be significant. The Project is expected to exacerbate an already serious drug and alcohol problem that exists in the LAA and RAA communities. It is anticipated that mitigation measures will not be able to eliminate or manage the increasing adverse effects on social pressures related to alcohol and drug use on these communities.

Drug and alcohol abuse was identified during engagement as a serious issue requiring attention and action in both the LAA and RAA communities. During both the construction, and operations and maintenance phase, the Project is anticipated to potentially increase the presence of non-resident workers, visitors and tourists in communities. During operations, the all-season road access provided by the Project will provide opportunities for residents to leave communities and access drugs and alcohol. Interactions with non-residents may lead to increased social pressures in the form of increased access to drugs or alcohol, increased sexually transmitted infections (STIs), teen pregnancies, and increased crime rates. Increased drug and alcohol abuse is associated with increased violent crime and abuse and increased vulnerability of women and girls.

The all-season presence of the Project is anticipated to provide a low-cost and easier way for drugs and alcohol to enter communities and may result in an increase in 'harder drugs' such as methamphetamine and cocaine in communities.

Proposed mitigation measures for addressing effects of the Project on social pressures during both construction and operations and maintenance include commitments to develop and implement a Mackenzie Valley Highway (MVH) Well-Being and Adaptive Management Plan that includes measures to address the project's effects on community wellness and substance abuse and bootlegging. Even with these mitigations applied, there may still be a risk of increased access to

drugs and alcohol or interactions that lead to increased rates of STIs and teen pregnancies and incidents of drug and alcohol related crime. The effectiveness of mitigations related to the provision of health and wellness programming will be limited by both the uptake and by the response of individuals to the programming. It is not possible to be definitive that the development or expansion of health and wellness programming will influence the choices that individuals might make that would eliminate the risks associated with interactions with outsiders. Negative social pressures are likely to result from the Project even with the mitigations in place and will be significant.

8.2.3 The Project Will Affect Public Safety

The effects of the Project on public safety are predicted to be significant. Although some of the effects could be managed, it is not possible to reduce all adverse effects of the Project. The overall adverse effect is moderate, and moderate-to-high for vulnerable populations (which includes but is not limited to women and girls, Indigenous peoples, those identifying as two-spirit, lesbian, gay, bisexual, transgender, queer, questioning, intersex and additionally sexually and gender diverse people (2SLGBTQIA+), and sex workers.

During the construction, and operations and maintenance phases of the Project, the increased presence of non-residents in local communities, and the increased access to drugs and alcohol that result, may lead to increased rates of crime, violent crime and abuse which disproportionately affect vulnerable populations. This situation has the potential to decrease feelings of personal safety and decrease perceived/actual mental health.

Concerns have been raised about both increased access by and interactions with non-resident construction workers leading to disproportionately higher adverse effects on the safety of young women and girls and other vulnerable populations. The link between such risks and increased levels of drug and alcohol access and use have also been raised.

Once operational, the Project is expected to increase all-season traffic from local communities to other communities in the form of passenger, cargo and industrial/commercial vehicles. Concerns have been raised about the possibility of an increased number of traffic accidents that result in serious injury or death. Insufficient communications infrastructure and emergency and highway rescue services are a current concern on the MVWR and all roads and highways in the NWT and interviewees emphasized that current gaps in services need to be more fully met and the gaps in services to be addressed before any pressures associated with the operations of the Project may be added to community services. This will also lead to additional demand on or need for ground-based emergency response services, which residents highlighted as an area where gaps in services exist for the winter road that the Project is intended to replace.

There is potentially a positive effect of all-season access. Having all-season vehicle access available could reduce the risk of traffic accidents because residents and visitors could more easily schedule their travel to avoid poor conditions or times of heavy traffic, which is not always an option with the existing winter road.

Proposed mitigation measures for addressing effects of the Project on public safety during both construction, and operations and maintenance phases include commitments to develop and implement both a MVH Road Safety Plan and a MVH Safety and Security Plan for Vulnerable Community Members focused on issues of safety, as well as a commitment to develop and implement a MVH Well-Being and Adaptive Management Plan that includes measures to address the effects of the Project on community safety. However, none of these measures can eliminate the risk of increased effects on public safety that arise due to the Project, and the ability to mitigate or respond to incidents may be limited. It is anticipated that significant residual effects on public safety will arise, particularly on women and girls and other vulnerable populations due to the Project even with the identified mitigations in place.

8.2.4 The Project is Likely to Result in Changes in Demands for Social Infrastructure and Services

The effects of the Project on changes in demands for social infrastructure and services (including, policing and crime, health services, and social services) during all phases are expected to be adverse, of low magnitude, irregular in frequency and reversible, and not significant.

During the construction phase, it is expected that there will be an increased demand for health services and emergency services in LAA communities due to construction worker injuries and illness that cannot be treated by worker camp medics. This demand will be minor as serious or traumatic injuries will be flown to Yellowknife for treatment. For workers who are injured or fall ill far from a community, there is a concern, as there is neither equipment nor a mandate for LAA community fire services to come to their aid. If any fires occur in the local area that involve flammable or building materials, it will be necessary for fire responders to be aware of what they are dealing with and trained to deal with these materials ahead of time.

The presence of non-resident construction workers can be expected to increase demand for the protective services provided by the RCMP detachments. This may be a concern for the community of Wrigley which does not have its own detachment but is served by Fort Simpson. No project construction-influenced changes in demand for emergency and protective services in the RAA communities are expected, due to the absence of construction workers in these communities.

During the operations and maintenance phase, the increase in number and severity of traffic accidents and traumatic injuries along the Project will result in increased demand on emergency, health and protection services. The Project may provide increased access to drugs and alcohol both due to local residents being able to leave their communities year-round, and as a result of non-residents being able to visit the community during most of the year. It is also expected that this will result in increased demand on health services and protection services to deal with crimes and incidents associated with the availability of drugs and alcohol.

Proposed mitigation measures for addressing effects of the Project on social infrastructure and services during both construction and operations and maintenance include commitments to develop and implement both a MVH Road Safety Plan and a MVH Safety and Security Plan for Vulnerable Community Members focused on issues of safety that are intended to address adverse

safety effects that could contribute to increased demand on social infrastructure and services, as well as a MVH Well-Being and Adaptive Management Plan that includes measures to address the Project's effects on community services.

Even with mitigation, the number of accidents during construction and traffic accidents, may increase in LAA communities during operations and maintenance and may increase pressure on emergency services, protection services, and health services in these communities. The increase in local community access to alcohol and drugs during both construction and operations and maintenance will result in increased demand on protection services to deal with crimes and incidents associated with the consumption of drugs and alcohol and increased demand in health counselling and facility-based treatment services.

8.2.5 The Project Will Minimally Affect Public Physical Infrastructure

The effects of the Project on public physical infrastructure such as existing roads, water sources, quarries and quarry materials, and waste management facilities are predicted to be adverse, of low magnitude, reversible, and not significant.

During the construction phase, it is expected that there will be an increased demand for public infrastructure (potable water, disposal of wastewater and solid wastes) in local communities due to construction camps and that in a small community such as Wrigley, this may have an adverse effect on community's infrastructure capacity.

While two dedicated project construction camps will be established that will supply their own heating and power for lighting and equipment, the construction camps will make use of municipal services related to drinking water and disposal of sewage and various kinds of waste, for those facilities in Wrigley, Tulita or Norman Wells that agree to accept project sewage and/or waste.

The location and duration of public infrastructure disruptions will be determined only after a construction schedule and agreements with communities are finalized. Any disruptions to the provision of public utilities to communities during the construction phase will be temporary and will be confined to the local communities. Regional communities will not be affected due to their distance from construction activities.

To mitigate the demands on public infrastructure, the GNWT will obtain approval and agreement from the Town of Norman Wells, the Hamlet of Tulita and the community of Wrigley to use their community water supplies, their sewage lagoon and solid waste disposal facilities. The Draft Waste Management Plan for the Project commits contractors to ensure that contaminated soils or liquid residue will be placed in drums and removed by a registered hazardous waste carrier to an approved facility. No residual effects on public infrastructure are anticipated during construction or operations and maintenance phases of the Project. No mitigation measures are required during operations and maintenance, as public infrastructure in local and regional communities will not be used for activities associated with project maintenance.

8.2.6 The Project Will Have Largely Positive Effects on Employment and the Economy

The ToR describes a number of potential effects of the Project on employment and economic opportunities that are to be assessed, including direct and indirect employment opportunities, maximizing of local and Indigenous employment and businesses, effects on capacity of local businesses, cost of living and consumer prices, changes to the traditional economy and the Project's contribution to the gross domestic product (GDP).

The Project is anticipated to have a number of positive effects on employment and economic opportunities, including contributions to the GNWT's GDP. The adverse effects are considered to be not significant.

8.2.6.1 The Project Will Positively Affect Local Employment and GDP and There Will Be Measures to Maximize Local and Indigenous¹ Employment

The construction of the Project will result in three types of employment: direct, indirect and induced. Construction planning has not advanced to the stage where firm employment opportunities or schedules are available, but a general estimate has been determined.

The Project is expected to require 10 years of construction activity that would take place over a time frame of up to 20 years. A summary of expected employment and income impacts arising in the NWT from construction (all years combined) are presented in the table below.

Table 8.1 Effects of Project Construction on NWT Employment and Income

	Direct	Indirect	Induced	Total
Employment (FTE)	2,500	1,050	503	4,053
Wages and Salaries	\$343,868,534	\$83,766,472	\$51,146,977	\$478,781,983
Benefits	\$24,070,797	\$6,031,186	\$3,682,582	\$33,784,566

It is anticipated that 50% of the 200-330 person contractor workforce will be from local Sahtu and Dehcho communities and elsewhere in the NWT, with the remainder of the workforce from outside the NWT. The Project Description (Chapter 5) assumes that 100 individuals will be hired from the labour pool in Sahtu and Dehcho regions that are able to willing to work rotational shift work. Project construction would generate approximately 3,550 person-years of direct and indirect employment in the NWT over the course of the full construction period, translating into approximately \$42.7 million in annual labour income. These positive effects are somewhat offset by the loss of economic activity associated with the construction and maintenance of winter roads replaced by the Project, but the overall effects are anticipated to be net positive.

¹ The ToR, published in 2015, makes reference to maximizing Aboriginal employment. Given the changes in generally accepted terminology from 'Aboriginal' to 'Indigenous', the term Indigenous is used in this summary and in Chapter 9 to replace the term 'Aboriginal'.

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Project construction will contribute positively to the NWT GDP and to government revenues from taxation. Employment income generated by direct and indirect project construction will be taxed, as will incomes earned by businesses directly supporting project construction, which will result in increased government revenues. Increased government revenues associated with the Project may offset some of the costs associated with mitigating the Project's potential adverse effects and enhancing benefits to communities.

The Project is estimated to have a combined direct and indirect territorial GDP effect of over \$650 million during the construction period and generate \$48 million in additional revenue for GNWT, and \$78 million in additional federal revenue.

Community members suggested that existing businesses and contractors were well positioned to support project construction and noted that the skills/experience gained by local residents could be applied to future employment (e.g., mine construction). There are concerns, however, that Southerners may be hired for jobs instead of LAA and RAA community members because of lack of education and training within the working-age community population and/or hiring practices that do not prioritize the local labour pool. It is also assumed that mostly Tulita and Norman Wells will benefit from construction-related employment.

Once the Project is completed, it will be necessary to employ workers to carry out its maintenance on an ongoing basis. Only a basic estimate of direct jobs required for operations and maintenance has been developed that include an estimated total of 21 to 27 positions in the summer and 12 to 15 positions in the winter, for an overall total of 33 to 42 positions. Once the Project is completed, there will be ongoing impacts on GDP and government revenues arising from expenditures on project maintenance. The Project is estimated to have a combined direct and indirect annual effect on Territorial GDP effect of over \$2.6 million annually and generate \$285,000 in additional revenue for GNWT, and \$291,000 in additional federal revenue each year.

While the effect of the Project on employment, income and GDP is anticipated to be positive, to enhance the positive effects for LAA and to a lesser extent, RAA communities, the GNWT will develop and implement a MVH Contractor Training and Employment Plan that includes measures that will support local hiring and businesses, and work collaboratively with communities to leverage existing programs and services to ensure that communities are prepared to take advantage of employment and business opportunities. It also includes measures that require contractors to demonstrate how both local and Indigenous labour and businesses will be sourced and how local and Indigenous people are being trained.

8.2.7 The Project Will Have Several Positive Effects and Minimal Adverse Effects on Local Businesses

The Project's adverse effects on economic opportunities and capacity of local businesses are considered to be not significant.

Construction of the Project will provide opportunities for businesses to obtain contracts to support project construction. Community members identified that there are a significant number of existing businesses and contractors in their communities that are well positioned to support both the construction and operations and maintenance phase. Overall, it is expected that the construction of the Project will have positive effects on economic development and local business opportunities.

Project operations could change the nature or viability of some existing local businesses. Community members suggested that easier and less costly all-season access could improve conditions for existing businesses. Project operations would likely also change the demand for air services currently flying in and out of communities due to all-season road access as a result of the Project.

Project operations could also change the viability for new local businesses or for business expansion. Community members suggested that there is potential for growth in almost every sector of the economy, including: adventure tourism, eco-tourism, hunting/fishing outfitting, traditional arts and crafts, conservation economy (i.e., Biosphere Reserve), oil and gas development, waste management, remediation services, and country foods processing.

While the effect of the Project on economic opportunities and business capacity is anticipated to be positive, to enhance the positive effects for LAA and to a lesser extent, RAA communities, the GNWT will develop and implement a MVH Contractor Training and Employment Plan that includes measures that will support local hiring and businesses, and work collaboratively with communities to leverage existing programs and services to ensure that communities are prepared to take advantage of employment and business opportunities. It will also include specific measures related to supporting communities to develop tourism plans to ensure that community infrastructure and businesses are prepared for increased numbers of visitors and tourists to their communities.

8.2.8 The Project Will Have an Overall Positive Effect on the Cost of Living

The Project is anticipated to have an overall positive effect on the cost of living.

The construction phase of the Project is not anticipated to result in any effect related to the cost of shipping goods to communities in the local and regional area.

Once operational, the Project is expected to contribute to a reduction in the cost of shipping goods to local communities that are connected to the all-season road. Lower prices will result in residents being able to buy more goods with the same amount of income, thereby effectively increasing their standard of living. The Project would reduce prices for many goods and services increase the variety of goods and services available to community residents and make them available all-season. Community members were unsure whether overall prices will actually reduce – or reduce

noticeably – once the Project is operational. Also, members of several communities believed that the Project would enable Norman Wells to be a staging area for supplies and goods in the region, which could result in costs savings for communities in the LAA as well as potentially some communities in the RAA.

As the effect of the Project on the cost of living is expected to be neutral to positive, no mitigation activities are proposed.

8.2.9 The Project Will Have Minimal Effects on Harvesting and the Traditional Economy

The residual adverse effects of the Project on the traditional economy are predicted to be not significant.

The traditional economy plays an important role in the economic well-being of residents of local and regional communities. Project construction could change the time available for participation in the traditional economy as construction employment may require local workers to be away from their home community for extended periods, potentially impacting their time available to participate in traditional hunting, fishing, and trapping activities. This in turn could increase reliance on store-bought foods and could potentially impact food security for those more reliant on country foods such as Elders. Project operation is not expected to result in a change in the time available for workers to participate in traditional harvesting or fishing activities, relative to any other form of wage employment.

Construction activities and operations of the Project may disturb the land, which may result in areas temporarily or permanently being unavailable as a source of traditional foods and harvesting, leading to a reduction in the ability to harvest traditional foods (e.g., fish, caribou and moose, vegetation, birds).

The operation of the Project may increase access to harvesting and trapping areas that were previously more difficult to access. However, community members also noted there is some concern among residents about increased numbers of non-residents accessing the area for recreational hunting, as it may lead to adverse effects on wildlife. Increased competition for wildlife could in turn reduce the availability of traditional foods for community consumption and increase reliance on store-bought foods to supplement diets.

Use of a rotational schedule during project construction may help community members have adequate time between construction shifts to continue to participate in traditional activities, such as hunting, fishing, trapping, and preparing country food. The MVH Contractor Training and Employment Plan includes a measure to support cultural awareness and anti-racism training to mitigate the potential adverse effects associated with the presence of non-resident workers. The GNWT has also committed to verify a community based cultural awareness and anti-racism training is part of the MVH Contractor Training and Employment Plan for non-NWT and non-Indigenous workers, which would support employers and contractors in setting employment conditions and terms (such as rotational shifts) that would help community members have adequate time to continue to participate in traditional activities.

Additionally, the GNWT will develop and implement a Wildlife Management and Monitoring Plan (WMMP) that includes measures that are intended to monitor and manage the effects of the Project of wildlife during project activities to mitigate adverse effects. This in turn will help address adverse effects of the Project on access to and availability of traditional foods.

8.2.10 The Project Will Have Mostly Positive Effects on Education, Training, and Skills

The effects of the Project on the levels of and access to education, training and skills are anticipated to be positive.

The Project is anticipated to have an adverse effect on the capacity of local educational institutions to meet the demand for education and skills training, but the residual effect is anticipated to be not significant.

8.2.10.1 Education, Certification and Training Levels and Access to Education and Training Programs

The effects of the Project on access to education and training programs and the effect on education levels is predicted to be positive. It may be possible for the Project to result in a moderate increase in education levels in the communities directly affected by the Project.

It is anticipated that the Project may result in positive changes in the educational levels of the community members most directly affected by the Project (i.e., those in the communities of Norman Wells, Tulita, and Wrigley). This is a result of the Project's numerous employment opportunities, notably in the trades, especially during the construction phase, but also in the long term, during the on-going operations and maintenance phase. The Project is expected to generate increased interest in completing high school and pursuing additional training (e.g., heavy equipment operators [HEO], pre-trades, safety [e.g., transportation of dangerous goods, chainsaw safety]) as community members look to take advantage of employment opportunities. Community members from Norman Wells and Tulita commented on the need for upgrading since many people with a high school diploma will not be able to pass the trades entrance exam.

As communities are connected to an all-season road that connects to Yellowknife during construction and into the operations phase, educational levels may also be positively affected as community members have all-season access to education and training programs in Yellowknife. The distance of the three communities to Yellowknife is large, and so it is not expected that community members would regularly travel to Yellowknife via the Project to access education, certification, and training.

The effects of the Project on education, training and skill levels and access to education and skills training programs are anticipated to be positive and so no mitigation is required.

8.2.10.2 There Will be Changes in Demand for Education, Certification and Training Programs

The effects of the Project on change in capacity to meet demand for education and training programs are considered not significant. They are predicted to be neutral, have no measurable change, and are irregular in frequency. The Project may have a moderately adverse effect on the capacity of Community Learning Centres (CLCs) to meet demand for programming.

The increased interest in pursuing training, most notably during the construction phase, may strain the capacity of Aurora College CLCs in the local area and they may struggle to meet the demand for educational programming and training. The CLCs may lack the space and number of instructors needed to address the demand for training, and also lack the expertise and specialized infrastructure required to provide trades training. Given this, it may not be possible to provide all required training locally within the three communities of Norman Wells, Tulita, and Wrigley. Once the Project is operational, it would potentially be easier to attract educators (elementary, secondary and post-secondary) to the LAA communities because they could drive in and out.

To mitigate the adverse effects associated with increased demand, the GNWT will develop and implement a MVH Contractor Training and Employment Plan that includes measures that will identify and support local education and training needs, and work collaboratively with communities to leverage existing programs and services to ensure that community members have the needed supports to access and obtain desired education and training programs that will prepare them for employment opportunities provided or facilitated by the Project.

8.3 Summary of Caribou, Moose and Harvesting Key Line of Inquiry

The assessment concludes that, with implementation of mitigation measures, the effects of the Project on caribou and moose due to change in movement, change in mortality risk and change in health will be not significant. The effects of the Project on caribou (specifically boreal caribou) due to change in habitat will be significant, because they add to existing disturbance in the assessment area that already exceeds a conservation threshold. Effects on other wildlife and bird harvested species will be not significant. For harvesting and land use, the Project will provide all-season access to areas previously only accessible in winter. This is likely to facilitate hunting, fishing, plant gathering, and access to cultural resources. This may increase harvest pressure on certain species, but increased access may also be seen as beneficial. This increased access may lead to overfishing, which could lead to a significant effect if not managed properly. The Project may result in a local loss of harvest or other traditional use sites, or the value of these sites, but will not result in the long-term loss of availability of traditional resources for cultural use or access to traditional resources or areas. Effects of the Project on harvesting, as an aspect of cultural use will be not significant.

8.3.1 Assessment Areas

The assessment of effects on caribou, moose, and harvesting is relative to four areas:

- The area of direct Project disturbance (such as clearing) is the Project Development Area (PDA).
- The Local Assessment Area (LAA) is the area within 1 km of the proposed highway alignment and 2 km of proposed borrow and quarry sources. The size of the LAA is based on measurable effects on most traditionally harvested species.
- The Caribou and Moose LAA is the area within 15 km of the proposed highway alignment and proposed borrow and quarry sources used in the assessment of potential effects on caribou and moose in Chapter 10. The Caribou and Moose LAA equals the Regional Assessment Area (RAA).
- The RAA is the area within 15 km of the highway alignment and proposed borrow and quarry sources that is used to capture a wide range of cultural resources that could potentially be affected cumulatively by the Project and other past, present, and reasonably foreseeable projects.

Additional information on how these areas were selected are provided within each chapter of the assessment.

8.3.2 The Project Will Reduce Boreal Caribou Habitat

Caribou of the boreal ecotype of woodland caribou (*Rangifer tarandus caribou*; hereafter referred to as boreal caribou) are designated as threatened under Schedule 1 of the federal *Species at Risk Act* and the territorial *Species at Risk (NWT) Act*. Based on GNWT collar data, boreal caribou are year-round inhabitants of the Caribou and Moose LAA. As summarized in Section 10.4.2, the Project will result in 0.03% reduction of selected boreal caribou habitat, and a combined direct and indirect loss of 0.15% of habitat in the Caribou and Moose LAA.

Environment and Climate Change Canada (ECCC) defines critical habitat for boreal caribou as the habitat that is necessary to maintain or recover self-sustaining local populations throughout their distribution. Based on the federal recovery strategy for boreal caribou, boreal caribou require at least 65% undisturbed habitat within their range to have a 60% probability of maintaining a self-sustaining population (ECCC, 2020). From a disturbance perspective, there is a pre-existing significant effect within the Caribou and Moose LAA. Within the Caribou and Moose LAA there is a combined fire and anthropogenic disturbance of 52.2%. At a broader perspective (that is likely more biologically relevant to the entire boreal caribou population in the NT1 range), 31% of the total range of the NWT boreal caribou population is disturbed (69% is undisturbed) and the current range conditions are described by ECCC as being sufficient to support a self-sustaining population.

An important life requisite for boreal caribou is winter habitat. Winter habitat consists of open coniferous forest and abundant lichen in areas where snow is shallow and soft. Boreal caribou have been found to avoid areas of human disturbance, with some exceptions and, generally, show a higher use of burned areas that are less than 10 years old or more than 30 years old.

Based on a Resource Selection Function habitat modelling study conducted across the NT1 boreal caribou range (ENR, 2020), 31.9% of the Caribou and Moose LAA is considered selected boreal caribou habitat.

Wildfire is the main source of boreal caribou habitat disturbance in the NWT (DeMars et al., 2020); however, human disturbances also contribute to habitat loss and alteration. The Project could result in a direct loss of boreal caribou habitat through vegetation clearing and could indirectly change habitat suitability through edge effects, habitat fragmentation, and sensory disturbances associated with blasting, construction, and vehicle use of the highway and access roads, such as noise and dust deposition.

The Project will reduce effects on boreal caribou habitat by using previously disturbed areas as much as possible and limiting areas of new clearing. Dust will be controlled by using methods to reduce dust during construction, blasting, and highway operations and maintenance. The effects of noise will be mitigated by reducing construction and blasting activities during sensitive periods for caribou and applying setback distances when caribou are present, in accordance with the Wildlife Management and Monitoring Plan (WMMP).

After applying these mitigation measures and others in the WMMP, the Project will result in a relatively small amount of direct and indirect habitat loss within the Caribou and Moose LAA compared to existing baseline conditions. The residual effect of change in boreal caribou habitat, following the application of avoidance and mitigation measures, is not expected to threaten the long-term persistence or viability of boreal caribou populations in the study area, but since it will contribute to a pre-existing exceedance of a conservation threshold, this effect will be significant.

8.3.3 The Project Does Not Overlap with Current, but Overlaps with the Historical, Barren-ground Caribou Range

Barren-ground caribou (*Rangifer tarandus groenlandicus*) are designated as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) but are not currently listed under Schedule 1 of the federal *Species at Risk Act* (SARA; Government of Canada, 2019). In the NWT, barren-ground caribou are listed as threatened under the territorial *Species at Risk (NWT) Act* (CMA, 2020). The current range of the Bluenose-East herd of barren-ground caribou includes parts of the eastern NWT and Nunavut (SARC, 2017).

While the broadest annual range (based on all historical data) overlaps with the eastern portion of the Caribou and Moose LAA, the current range (based on 2012-2022 collar data) does not overlap with the Caribou and Moose LAA. Barren-ground caribou were excluded from the residual effects assessment of direct effects because of no direct interaction with the Project. The indirect effects of the Project on barren-ground caribou from stressors such as increased access have been assessed,

and consider the future possibility of range expansion where there might be a greater overlap with the Project.

8.3.4 There Will be Marginal Changes to Moose Habitat

Moose are found year-round in river valleys, along the shores of lakes and in areas that are revegetating after forest fire. Traditional Knowledge identifies moose pastures within the PDA and Caribou and Moose LAA and calving areas on certain islands with high willow growth within the Mackenzie River (Deh Cho). Across the NWT, moose are most common along the Mackenzie River (Deh Cho) (within the caribou and moose LAA), where they use early successional habitats along the Mackenzie River (Deh Cho) and its islands and shores.

The Caribou and Moose LAA overlaps with three Important Wildlife Areas (IWAs) for moose (Wilson and Haas, 2012). The Sahtu Rivers IWA includes riparian areas along the Mackenzie River (Deh Cho) and its tributaries, including islands in the Mackenzie River (Deh Cho). Three Day Lake IWA, located southwest of Norman Wells, is used by moose in summer and fall and is known for having some of the highest moose densities in the Sahtu Region. The Dehcho Winter Use IWA is an area of high moose densities in the winter. These IWAs are highly suitable moose habitat and are therefore considered particularly important to moose.

The Project could result in a direct loss of moose habitat through vegetation clearing and change moose habitat suitability through edge effects, habitat fragmentation, and sensory disturbances associated with blasting, construction, and vehicle use of the highway and access roads, such as noise and dust deposition.

The Project will reduce effects on moose habitat by avoiding known moose pastures where possible, using previously disturbed areas as much as possible, limiting areas of new clearing, and maintaining vegetation and riparian buffers. Other mitigation measures are detailed in the WMMP.

After applying these mitigation measures and others in the WMMP, the Project will result in 0.2% direct loss of suitable moose habitat in the Caribou and Moose LAA compared to existing baseline conditions. There will be some indirect habitat loss through sensory disturbance from construction activities and vehicle traffic. Using a zone of influence (ZOI) buffer of 250 m, indirect habitat loss for moose is estimated to be < 2% of the Caribou and Moose LAA. Notably, this value includes areas of existing human disturbances in the Caribou and Moose LAA and PDA, which have been observed to be used by moose during their lifecycle. The existing MVWR is already contributing to indirect habitat changes. The residual effect of change in habitat on moose is unlikely to alter the population viability or persistence of moose within the study area following the application of avoidance and mitigation measures.

8.3.5 The Highway Could be a Barrier to Boreal Caribou Movement

The ability to move between patches of suitable habitat is important for the persistence of boreal caribou. Human-caused disturbances, such as roads, may present real (physical) or perceived (sensory) barriers that may alter movements between patches of suitable habitat and access to resources such as food and cover.

The existing MVWR, which includes a cleared ROW, plowed roadway, and vehicle traffic in winter is an existing human disturbance. Available GNWT collar data indicate the presence of boreal caribou in certain parts of the PDA in all seasons (Appendix 10A, Section 3.2.2.1), suggesting the possibility that crossings may have occurred; however, it is not certain if the current MVWR acts as a barrier to their movements. A concurrent study on the movement of boreal caribou is being conducted. The objective of the work is to evaluate local movement patterns by assessing the potential effects of the MVWR on the movement of boreal caribou, including investigating whether the winter road is a filter or barrier to movement. Habitat selection models will be developed that account for movement parameters (step lengths and turn angles) to infer seasonal movement patterns of boreal caribou in the region. The supplemental information will be available in late fall 2023.

The project design incorporates the existing MVWR ROW into the route of the highway to the extent possible, but widening the ROW to 60 metres (m) and building a road embankment may increase the potential barrier effect. To mitigate potential barriers from sensory disturbances, project activities will cease when caribou are within 0.5 km and other restrictions will apply during specific times of the year, as specified in the WMMP.

The anticipated year-round construction and operation in the PDA may make the PDA more difficult to cross compared to the current road that has winter traffic only. Once constructed, traffic on the completed highway is expected to be approximately 50 vehicles per day, which is the same as the current winter traffic but will occur all-season. While the Project may cause changes to boreal caribou movements within the Caribou and Moose LAA, it is not expected that there will be a measurable change in their distribution and/or abundance in the Caribou and Moose LAA.

8.3.6 The Project May Change Moose Movements, Which is Not Predicted to Affect Their Distribution

Project activities such as construction and establishment and use of an all-season highway could potentially change moose movement patterns and movement corridors through habitat changes and sensory disturbances. Available location data suggests that the MVWR may not currently act as a barrier to movement of moose. Widening the ROW to 60 m and building a road embankment may reduce the ability of moose to move through the PDA. The WMMP includes mitigation measures to reduce effects on moose movements, including mitigation measures to reduce habitat loss, alteration, and sensory disturbances during construction and operations.

While alteration of moose movement patterns and potential movement corridors may occur within the Caribou and Moose LAA, project-related changes in moose movement are not expected to result in a measurable change in their distribution and/or abundance in the study area.

8.3.7 The Risk of Caribou and Moose Mortality from Vehicle Collisions is Expected to be Low

The potential presence of caribou (boreal and barren-ground) and moose on the highway and on roads with less frequent vehicle use, such as quarry access roads, presents potential for vehicle collisions causing mortality of caribou and moose. Despite this, there have been no documented instances of collisions with caribou on existing highways in the Sahtu Region. Documented vehicle collisions with moose on existing highways in the Dehcho Region between 2011 and 2019 indicate less than one collision per year. Project highway traffic volume will be similar or less than traffic on existing NWT highways.

Specific mitigation measures to reduce risk of mortality from collisions include reducing project construction activities when caribou and moose are in the area, where possible; reducing speeds of project vehicles; and allowing wildlife passage on project roads. Other mitigation measures, such as implementing vegetation control in the ROW, will improve visibility for drivers and reduce the potential for moose to forage on the ROW. The risk of caribou and moose mortality from collisions is expected to be low.

8.3.8 The Project May Facilitate Caribou Harvesting

A number of caribou harvesting areas relative to the Project have been identified by Indigenous Governments, Indigenous Organizations, and other affected parties through engagement. Portions of the Caribou and Moose LAA that may have been previously inaccessible for harvesting, or only accessible during winter, may become accessible for most of the year as construction of the Project advances. For example, while most proposed quarries and borrow sources are within 1 km of the highway alignment, new access roads will be constructed to create access to several quarries which are more than 1 km from the alignment (9.025B and 9.019 in the Dehcho Region and 8.039 and 7.083 in the Sahtu Region). Additionally, the highway itself will facilitate all-season access to areas that have only been accessible in winter by the MVWR and in summer by boat on the Mackenzie River (Deh Cho).

All-season access will facilitate harvesting of boreal caribou by Indigenous and resident hunters and may facilitate harvest of barren-ground caribou by Indigenous harvesters and General Licence Holders. Indigenous Governments, Indigenous Organizations, and other affected parties have reported that both boreal and barren-ground caribou are culturally important species, with Sahtu Dene and Métis conducting communal hunts during the fall migration. Harvest of barren-ground caribou is currently closed to non-resident hunters and resident harvest is limited. Survey programs, currently conducted by the GNWT Department of Environment and Climate Change (GNWT-ECC), will continue to collect ongoing information on distribution, abundance, and population trends of caribou, subject to periodic assessments and adjustments. The WMMP will be designed to determine if the highway is resulting in a pattern or level of harvest mortality for caribou that would suggest a conservation concern or need for additional harvest management actions.

8.3.9 The Project May Facilitate Moose Harvesting

Moose are an important subsistence harvest species in the Dehcho and Sahtu regions, with annual reported harvest in the Mackenzie Valley about 30 moose, or 6% of the population in the studied region. Through early project engagement, approximately 14 moose harvesting areas were identified by Indigenous Governments, Indigenous Organizations, and other affected parties relative to the Project. Harvest is generally higher where access is available, such as near communities, roads, and waterbodies. Resident moose harvest is monitored through the NWT Resident Hunter Harvest Survey. Non-residents are required to report on their moose harvest. Hunting in the Sahtu Settlement Area is subject to terms and conditions in accordance with the Sahtu Dene and Métis Comprehensive Land Claim Agreement. Non-participants must ask for and receive permission to access and hunt on Sahtu Settlement Lands (private lands).

Portions of the Caribou and Moose LAA that may have been previously inaccessible, or only accessible during winter, may become accessible to harvesters year-round as construction of the Project advances. Survey programs, currently conducted by the GNWT-ECC, will continue to collect ongoing information on distribution, abundance, and population trends of moose, subject to periodic assessments and adjustments. The WMMP will be designed to determine if the highway is resulting in a pattern or level of harvest mortality for moose that would suggest a conservation concern or need for additional harvest management actions. The responsibility for wildlife management, including harvest management, is shared between governments, users and renewable resources board set up under land claim agreements like the Sahtú Renewable Resources Board.

8.3.10 Change in Mortality Risk to Caribou and Moose from Harvesting and Predator Access Will be Within Current Harvest Limits or the Range of Natural Variability

For caribou and moose, harvest is presumed to be additive to natural and predator mortality and may accelerate a decline and hinder recovery efforts. The Project may facilitate predation (through creating improved and all-season access that may be used by predators) and increase competition for habitat by other species (such as deer) through vegetation clearing. Wolves are the primary predator of boreal caribou in the Dehcho Region (Larter et al., 2019), and a study of moose mortality conducted near Norman Wells (Stenhouse et al., 1995) found that wolf predation was a key source of mortality.

Females and calves of boreal caribou and moose disperse to avoid predators during the calving and post-calving seasons and winter seasons are critical to population sustainability. New disturbances can facilitate predation by wolves and might attract other prey species more tolerant of disturbances (e.g., moose), which indirectly increase predation pressure on caribou. To mitigate the risk of increased predation, the Project will limit areas of new clearing and reclaim areas when no longer needed. By applying these mitigation measures and others in the WMMP it is anticipated that any change in mortality risk on caribou and moose due to increased harvest pressure and predation is expected to remain within current harvest limits or the natural range of variability.

8.3.11 The Project is Not Expected to Cause Changes to Caribou and Moose Health

Boreal caribou in the Dehcho Region appear to be in good health, though baseline information on contaminants is not available. Moose are in good to excellent condition, though elevated levels of cadmium have been found in kidneys of moose harvested in the Mackenzie Mountains west of the Caribou and Moose LAA. Construction, and operations and maintenance of the Project could affect boreal caribou and moose health through exposure to potential contaminants or emissions as part of regular activities or in the case of an accidental spill.

Mitigation measures such as limiting areas of new clearing, implementing dust control measures, storing equipment and fuel away from water, and implementing a Spill Contingency Plan (SCP) will reduce potential for contaminants to affect caribou and moose. Best practices for reducing emissions, such as regular maintenance of equipment and operating incinerators in accordance with manufacturer's specifications, will reduce potential for emissions. By implementing these and other measures in the WMMP, caribou and moose health is expected to remain within the natural range of variability.

Indirect stressors, such as project-related sensory disturbance (for example, noise and human presence), increased predation, and increased hunting pressure could affect boreal caribou and moose health, including changes in energetics and physical condition if they change behavior or movements. Sensory disturbance may result in increased stress in animals and increased susceptibility to parasites and diseases and/or altered energetics. Based on collar information and moose surveys, boreal caribou and moose have been recorded near the MVWR during all seasons, including during its operation in winter. These observations suggest that the MVWR is not a complete barrier to moose and caribou movements, however, it's possible that there has been a reduction in movement compared to the habitat prior to the MVWR.

While effects on caribou and moose health may occur from exposure to potential contaminants and sensory disturbance, it is anticipated that changes in caribou and moose health will remain within the natural range of variability.

8.3.12 The Project Will Facilitate Access to Cultural Use Sites and Areas

In this assessment, cultural and traditional land use are referred to as 'cultural use,' which is understood to encompass various traditional activities, practices, sites, areas, and resources of Indigenous peoples. Cultural use sites and areas identified by Indigenous Governments, Indigenous Organizations, and other affected parties within the RAA include sites and areas of historical interest or use, hunting areas, fishing areas, medicinal plant locations, trapping areas, ceremonial sites, areas of cultural or spiritual importance, habitation sites (including cabins), and current use areas. Cultural use also encompasses conditions of use, seasonal cycles, inter-generational knowledge transmission, landforms and named places, and other factors that provide context, setting, or understanding for the practice of cultural use activities at these sites.

Cultural and spiritual sites have been identified within the RAA by Indigenous Governments, Indigenous Organizations, and other affected parties and these include habitation sites (such as cabins), some of which are located within 1 km of the Project (the LAA). Archaeological sites have been identified within the RAA, with highest densities of sites near the confluence of major creeks with the Mackenzie River (Deh Cho) and other specific areas such as Bear Rock (Petınıꞑah) and the Pehdzéh Kì N'deh area.

The Project will facilitate all-season access to sites and areas that may have only been accessible during part of the year using the MVWR in winter or waterways in the summer. This may be beneficial to cultural use or may result in a loss or decrease the cultural value of these sites. Where concerns about adverse effects have been noted through engagement, the GNWT has identified design options to avoid culturally sensitive or important areas, such as Bear Rock (Petınıꞑah) and a moose pasture north of Mount Gaudet.

The principal mitigation to avoiding effects on cultural resources is to follow the MVWR, which is an existing disturbance, as much as possible; however, with the additional widening of the ROW, some sites or portions of traditional trails within the PDA may be permanently lost. It is anticipated that sites or areas for cultural use outside areas of direct physical disturbance (the PDA) would remain largely unchanged.

Additional engagement with affected landowners and land users will continue during project design to obtain more information about the location, frequency, and nature of use of cultural use sites. Additionally, archaeological impact assessments will be completed in areas with high archaeological potential and mitigation measures such as avoidance will be implemented in accordance with the Sahtu Land Use Plan and guidance provided by the Prince of Wales Northern Heritage Centre.

The Project will not result in the long-term loss of availability of traditional resources for cultural use or access to traditional resources or areas to an extent that cultural use would be critically reduced or eliminated.

8.3.13 The Project Will Change the Availability of Harvested Resources

Aside from caribou and moose, the Project has the potential to change the availability of other harvested resources such as fish, plants, birds, and other mammals. Through direct habitat loss from vegetation clearing and indirect habitat loss from edge effects, sensory disturbance, and dust, there will be changes to harvested wildlife and bird resources on and adjacent to the PDA where the effects of dust and sensory disturbance may be measurable. To mitigate these effects, the Project will use previously disturbed areas as much as possible and limit areas of new clearing. Dust will be controlled by using methods to reduce dust during construction, blasting, and highway operations and maintenance. The effects of noise will be mitigated by reducing construction and blasting activities during sensitive periods for wildlife and applying setback distances from wildlife and wildlife features, in accordance with the WMMP.

Through clearing activities and edge effects, the abundance and distribution of harvested plants may change. This is not anticipated to affect current harvesting because most areas of the PDA are currently not easily accessible in the summer when plants are present. The Project will create new summer access to areas, which will create new harvesting opportunities. To mitigate effects on rare plants that may also be harvestable traditional plants, a rare plant survey will be completed before construction.

8.3.14 The Project will Facilitate Access to Harvested Resources

The Project will facilitate all-season access to resources and areas that are currently accessible only in the winter using the MVWR, or in the summer using waterways. This will generally have a greater effect on resources harvested in the summer, such as fish and birds, because resources harvested in the winter are already able to be accessed using the MVWR. Indigenous Governments, Indigenous Organizations, and other affected parties have indicated that by increasing access for both Indigenous and public users, the Project may result in both adverse and positive effects.

The Project may increase harvesting pressure on traditional resources by permitting greater access for non-local hunters and fishers. Increased summer access could lead to increased fishing pressure, which could result in reduced stock levels. Arctic grayling is the most common large-bodied fish found in watercourses crossed by the project highway alignment and the most likely to be affected by an increase in fishing pressure. To mitigate effects of fishing pressure, project workers will be prevented from harvesting while staying at work camps and the GNWT will avoid constructing pullouts near larger watercourses.

There is uncertainty in population numbers of large-bodied fish in the LAA; therefore, the level of increased fishing pressure that a population can withstand and remain sustainable is also unknown. The degree of increased fishing pressure that may occur along the project highway alignment is also unknown. Owing to the uncertainty in large-bodied fish stocks, uncertainty in the amount of harvesting pressure the Project will create, and uncertainty in the effects this harvesting pressure may have on fish stocks, conservatively, the effect on fish resources from overfishing due to increased access has potential to be significant. The GNWT, working with regulatory bodies with responsibilities for fisheries management and land claim organizations, may need to monitor harvesting activities along the highway to determine if additional management strategies are needed.

8.4 References

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8.0 Summary of Key Lines of Inquiry

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9.0 SOCIO-ECONOMIC IMPACT ASSESSMENT

9.1 Introduction

Local social and economic considerations was one of the two key lines of inquiry (KLOIs) identified during the Mackenzie Valley Environmental Impact Review Board (MVEIRB)'s scoping meetings.

Potential direct and indirect social and economic effects of an all-season highway were raised in communities along the route during the MVEIRB scoping sessions held in Wrigley, Tulita, Norman Wells, Fort Good Hope (K'asho Got'ine), hereafter referred to as Fort Good Hope, and Inuvik in September 2013. The Terms of Reference (ToR) for the Developer's Assessment Report (DAR) (MVEIRB, 2015 [PR#66]), Section 7.2.1, notes that during the sessions, community members identified existing social issues that could be worsened, and new issues that could arise, because of the all-season highway extension. These included concerns and potential effects of the development on community life, including human health and community wellness, and the capacity of social infrastructure including services to meet potentially increased demands.

Based on issues and concerns identified during the MVEIRB's scoping sessions, as per the ToR (Section 7.2.1), the socio-economic impact assessment (SEIA) was to specifically assess existing conditions and potential effects from the Project on the following (at both general and community-specific levels):

- Availability of drugs and alcohol and related social changes at the community, family and individual levels
- Human safety including collisions on the all-season road, collisions with pedestrians in town, impaired driving, and the capacity for emergency response to accidents in communities and remote areas
- Predicted changes in demands for social infrastructure (including, policing and crime, health services, and social services), and the adequacy of existing social infrastructure to meet those changes (including potential shortfalls)
- Capacity of public physical infrastructure such as existing roads, water sources, quarries and quarry materials, and waste management facilities

The ToR notes that during the MVEIRB's scoping sessions, several communities communicated interest in potential economic benefits of the Project and expressed concerns to the MVEIRB about their readiness and capacity to take full advantage of these opportunities. As per the ToR (Section 7.2.1), the assessment was to specifically describe and assess potential effects of the Project on the following (at both the general and community-specific levels):

- Direct and indirect employment opportunities generated by the development and the potential for uptake of these opportunities locally by Indigenous peoples

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9.0 Socio-Economic Impact Assessment

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- Employment and income opportunities for every year of construction and operation, with particular reference to wage and salary employment by length of employment, form of employment (full time, part time, seasonal), skills category
- Measures, plans and commitments for increasing local and Indigenous employment and businesses
- Increasing local and Indigenous participation in contractor and sub-contractor business opportunities
- Effects on capacity of local businesses to service other sectors during the construction phase;
- Cost of living and consumer prices for different types of goods
- Proposed education and training programs required for highway-related construction and operation employment, including:
 - Local and regional training opportunities
 - Timing and duration of programs, in relation to the highway development schedule
 - Skills and experience gained in the highway workforce that could be applied to other available projects or sectors
 - The number of people expected to be employable and available
 - The potential for local development of skills for senior professional positions (e.g., labourer/heavy equipment operator vs. supervisor /manager)
 - Proposed programs that would be provided by or sponsored by the GNWT
- The development's contribution to the Gross Domestic Product (GDP), provided separately for direct, indirect, and induced economic activities for the regional and (to the extent possible) territorial and national economies
- Highway-related effects on harvesting and the traditional economy and their effects on community income and household economies

Five socio-economic valued components (VCs) have been identified based on the potential for the Project to affect human health and community wellness; education, training and skills; employment and economy; infrastructure, services and institutional capacity; and non-traditional land and resource use.

9.1.1 Summary of Assessment

The assessment of potential effects on the socio-economic VCs concludes that there will be positive effects of the Project in the areas of human health and community wellness, employment and economy, and education, training and skills, provided that measures are put in place to realize benefits and assist in community readiness.

There are also anticipated to be some low magnitude residual adverse effects of the Project across all socio-economic VCs, even after mitigations are applied and with an adaptive management plan and monitoring framework in place. Most residual effects will not result in long-term adverse changes in socio-economic conditions and will be not significant. There are two exceptions in that the assessment of effects of the Project on public safety and social pressures (which includes drug and alcohol use and misuse) indicate that the residual adverse effects will be significant, given the seriousness of the effects and how they exacerbate existing concerns and problems. When looking at how the Project might interact cumulatively with other projects and activities that are planned or reasonably foreseeable, it is predicted that most cumulative effects will be not significant, with the exception of public safety and social pressures, which are anticipated to be significant.

Overall, even though there are two project residual adverse effects identified as significant, the overall determination of all of the Project's adverse effects are not significant. This is due to the fact that most of the residual adverse effects are identified as not significant, and the GNWT will develop and implement follow-up and monitoring activities, including the development of a well-being adaptive management plan, that will support the development of measures to address the adverse effects of the Project.

With respect to the Project, as a result of a temporal boundary of up to 20 years construction, and an evolving socio-economic environment in the NWT, confidence in prediction of the Project's socio-economic effects ranges from low to moderate. In most cases, this lower level of confidence or greater uncertainty can be addressed through ongoing engagement, updating and expanding Traditional Knowledge (TK) and land use studies, implementation of monitoring, adaptive management and follow-up programs.

9.1.2 Methodology

The assessment of potential effects of the Project has been guided by the ToR for the Project (MVEIRB, 2015 [PR#66]). Feedback provided during the MVEIRB's 2013 scoping phase identified high-priority issues that are important to communities along the project alignment and are of particular interest to the MVEIRB, reflected in KLOIs.

Subjects of Note (SONs) identified in the ToR (Section 7.3) are lower-priority environmental receptors that require sufficient analysis to determine whether the Project is likely to cause significant adverse effects. Several SONs relate to changes to the socio-economic environment.

More information about the priority issues and concerns that were gathered by the MVEIRB during its scoping sessions, and which led to the identification of the KLOIs and SONs that guide the SEIA process is included in Appendix 9A. Further information on KLOIs and SONs are provided in Chapters 1 and 4.

The approach to the socio-economic impact assessment (SEIA) has also been informed by the following MVEIRB materials:

- SEIA Guidelines, which outlines the MVEIRB's expectations for assessing socio-economic and cultural impacts, including guidelines and considerations for carrying out engagement and incorporating the key concerns and issues raised during engagement into the SEIA (MVEIRB, 2007).
- Evolving Environmental Impact Assessments in the Mackenzie Valley and Beyond Perspectives Paper, which provides guidance and information to support continuous improvement in Environmental Impact Assessment process and ensure that well-being is considered along with significant environmental impacts as part of the assessment of the Project (MVEIRB, 2020).

Engagement with potentially affected communities and parties is a central component of SEIA and is a key component of the methodology to assess the effects of the Project on socio-economic VCs. Engagement with Indigenous Governments, Indigenous Organizations, and other affected parties to gather information on existing conditions and potential effects of the Project was conducted at several points in the development of the effects assessment. More detailed information on the engagement approach and influence of engagement are contained in Section 9.2.2.

9.1.3 Socio-Economic Valued Components

A list of preliminary anticipated VCs, indicators and the rationale for their inclusion was produced (see Table 9.1), based on the KLOI and SON, experience with similar projects, and review of other similar projects. The VCs identified refer to those features of the environment that may be affected by the Project and that have been identified to be of concern by MVEIRB, the proponent – the GNWT, Indigenous Governments, Indigenous Organizations, and other affected parties. The value of a component relates to its role in the environment (social or physical) and its scientific, social, cultural, economic, historical, archaeological, or aesthetic importance. Indicators represent more specific items that reflect the key characteristics of the VC that serve as the focus of the assessment. Note, 'Heritage Resources' and 'Culture and Traditional Land Use, including Harvesting' are reported on in Chapters 22 and 11, respectively, of the DAR. Additionally, the interconnectedness of land and well-being is recognized as part of the holistic approach and there are references to these other effects assessments in the more detailed effects assessments for each Socio-Economic VC.

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Table 9.1 Preliminary Socio-Economic Valued Components and Indicators

Preliminary Socio-economic Valued Components	Preliminary Indicators	Rationale for Inclusion
Human Health and Community Wellness	Population composition, migration (in/out)	<ul style="list-style-type: none"> • Identified in ToR Sections 5.2.1, 5.2.5, 7.2.1, 7.3.3, 7.3.4 • Availability of drugs and alcohol, related social changes and human safety are identified as KLOI in the ToR
	Population health (e.g., communicable and chronic disease; self-perceived health; mental health and addictions; preventative services and screening.)	
	Social determinants of health (SDOH) (e.g., income and income assistance)	
	Community/family and social ties (e.g., connecting families, alleviating isolation)	
	Social pressures (e.g., increased access to and use of drugs and alcohol ¹ , crime, teen pregnancies)	
	Food security	
	Nuisance (e.g., air quality, noise, vibrations)	
	Drinking and recreational water quality	
Education, Training and Skills	Level of education and availability/capacity of education and certification/training programs	<ul style="list-style-type: none"> • Identified in ToR Sections 5.2.3, 7.2.1 • Education and training programs are identified as KLOI in the ToR
	Education and skills development programs	
Employment and Economy	Employment and income (including local and Indigenous employment/opportunities)	<ul style="list-style-type: none"> • Identified in ToR Sections 5.2.2 and 7.2.1 and as KLOI
	GDP and government revenues	
	Business development/economic opportunity (local and regional)	
	Capacity of local businesses (e.g., local Indigenous Governments and Indigenous Organizations, and regional office of Industry, Tourism and Investment)	
	Cost of living and consumer prices for goods and services	
	Traditional economy (including harvesting and related community/household income)	

¹ While the ToR refers to ‘availability and use of drugs and alcohol’, the indicator focuses on ‘access to and use of drugs and alcohol’ due to availability of information (use can be captured in some health and social service as well as justice indicators) and statistical information is available on alcohol and drug use, while availability can be assessed using qualitative reports from community members and/or front-line service providers like the RCMP.

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Preliminary Socio-economic Valued Components	Preliminary Indicators	Rationale for Inclusion
Infrastructure, Services, and Institutional Capacity	Housing and accommodation including demand and supply (e.g., adequacy, affordability, and suitability; privately owned, rented and Housing Northwest Territories housing stock; length of public housing waiting list.)	<ul style="list-style-type: none"> • Identified in ToR Sections 5.2.4, 7.2.1 • Demand for social infrastructure and capacity of public infrastructure are identified as KLOI in the ToR • Note: the GNWT operations included per the DAR Chapter 5
	Demand for and capacity/adequacy of social infrastructure (e.g., work with Municipal and Community Affairs (MACA) and Community Government Services to understand emergency services, law enforcement, health facilities and services, social services)	
	Capacity of public infrastructure (e.g., existing roads, water sources, quarries and quarry materials, waste management facilities, other utilities)	
	Demand for and capacity/adequacy of Institutional facilities and services (e.g., schools, education facilities, early childhood education/care)	
Non-Traditional Land and Resource Use	Conformity with existing land use designations/plans (e.g., Sahtu Land Use Plan (SLUP))	<ul style="list-style-type: none"> • Identified in ToR Sections 5.2.7, 7.3.4, 7.3.14
	Existing/planned land uses (including seasonal and permanent camp areas, parks/recreation areas, transportation corridors, industrial zones, protected areas, ecologically important areas, navigable waters, and others)	
	Existing resources (including aggregate and granular resources (e.g., sand and gravel), mineral resources, forest resources, oil and gas)	
	Access (e.g., to land and surrounding lakes, environmentally and culturally sensitive areas)	
	Aesthetics	

9.1.4 Well-Being Centered (Holistic) Approach

The approach used by the GNWT for conducting the SEIA of the Project is based on the “well-being centered” approach described by the MVEIRB in its document “Evolving Environmental Impact Assessments in the Mackenzie Valley and Beyond Perspectives Paper”, which states:

This holistic mandate recognizes the relationship between the health of the environment we live in and the health of individuals, communities, and our social structures. The concept of well-being includes the relationships between many tangible and intangible aspects of human health and the social, economic, cultural, and biophysical environment. (MVEIRB, 2020).

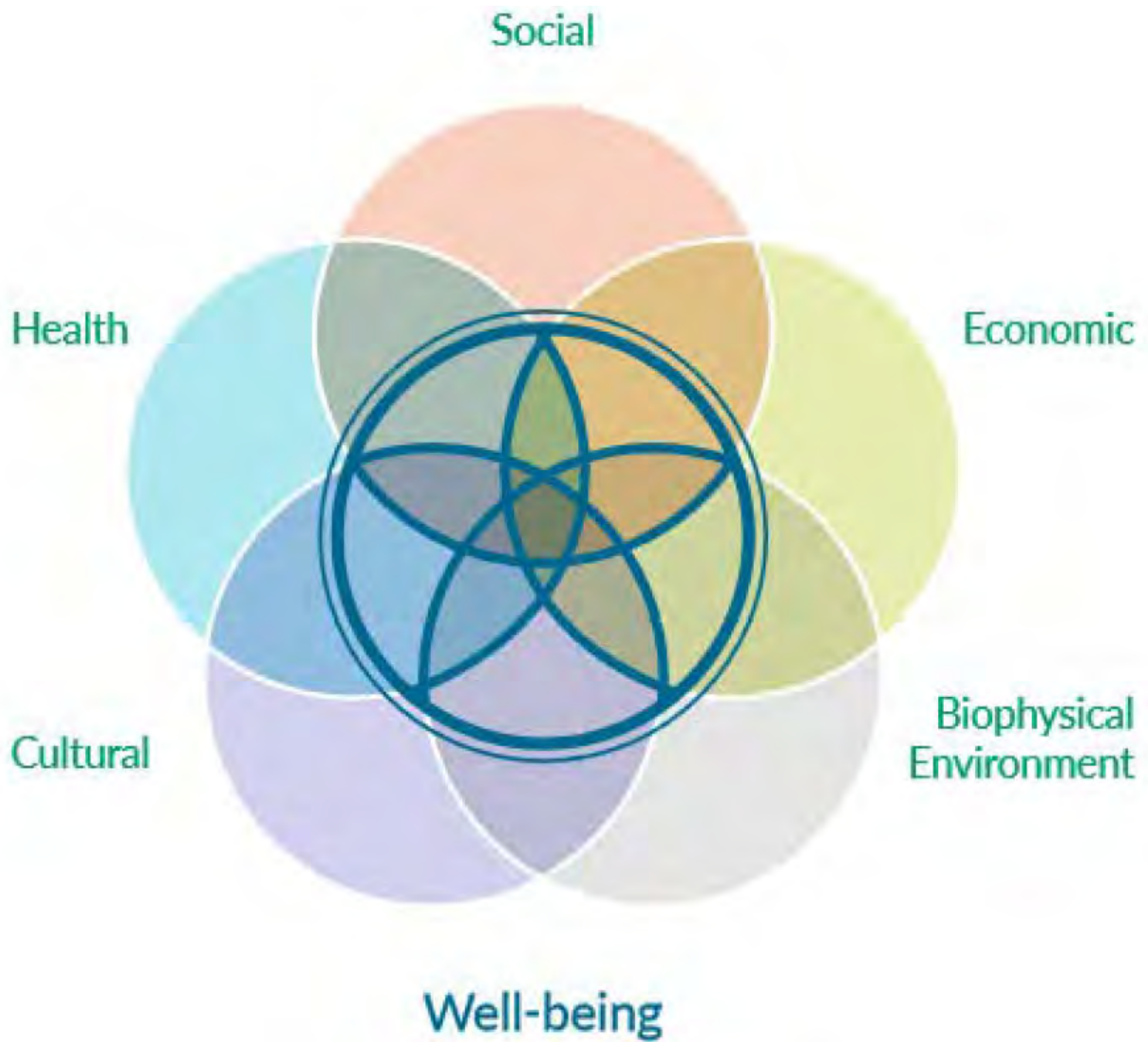
As per MVEIRB (2020), a well-being centered approach to environmental impact assessment:

- *Considers these different contexts and how they may influence peoples' experiences of effects of the Project*
- *Looks at impacts holistically and systemically, considering the connections between them*
- *Works to understand community-specific definitions of well-being and the factors that affect it and*
- *Assesses and monitors impacts against community-driven indicators of well-being (MVEIRB, 2020)*

Figure 9.1 illustrates the interrelationship of the various components of the socio-economic and biophysical environment that encompass the well-being centered approach.

In addition to there being an interrelationship between the socio-economic and biophysical environments, each socio-economic VC is interconnected with other socio-economic VCs. For example, changes in employment and economy related to local employment and household income can increase social pressures such as drug and alcohol use or crime, which are part of human health and community wellness; and increased community wealth can lead to increased investment in community infrastructure, which is part of infrastructure, services and institutional capacity. Further details and examples of these interactions are provided in the overviews of the socio-economic VCs contained in this chapter. Due to the interconnectedness of these VCs, they have been described together in a single chapter, which provides a holistic description and assessment of the socio-economic environment that may be affected by the Project.

Figure 9.1 Well-Being in Relation to Socio-Economic and Biophysical Environments



Source: MVEIRB (2020).

9.1.5 Highlights of Each Socio-Economic VC

The following are highlights of essential features of the five socio-economic VCs used in this SEIA. These highlights are intended to provide a general overview of what tends to constitute each of the five socio-economic VCs. All of the socio-economic VCs were selected because of their importance to people (e.g., the public and community residents, Indigenous communities and Indigenous organizations, other affected parties) and for the potential for them to be affected by the Project. The determination that the Project has the potential to affect existing conditions of socio-economic VCs was informed through review of relevant literature and existing conditions in communities, analysis of relevant studies and other projects, and engagement with Indigenous Governments, Indigenous Organizations, and other affected parties.

- **Human Health and Community Wellness VC** includes the physical, mental and social health of residents and the support systems and programs available to address human health and community wellness in communities along the project alignment.
- **Education, Training and Skills VC** reflects how changes in demand for education and training programs and the operation of the Project itself can affect educational attainment rates as well as the existing services and supports available to the local and regional communities.
- **Employment and Economy VC** includes and reflects changes in local, regional and the GNWT employment levels, as well as local business activity and other economic activity including connections to the traditional economy that are present in many communities and which may be affected by the Project.
- **Infrastructure, Services and Institutional Capacity VC** includes the provision of utilities, roads, and infrastructure used to provide services such as education and health, as well as the judicial system, and are essential to the quality of life in communities throughout Canada.
- **Non-Traditional Land and Resource Use VC** reflects the social and economic importance that a number of non-traditional land use activities – including oil and gas, mining, commercial tourism and recreation, and use of parks and protected areas – have for communities. Having access to non-traditional land and resources is important to communities. This includes businesses which are based on the extraction, refining, and selling of non-renewable resources (e.g., minerals, oil and gas), the enjoyment of the land and natural resources (e.g., tourism), as well as residents who rely on the land and natural resources for transportation (e.g., use of roads and navigable waterways), recreation (e.g., camping, recreational hunting and fishing), and quality of life (e.g., aesthetics).

Additionally, the changes in the socio-economic VCs are informed by changes in other VCs, including:

- Culture and Traditional Land Use Including Harvesting (see Chapter 11), including discussion of biophysical effects on vegetation and wildlife
- Vegetation and Wetlands (see Chapter 18)
- Fish and Fish Habitat (see Chapter 17)
- Wildlife and Wildlife Habitat (see Chapter 19)
- Birds and Bird Habitat (see Chapter 20)
- Caribou and Moose (see Chapter 10)
- Air Quality (see Chapter 12)
- Noise (see Chapter 13)
- Water and Sediment Quality (see Chapter 16)
- Biodiversity (see Chapter 21)

The residual effects of each socio-economic VC are used to inform the assessment of effects of the Project on other socio-economic VCs. The individual effects assessments for each of the socio-economic VCs provide more detail about how changes or the effects assessments for other VCs informed the assessment of potential effects of the Project.

Figure 9.2 illustrates the interconnected nature of potential effects of the Project on the socio-economic environment.

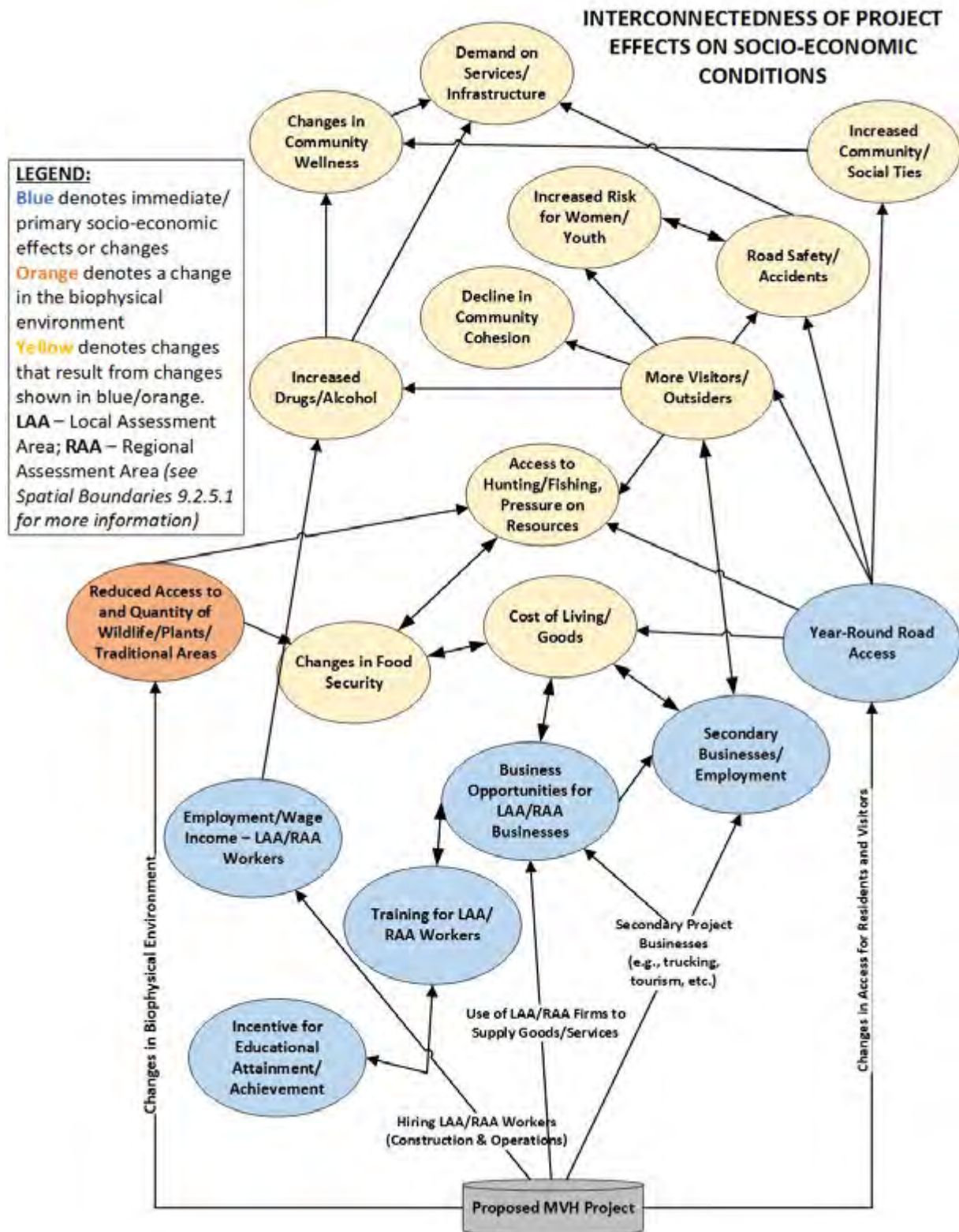
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Figure 9.2 Interconnectedness of Potential Socio-Economic Effects of the Project



9.1.6 Highlights of Engagement on Socio-Economic Issues

As a component of the assessment of socio-economic VCs, engagement that was specifically focused on socio-economic issues was conducted with approximately 200 individuals representing Indigenous Governments, Indigenous Organizations, and other affected parties. The process of engaging these parties on socio-economic issues was iterative and included both in-person engagement and telephone interviews. The first period of socio-economic engagement took place between July 2021 and April 2022: it focused on existing socio-economic conditions of the communities. The second period of socio-economic engagement took place between October and December 2022: it focused on potential socio-economic impacts. The third period of socio-economic engagement took place between November 2022 and February 2023: it focused on socio-economic assessment findings and effects of the Project. The GNWT did not engage with community organizations or community members in Wrigley, and engagement has not been conducted on the mitigation measures and commitments outlined by the GNWT.

Engagement activities ranged from one-on-one interviews to small focus group sessions to larger community meetings. The engagement provided an opportunity for a cross-section of Indigenous Governments, Indigenous communities, and other affected parties – such as Elders, youth, women, health care providers, educators, emergency service providers, leadership, and representatives from economic development and land corporations – to provide input on how they think the Project might positively and/or adversely affect their communities and to identify possible enhancement and/or mitigation measures to address the potential effects. An overview of the results of engagement and how the engagement influenced the assessment of socio-economic VCs is provided in Section 9.2.2 (Influence of Engagement) and additional details of the parties engaged, the processes used for engagement on socio-economic issues is provided in Appendix 9A. Engagement on socio-economic issues was only a portion of the engagement regarding the proposed Project: details on the engagement process and key findings are summarized in Chapter 2. In the SEIA (Chapter 9), the term ‘engagement’ is hereafter used to refer to engagement specifically focused on socio-economic issues.

Engagement revealed there is support for the Project, but that support is conditional on communities being sufficiently prepared/ready to increase positive effects (e.g., employment, training) and reduce adverse effects (e.g., exacerbation of existing social conditions such as alcohol and drug use, and/or crime). There was also overall agreement that communities need to work closely with the GNWT and the federal government to plan and prepare for the construction and operation of the Project and that the approach to readiness needs to be community-driven.

The Project was viewed by community members who participated in the engagement as having many potential benefits across the socio-economic VCs as a result of the Project allowing residents to travel more easily out of communities and between communities. These included:

- Improvements to health and wellness due to increased access to non-emergency health and dental services

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- Ability to more easily and cost-effectively leave the community to visit family and friends in other communities and to attend sporting events and cultural games (especially for youth), and
- Access to a greater variety and quality of store-bought foods and supplies

Community members also spoke about the various employment and business/contracting opportunities available during the construction (e.g., heavy equipment operators, surveyors, camp staff, general labourers) and operations (e.g., geographic information system (GIS), project maintenance, wildlife/environmental/heritage resource monitoring, tourism) phases of the Project. They also commented that all-season road access might lead to:

- An increase in the number of available instructors/teachers
- An increase in the variety of education and skills training programs/courses available locally (e.g., mobile trades truck) or regionally, and
- A decrease in the cost of teaching equipment and supplies

Community members also talked about the Project providing an opportunity to develop additional recreation areas (e.g., walking trail to Four Mile Creek, situated about 6 km east of Tulita), and to take part in recreational activities such as hiking and fishing in more areas (i.e., increase choice of where they go). Additionally, the Project would provide opportunities for the tourism industry to be further developed and would allow for easier and less expensive access to mineral resources in the area.

Community members also expressed concerns about the Project. In particular, they spoke about the Project exacerbating existing alcohol and drug problems as a result of increased access to substances, which in turn would lead to increasing rates of domestic violence, crime, and accidents. Additionally, community members spoke about their concerns that health services may be strained to respond to an increase in community service and support needs, and that emergency services or protective services (e.g., Royal Canadian Mounted Police [RCMP]) do not currently have adequate capacity and lack skills, staff, training or equipment to service an all-season road. There are also concerns that low levels of educational attainment, a lack of skills training, as well as existing social problems, might limit community members' ability to participate in employment/business opportunities and benefit from increased income as a result of employment with the Project.

Community members are worried that the Project will bring more outsiders into the community, and this may result in safety concerns for women, youth, two-spirit, lesbian, gay, bisexual, transgender, queer, questioning, intersex and additionally sexually and gender diverse people (2SLGBTQQA+) persons and vulnerable populations (e.g., kidnapping, sex trafficking) as well as an increase in sexually transmitted infections (STIs) and other diseases (e.g., COVID-19) and an overall decrease in sense of personal safety and community cohesion. There are also concerns that there will be more traffic accidents on the completed highway than on the Mackenzie Valley Winter Road (MVWR) and that existing emergency response will not be equipped to handle the volume and seriousness of these accidents because they lack the necessary staff, training and equipment. Community members are also worried that because traditional lands will be more accessible, non-residents will overharvest traditional food which may lead to increased rates of food insecurity.

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To realize potential project benefits, and to mitigate possible project adverse effects, community members consistently emphasized the importance of early planning and preparedness. Some of the new enhancements and mitigation measures that communities identified included:

- Education/training plans and early availability of construction schedules that identify the types of training, instructors and equipment needed
- Contractor agreements that identify commitments to train (beginning prior to construction) and hire local employees; supports for local businesses to prepare them for contract opportunities
- Project safety awareness campaigns, signage, communications (e.g., satellite phone) and checkpoints/patrols to help address community safety concerns
- Emergency services response plans to address project accidents and other incidents
- Tourism plans that identify infrastructure needs (e.g., hotel and restaurant services, water and waste) to support annual surges
- Plans to protect the land and wildlife from disturbances (e.g., dust and noise) caused by the Project

Throughout engagement, community members also spoke about the importance of the role of both the GNWT (as the proponent and as a government) and the federal government (as an interested party) in addressing existing social conditions (e.g., mental health problems, addictions) and the lack of educational/employment readiness brought about as a result of the legacy of residential schools and other colonial practices. They also spoke about the need to deal with the current gaps in provision of health, wellness and emergency services and supports in the communities and regions. Without addressing these existing challenges, the potential benefits arising from the Project may not be realized. Using a community-driven approach that involves shared decision-making and collaborative and participatory processes to address existing conditions and improve programs and services, where possible, the GNWT and the federal government can advance reconciliation and improve the quality of life for Indigenous community members. Alternative mitigation measures were identified and implemented from past highway projects focused on highway safety education and enforcement where community emergency service capacity is either limited or not available.

Greater detail in terms of community views on the effects pathways and suggested mitigation in each of the various socio-economic VCs is provided in Sections 9.5 through 9.9 of this chapter.

9.2 Scope of Assessment

9.2.1 Regulatory and Policy Setting

The assessment of potential project-related effects on socio-economic VCs is guided by the ToR (MVEIRB, 2015) and various legislation, regulations, policies and guidance at the territorial, regional and municipal levels, and the Sahtu Land Use Plan (SLUP). Governments' regulatory and policy environment are influenced by their priorities, planning and financial management as reflected in their business plans, strategic frameworks, action plans and other documents. Details of these for each of the five socio-economic VCs, are provided in Appendix 9A.

There are social and economic challenges that currently exist in the communities that may be potentially affected by the Project. These existing challenges are known to community residents, community governments and departments of the GNWT and are being treated according to the capacity of service providers. During the process of engagement, community members highlighted the need for readiness/preparation and suggested measures to mitigate or limit the risk of exacerbating these pre-existing challenges.

9.2.1.1 Sahtu Land Use Plan

Specific to the areas to which the SLUP applies, the Project must meet the 13 general conformity requirements of the SLUP (Sahtú Land Use Planning Board [SLUPB], 2023). Relevant to the socio-economic impact assessment, the SLUP's conformity requirements include consideration of community benefits in Conformity Requirement (CR)#3:

"The intent and priority are for residents and communities to benefit from land use activities. Land use activities must contribute to the social, cultural, and economic well-being of residents and communities, as per the guiding principles outlined in S 25.2.4 of the Sahtu Dene and Metis Comprehensive Land Claim Agreement and S. 35 of the Mackenzie Valley Resource Management Act and applicants are encouraged to work with relevant community organizations and businesses to maximize the benefits to communities, businesses, and residents from proposed land uses."

Conformity Requirement #2 requires:

1) For all applications for land use activities, community organizations and potentially affected community members must be adequately engaged with respect to:

a) Proposed activities,

b) Potential impacts of the proposed activities on specific locations, including heritage resources, and other issues of concern identified in the engagement,

c) Traditional knowledge that is relevant to the location, scope, and nature of the proposed activities.

2) The proposed activities must be designed and carried out with due regard for community concerns and incorporate relevant traditional knowledge."

9.2.2 Influence of Engagement

The GNWT staff and project consultants have visited communities and specifically invited Indigenous Governments, Indigenous Organizations, and other affected parties in the Sahtu and Dehcho regions to participate in the GNWT's engagement on the Project. Refer to Chapter 2 for additional details on overall engagement efforts related to the Project and definitions of Indigenous Governments, Indigenous Organizations, and other affected parties.

Engagement with potentially affected communities and parties is a central component of SEIA. Information from statistics and other 'hard data' are important components of SEIA, but they cannot convey the inter-connectedness of the social, cultural and economic components of community life and the families and individuals who live in the community. The experiences of other communities with similar projects can provide important insights; however, each project is unique, as is each community that may be affected by the Project. It is only through an iterative process of engagement with Indigenous Governments, Indigenous Organizations, and other affected parties that a sound understanding of their views, hopes and concerns can be obtained, and an accurate assessment of the socio-economic environment be conducted. Engagement with Indigenous Governments, Indigenous Organizations, and other affected parties about the Project and its effects, as well as mitigation measures is key to ensure that mitigation measures and adaptive management measures are successful, and that Indigenous Governments, Indigenous Organizations, and other affected parties are supported.

Engagement included meetings and interviews held with Indigenous Governments, Indigenous Organizations, and other affected parties within the LAA (Local Assessment Area) and RAA (Regional Assessment Area) communities. Refer to Section 9.2.5.1 – Spatial Boundaries for more information on these defined areas. It includes representatives of Indigenous communities and organizations such as community leadership, community members representing different groups in communities (e.g., Elders, youth, women, knowledge holders), land corporations and resource councils. It also includes staff and representatives of community-based services and organizations (e.g., health centre, Aurora College community learning centres [CLCs], schools, fire services, childcare), local business owners and employees, municipal or hamlet governments, and economic or business development organizations.

Engagement with Indigenous Governments, Indigenous Organizations, and other affected parties provided information on existing conditions of socio-economic VCs in communities and observations on how the Project may positively or adversely affect current conditions in communities. Information was also shared about linkages between conditions of socio-economic VCs in communities and how Project effects may be interconnected to each other. Suggestions for mitigation and enhancement measures were also provided, as well as comments on potential resourcing and timing for mitigation and enhancements to be most effective.

The GNWT did not engage with community organizations or community members in Wrigley. The effects assessment relies on publicly available information to complete some parts of the assessment as it related to Wrigley. The GNWT has, in the interim, continued dialogue with Pehdzéh Kì First Nation leadership on approaches to facilitate a meaningful and agreeable path forward for

Pehdzéh Kì First Nation's participation and remains committed to engaging with Pehdzéh Kì First Nation and Wrigley about the Project. Engagement has not been conducted on the mitigation measures and commitments outlined by the GNWT that have been included in the effects assessment, which are summarized in Section 9.16 – Summary of Mitigation and Commitments. Information on overall engagement efforts related to the Project are contained in Chapter 2, Consultation and Engagement.

A complete list of the organizations and groups that were met with or interviewed, along with a summary of the key comments and information provided through engagement, is included in Appendix 9A.

9.2.2.1 Regulatory Engagement and Information from the GNWT Departments and Agencies

Engagement with regulators and discussions with the GNWT departments and agencies provides the perspectives of parties and service providers who may be influenced by the Project. Engagement with regulators and discussions with the GNWT departments and agencies help to determine how a project may influence their organizational capacity, core functions, and service recipients within the communities they serve. Regulator engagement therefore complements engagement with Indigenous Governments, Indigenous Organizations, and other affected parties.

Discussions with the GNWT departments and agencies consisted of meetings and interviews with senior staff of nine GNWT departments: Environment and Climate Change (ECC), Education, Culture and Employment (ECE), Executive and Indigenous Affairs (EIA), Health and Social Services (HSS), Industry, Tourism & Investment (ITI), Infrastructure (INF), Justice (JUS), MACA) and two agencies (Housing NWT, NWT Power Corporation), each of which have mandates related to one or more of the five socio-economic VCs. Engagement with regulators also included representatives of federal departments and agencies such as Parks Canada, and the RCMP-GRC.

Engagement with regulators and discussions with the GNWT departments and agencies provided information relevant to the existing conditions in communities, and existing policies, programs and regulatory frameworks that are relevant to current conditions or mitigation measures. Information was also shared about potential effects of the Project on existing conditions of socio-economic VCs from the perspectives of their roles and the mandates of their organization/department/agency.

9.2.2.2 Summary of Engagement

Feedback provided by engagement with Indigenous Governments, Indigenous Organizations, and other affected parties has been considered and summarized in Table 9.2 and has been integrated into the assessment of potential effects on the local social and economic environment that follows.

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Table 9.2 Summary of Engagement Feedback: Local Social and Economic Considerations

Comment	Source	GNWT Response	Where Addressed
Human Health and Community Wellness			
Engagement participants stated all-season road access may help attract and retain professional staff to communities while also increasing the retention of local residents by making their home communities less remote.	October to December 2022 Engagement	As this was seen as a positive effect of the Project, no mitigation is required.	For information about population migration, see Section 9.5.2.
Engagement participants raised concerns about potential increases in disease outbreaks as a result of increased presence of non-residents (e.g., construction workers, visitors to communities) or as a result of all-season access for community members to visit other communities.	October to December 2022 Engagement	The GNWT has identified mitigation measures to reduce the effects of the Project on population health via the Well-Being Adaptive Management Plan, including measures to work with communities to identify how existing programs and services can support communities and identify potential needs for expansions to existing health and wellness related programming. The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.	For information about population health, including communicable diseases, see Section 9.5.3. For mitigation measures to reduce effects of the Project on population health, see Table 9.10.
Engagement participants identified potential Project benefits including increased mental wellness due to the ability to travel between communities to see family/friends and participate in events.	October to December 2022 Engagement	As this was seen as a positive effect of the Project, no mitigation is required.	For information about population health, including mental and physical wellness, see Section 9.5.3. For mitigation measures to reduce effects of the Project on mental wellness, see Table 9.10.

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Comment	Source	GNWT Response	Where Addressed
<p>Engagement participants identified potential health and well-being benefits associated with all-season road access allowing increased participation of youth in sports.</p>	<p>October to December 2022 Engagement</p>	<p>As this was seen as a positive effect of the Project, no mitigation is required.</p>	<p>For information about community and social ties, see Section 9.5.4.</p>
<p>Engagement participants identified concerns related to decreased food security as a result of adverse effects of the Project on wildlife that decreases availability of or access to traditional foods. Participants also indicated that Indigenous communities need to be involved in monitoring effects of the Project on wildlife levels and that there is an appropriate role for the Indigenous Guardians in wildlife monitoring.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures related to wildlife as part of the Wildlife Management and Monitoring Plan (WMMP). The GNWT has indicated that they are open to considering use of the Indigenous Guardians and have committed to wildlife monitoring as part of the WMMP.</p>	<p>For more information on food security, see Section 9.5.5. For mitigation measures related to food security, see Table 9.10.</p>
<p>Engagement with regulators provided information on potential effects of the Project on the ability for drugs and alcohol to move more freely between communities due to the Project, or that bootlegging may become more prominent. Regulators also noted a concern that all-season road access provided by the Project may lead to a greater variety of drugs, or 'harder' drugs may become more prevalent as a result of all-season access between communities.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on drugs and alcohol abuse via the Well-Being Adaptive Management Plan (see Section 9.5.6.2). The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about social pressures including drugs and alcohol, see Section 9.5.6. For mitigation measures to reduce effects of the Project on social pressures, including drugs and alcohols, see Table 9.10.</p>

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Comment	Source	GNWT Response	Where Addressed
<p>Engagement participants raised concerns about construction or operation of the Project increasing access of non-residents (e.g., construction workers, visitors, tourists, transient workers) to communities would increase drug and alcohol abuse, which have already been noted by communities as serious issues within communities that require additional resources to address.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on drugs and alcohol abuse via the Well-Being Adaptive Management Plan.</p> <p>The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about social pressures including drugs and alcohol, see Section 9.5.6.</p> <p>For mitigation measures to reduce effects of the Project on social pressures, including drugs and alcohols, see Table 9.10.</p>
<p>Engagement with regulators raised concerns about the potential for increased crime and accident rates due to the Project.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on crimes and road accidents via the Road Safety Plan and the Safety and Security Plan for Vulnerable Community Members.</p> <p>The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about social pressures including crime, see Section 9.5.6.</p> <p>For information about public safety including personal safety and accidents, see Section 9.5.9.</p> <p>For mitigation measures to reduce effects of the Project on social pressures and public safety, see Table 9.10.</p>
<p>Engagement with regulators stated concerns about the lack of communication infrastructure along the proposed Project that would lead to drivers or vulnerable populations being in dangerous situations while using the Project.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT has identified mitigation measures related to safety issues associated with a need for communications infrastructure and support via the Road Safety Plan.</p>	<p>For information about social pressures including crime, see Section 9.5.6.</p> <p>For information about public safety including personal safety and accidents, see Section 9.5.9.</p> <p>For mitigation measures to reduce effects of the Project on social pressures and public safety, see Table 9.10.</p>

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Comment	Source	GNWT Response	Where Addressed
<p>Information was provided by MACA, JUS, Department of (HSS, Department of EIA, Housing Northwest Territories (Housing NWT), and RCMP regarding the possible increased pressure on health and social services due to increased local population use of drugs and alcohol.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on population health through the Well-Being Adaptive Management Plan which includes specific measures related to community wellness, community services and community safety. The GNWT has also identified measures related to addressing adverse effects of the Project on public safety through the Road Safety and Safety and Security for Vulnerable Community Members, which are designed to address the adverse effects of the Project that would in turn result in increased demand on health services.</p> <p>The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about social pressures including drugs and alcohol, see Section 9.5.6.</p> <p>For information about public safety including personal safety and accidents, see Section 9.5.9.</p> <p>For mitigation measures to reduce effects of the Project on social pressures and public safety, see Table 9.10.</p> <p>For information about effects of the Project on social infrastructure and services, see Section 9.8.3.</p> <p>For mitigation measures to reduce effects of the Project on social infrastructure and services, see Table 9.20.</p> <p>For a summary of the Community Readiness Strategy and all plans and measures included in it, see Section 9.16.1.</p>
<p>Engagement participants raised concerns related to increased demand for health services, and expressed concerns that the Project would result in additional adverse effects in the areas of substance abuse and mental health in particular that could not be adequately addressed by the existing health services, given the gaps and challenges in meeting existing needs.</p>	<p>October to December 2022 Engagement</p>		

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Comment	Source	GNWT Response	Where Addressed
<p>Engagement participants raised concerns about potential increased demand on health services due to drugs, alcohol and associated issues like family violence.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on population health through the Well-Being Adaptive Management Plan which includes specific measures related to community wellness, community services and community safety.</p> <p>The GNWT has identified mitigation measures related to monitoring and addressing adverse effects of the Project that may lead to increased demand on social and health services via the Well-Being Adaptive Management Plan.</p> <p>The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about social pressures including drugs and alcohol, STIs and teen pregnancies and crime levels, see Section 9.5.6.</p> <p>For mitigation measures to reduce effects of the Project on social pressures, see Table 9.10.</p> <p>For information about effects of the Project on social infrastructure and services, see Section 9.8.3.</p> <p>For mitigation measures to reduce effects of the Project on social infrastructure and services, see Table 9.20.</p> <p>For a summary of the Community Readiness Strategy and all plans and measures included in it, see Section 9.16.1.</p>

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Comment	Source	GNWT Response	Where Addressed
<p>Engagement participants raised concerns about adverse effects from the Project, especially those related to increased drugs, alcohol, sexual and family violence, crime, and traffic accidents having a disproportionate effect on vulnerable people like youth, women, Elders, 2SLGBTQQIA+ among others.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to address the adverse effects of the Project being felt disproportionately by vulnerable populations through the Safety and Security Plan for Vulnerable Community Members. The GNWT has also identified mitigation measures in the Well-Being Adaptive Management Plan related to community wellness, substance abuse and community safety that incorporate a health equity lens and will work with communities to identify vulnerable populations that may be disproportionately and adversely affected by the Project.</p> <p>The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about social pressures including drugs and alcohol, see Section 9.5.6.</p> <p>For information about public safety including personal safety and accidents, see Section 9.5.9.</p> <p>For mitigation measures to reduce effects of the Project on social pressures and public safety, see Table 9.10.</p> <p>For a summary of the Community Readiness Strategy and all plans and measures included in it, see Section 9.16.1.</p>
<p>Engagement participants highlighted a need for planning and time to prepare for potential effects of the Project related to health and wellness.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on community health via the Well-Being Adaptive Management Plan and the Social Monitoring Plan.</p> <p>The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For mitigation measures to reduce adverse effects of the Project on community health, see Table 9.10.</p> <p>For a summary of the Community Readiness Strategy and all plans and measures included in it, see Section 9.16.1.</p>

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Education, Training and Skills			
Community education providers provided information on the types of training programs needed in the communities and the types of training anticipated to be needed, including heavy equipment operators, plumbers, electricians, carpenters, and iron workers.	October to December 2022 Engagement	<p>The GNWT has identified mitigation measures to enhance the positive effects of the Project on training programs in the communities via the Contractor Training and Employment Plan.</p> <p>The GNWT currently offers programs and services designed to support students in obtaining education and training and facilitate their participation, and has identified that through the community services portion of the Well-Being Adaptive Management Plan, the GNWT will work collaboratively with communities and education partners to identify measures that may be needed to respond to adverse effects of the Project, such as increased demand for education services and training opportunities (including on-the-job training) that may not be able to be met by existing facilities, programs and services.</p> <p>The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about change in level of education, training and skills development, see Section 9.6.2.</p> <p>For mitigation measures to enhance the positive effects of the Project on education, training and skills development, see Table 9.13.</p>
Engagement participants provided information on potential for increased employment rates in the LAA and specific training requirements in communities.	October to December 2022 Engagement		
Community education providers raised concerns about lack of capacity to meet increased demand for training programs in the LAA and the need to prepare and have enough time before construction begins.	October to December 2022 Engagement		
Community education providers stated that the desire among residents to receive on-the-job training in addition to formal training and skills upgrading programs because the time commitment required for upgrading is considerable and can serve as a deterrent.	October to December 2022 Engagement		

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Comment	Source	GNWT Response	Where Addressed
<p>Engagement participants expressed a need for a satellite campus for Aurora College in Norman Wells which would encourage participation in training and education as students/trainees would not have to travel.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT currently offers programs and services designed to support students in obtaining education and training and facilitate their participation, which extends to students that may not have access to a local educational institution or local training facilities. While the GNWT is not committing to an establishment of a satellite Aurora College campus at this time, mitigation measures have been identified to enhance the positive effects of the Project on education and training through the leveraging of existing programs and supports (see Section 9A.3 for details on existing programs and policies) and respond to educational and training needs that are identified and linked to the Project. .</p>	<p>For information about access to education, certification, and training programs, see Section 9.6.3. For mitigation measures to enhance the positive effects of the Project on education, training and skills development, see Table 9.13.</p>
<p>Senior staff of the GNWT's Department of Education, Culture and Employment (ECE) and adult educators from the Norman Wells and Tulita CLCs provided information on the level of existing education and training programs available in the communities, including the lack of available trades training programs in the communities. They noted the need for the communities to be informed about the timing of project construction and be provided with more information on the education and certification requirements needed for the construction jobs.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to enhance the positive effects of the Project on education and training programs via the Contractor Training and Employment Plan. The GNWT has committed that as part of the development and implementation of all aspects of the Community Readiness Strategy information will be shared with all parties and with communities to support planning and preparedness and readiness activities. The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about access to education, certification and training programs, see Section 9.6.3. For measures to enhance positive effects of the Project on access to education, certification and training programs, see Table 9.13. For a summary of the Community Readiness Strategy and all plans and measures included in it, see Section 9.16.1.</p>
<p>Engagement participants identified potential project educational benefits including increases to the graduation rate and employment opportunities, as well as potential easier access to education facilities at Norman Wells.</p>	<p>October to December 2022 Engagement</p>	<p>October to December 2022 Engagement</p>	<p>October to December 2022 Engagement</p>

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Comment	Source	GNWT Response	Where Addressed
<p>Community education providers emphasized the need for additional funding required to deliver apprenticeship training programs locally (via a satellite campus).</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT currently offers programs and services designed to support students in obtaining education and training and facilitate their participation, which extends to students that may not have access to a local educational institution or local training facilities. While the GNWT is not committing to an establishment of a satellite Aurora College campus at this time, mitigation measures have been identified to enhance the positive effects of the Project on education and training through the leveraging of existing programs and supports (see Section 9A.3 for details on existing programs and policies) and respond to educational and training needs that are identified and linked to the Project. The GNWT has also identified measures as part of the Well-Being Adaptive Management Plan that will monitor effects that put pressure on existing institutional facilities, including educational facilities, and work to address these adverse effects.</p> <p>For a summary of the Community Readiness Strategy and all plans and measures included in it, see Section 9.16.1.</p>	<p>For information about in capacity to meet demand for education, certification and training programs, see Section 9.6.4.</p> <p>For measures related to effects of the Project on education, certification and training capacity, see Table 9.13.</p>
<p>Engagement participants identified the potential ability to offer more courses due to it being easier to attract instructors and get educational supplies as a potential educational benefits Project.</p>	<p>October to December 2022 Engagement</p>		

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Comment	Source	GNWT Response	Where Addressed
Employment and Economy			
Engagement participants raised concerns regarding whether or not jobs would actually be available locally or would be filled by people from the south or outside the territory.	October to December 2022 Engagement	The GNWT has identified mitigation measures to enhance the positive effects of the Project on employment via the Contractor Training and Employment Plan. The plan includes measures to support local employment.	For information about employment, see Section 9.7.2.
Hamlet staff noted there is a lot of local knowledge in road building as well as equipment for road construction which should be used for the Project and that hiring locally should be top priority.	October to December 2022 Engagement	The GNWT has also committed to include conditions in contractors that require contractors to develop plans that will describe how they will enhance local employment and training, in order to increase employment and business opportunities for LAA and RAA communities. The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.	For measures to enhance positive effects of the Project on employment, see Table 9.14.

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Comment	Source	GNWT Response	Where Addressed
<p>Senior staff of the GNWT EIA, observed that the Project will have positive effects such as increase in local employment (for both construction and maintenance of the Project), thereby stimulating economic diversification at both the local and regional levels.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to enhance the effects of the Project on local employment and business development via the Contractor Training and Employment Plan, which include support for local businesses to help them prepare for contracting opportunities.</p>	<p>For information about employment, see Section 9.7.2. For information about businesses, see Section 9.7.4.</p>
<p>Engagement participants stated that there may be local contracting business opportunities for the Project and ROW maintenance but expressed concern that some local businesses may not be ready or lack the capacity to get contracts or compete with firms from outside the territory.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has also committed to include conditions in contracts that require contractors to develop plans that will describe how they will enhance local employment and training, in order to increase employment and business opportunities for LAA and RAA communities. The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For mitigation measures to enhance positive effects of the Project on employment and businesses, see Table 9.14.</p>
<p>Municipal staff and other affected parties provided information on potential effects of the Project on business activity (including mineral and recreation) and visitor volumes in local communities.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to enhance the positive effects of the Project on business via the Contractor Training and Employment Plan. This includes measures related to working collaboratively with communities to support the development of tourism plans and identify needed measures to address adverse effects of the Project related to increased tourism and numbers of visitors. This work will build on and leverage existing programs and services provided by the GNWT Department of Industry, Tourism and Investment (ITI) related to supporting the development of tourism plans.</p>	<p>For information about employment, see Section 9.7.2. For information about businesses, see Section 9.7.4. For mitigation measures to enhance the positive effects of the Project on business, see Table 9.14.</p>

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Comment	Source	GNWT Response	Where Addressed
<p>The GNWT representatives from Department of Infrastructure (INF), HSS, Department of MACA and NWTTC stated that more economic activity in towns along project alignment can be expected – in particular, Wrigley, which was formerly the ‘end of the road’. They also expect the Project to stimulate the economy/tourism which will create micro economies and provide opportunities for local artisans to sell handicrafts.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to enhance the positive effects of the Project on the local economy and tourism via the Contractor Training and Employment Plan.</p> <p>This includes measures related to working collaboratively with communities to support the development of tourism plans and identify needed measures to address adverse effects of the Project related to increased tourism and numbers of visitors. This work will build on and leverage existing programs and services provided by ITI related to supporting the development of tourism plans</p>	<p>For information about businesses, see Section 9.7.4.</p> <p>For mitigation measures to enhance the positive effects of the Project on the local economy and tourism, see Table 9.14.</p>
<p>Engagement participants anticipate an increase in tourism in communities along the Project which was identified as a positive for local businesses but also an area of concern due to lack of infrastructure and plans/preparedness to accommodate increased visitors and tourists.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures in the Contractor Training and Employment Plan related to working collaboratively with communities to support the development of tourism plans and identify needed measures to address adverse effects of the Project related to increased tourism and numbers of visitors.</p>	<p>For information about effects of the Project on local businesses, see Section 9.7.4.</p> <p>For mitigation measures to enhance the positive effects of the Project on tourism-related business and</p>
<p>Engagement participants stated that an increase in tourism will have many positive business effects for contracting companies, hotels, restaurants, camps, and gas stations, but concerns were raised about the need to prepare and ensure that there is sufficient infrastructure and that local businesses have the necessary capacity and knowledge to respond to increased demand.</p>	<p>October to December 2022 Engagement</p>	<p>This work will build on and leverage existing programs and services provided by ITI related to supporting the development of tourism plans.</p>	<p>minimize the adverse effects of the Project associated with increased visitors and tourists, see Table 9.14.</p>

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Comment	Source	GNWT Response	Where Addressed
Engagement participants identified potential economic benefits of the Project such as decreased cost of goods and cost of living in LAA communities, and also to some extent in northern RAA communities associated with the Project allowing Norman Wells to be used as a staging area or place to stockpile goods.	October to December 2022 Engagement	As this was seen as a positive effect of the Project, no mitigation is required.	For information about cost of living, see Section 9.7.5.
Engagement participants identified potential project benefits including decreased costs of doing business due to all-season road-based transportation of goods.	October to December 2022 Engagement	As this was seen as a positive effect of the Project, no mitigation is required.	For information about cost of living and consumer prices, see Section 9.7.5.
Infrastructure, Services and Institutional Capacity			
Information was provided by MACA, JUS, HSS, EIA, NWTHC and RCMP regarding the possible pressure of non-resident construction workers on housing.	July 2021 to April 2022 Engagement	The construction phase of the Project is not anticipated to impact housing needs, so no mitigation is identified. Once construction is complete, the GNWT will investigate the potential repurposing of construction camps for use as housing in LAA communities. The GNWT has identified mitigation measures as part of the Contractor Training and Employment Plan related to working collaboratively with communities to support the development of tourism plans and identified needed measures to address adverse effects of the Project related to increased tourism and numbers of visitors. This work will build on and leverage existing programs and services provided by ITI related to supporting the development of tourism plans.	For information about housing and accommodation, see Section 9.8.2.
The GNWT-ECC provided views on potential effects of the Project on potential changes in the volume of tourists that result in increased demand for short-term accommodation and parking.	July 2021 to April 2022 Engagement		For mitigation measures to reduce effects of the Project related to increased visitors and tourists, see Table 9.20.

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Comment	Source	GNWT Response	Where Addressed
<p>Senior staff of Sahtú Got'iné Regional Health and Social Services Centre provided information on the provision of existing health services to Norman Wells and Tulita, identified the possible increased demand for health services by non-local construction workers, and increased demands for Norman Wells health services from smaller communities all-season</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures related to monitoring and addressing adverse effects of the Project that may lead to increased demand on social and health services via the Well-Being Adaptive Management Plan (see Section 9.8.3.2). The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about health and social services, see Section 9.8.3. For mitigation measures to reduce effects of the Project on health and social services, see Table 9.20.</p>
<p>Information was provided by MACA, JUS, HSS, EIA, NWTHC and RCMP regarding the possible increased pressure on social services by non-resident construction workers.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT has identified mitigation measures related to monitoring and addressing adverse effects of the Project that may lead to increased demand on social and health services via the Well-Being Adaptive Management Plan. The GNWT has also committed that all mitigation measures and plans that are part of the Community Readiness Strategy will involve working collaboratively with communities and leveraging existing programs and services, which are outlined in Section 9A.3.</p>	<p>For information about social services, see Section 9.8.3. For mitigation measures to reduce effects of the Project on social services, see Table 9.20.</p>

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Comment	Source	GNWT Response	Where Addressed
<p>Engagement participants stated concerns about the potential need for ambulance services and more trained first responders due to the increased number and severity of traffic accidents, as well as more counselling support for family members of those involved in serious traffic accidents.</p>	<p>October to December 2022 Engagement</p>	<p>The management and delivery of ground ambulance and highway rescue services in the Northwest Territories (NWT) is challenged by the social and geographic conditions that exist for communities and highways in the territory. A large geographic area, low population base, extensive distances between communities, the small size and remoteness of many communities, a limited communications network, harsh climatic conditions and lack of an all-season territorial-wide transportation network are factors that impact the effectiveness and efficiency of the provision of these services. The GNWT will continue to build safe roads and focus highway safety education and enforcement where community emergency service capacity is either limited or not available. Alternative mitigation measures identified and implemented from past highway projects focused on highway safety education and enforcement where community emergency service capacity is either limited or not available.</p>	<p>For information about emergency services, see Section 9.8.3.</p> <p>For mitigation measures to reduce effects of the Project on emergency services, see Table 9.20.</p>
<p>Information was provided by MACA, JUS, HSS, EIA, NWTTC and RCMP regarding the possible increased need for community emergency services due to traffic accidents.</p>	<p>July 2021 to April 2022 Engagement</p>		
<p>Engagement participants identified potential project benefits including increased ease of access for health services like scans or dental work, particularly in the LAA, which would lead to increased levels of physical well-being.</p>	<p>October to December 2022 Engagement</p>	<p>As this was seen as a positive effect of the Project, no mitigation is required.</p>	<p>For information about health and social services, see Section 9.8.3.</p> <p>For information on population health, see Section 9.5.3.</p>
<p>Senior staff of the GNWT EIA, observed that the Project will have positive effects such as improved local resident access to services.</p>	<p>July 2021 to April 2022 Engagement</p>		

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Comment	Source	GNWT Response	Where Addressed
Engaged regulators stated concerns about possible increased demand on local safe drinking water supplies and landfills by construction worker camps.	July 2021 to April 2022 Engagement	The GNWT has identified mitigation measures to mitigate the potential impact on public infrastructure in the areas of drinking water, waste and sewage that are anticipated to be affected by the Project.	For information about public infrastructure including water and waste services, see Section 9.8.4.
Engagement participants raised concerns about possible additional pressure on water, sewer and solid waste by construction worker camps.	October to December 2022 Engagement		For mitigation measures to reduce effects of the Project on water and waste services, see Table 9.20.
Engagement participants provided information on the need to prepare sufficient infrastructure in isolated communities to appropriately handle the additional traffic volume and visitors that would be present all-season.	October to December 2022 Engagement	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on road infrastructure via the Road Safety Plan and through measures in the community safety portion of the Well-Being Adaptive Management Plan.</p> <p>The GNWT has identified mitigation measures as part of the Contractor Training and Employment Plan related to working collaboratively with communities to support the development of tourism plans and identified needed measures to address adverse effects of the Project related to increased tourism and numbers of visitors. This work will build on and leverage existing programs and services provided by ITI related to supporting the development of tourism plans.</p>	<p>For information about public infrastructure including roads, see Section 9.8.4.</p> <p>For mitigation measures to reduce effects of the Project on road infrastructure, see Table 9.20.</p>
The GNWT representatives from INF, HSS, MACA and NWT HC stated that more economic activity in towns along the project alignment can be expected, spurring development of a waste management and remediation services hub in Norman Wells.	July 2021 to April 2022 Engagement	As this was seen as a positive effect of the Project, no mitigation is required.	For information about public infrastructure including waste services, see Section 9.8.4.

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Comment	Source	GNWT Response	Where Addressed
<p>Engagement participants raised concerns about possible increased use of recreation facilities/programs by non-local construction workers and then during operations by neighbouring communities (e.g., intramural hockey).</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on institutional facilities via the Well-Being Adaptive Management Plan.</p>	<p>For information about institutional facilities including recreation, see Section 9.8.5.</p> <p>For mitigation measures to reduce effects of the Project on institutional facilities, see Table 9.20.</p>
<p>Non-Traditional Land and Resource Use</p>			
<p>The GNWT-ECC provided information on relevant land use legislation and policies, non-traditional land use planning, potential effects of the Project on non-traditional land use, including changing patterns in land access for recreational use.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on non-traditional land use via measures that will restrict access or activities by people working on the Project at certain times or under certain circumstances.</p>	<p>For information about non-traditional land use, see Section 9.9.2.</p> <p>For mitigation measures to reduce effects of the Project on non-traditional land use, see Table 9.21.</p>
<p>The GNWT representatives from INF, HSS, MACA and NWT HC stated that more economic activity in towns along the project alignment can be expected.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>This is a positive effect and so no mitigation is identified.</p>	<p>For information about non-traditional land use, see Section 9.9.2.</p>
<p>The GNWT-ECC provided information on environmental issues that had been encountered with the Canyon Creek All Season Access Road Project (CCASAR) for consideration in the development of the Project – in particular, permafrost; that prior to project construction, land use status will need to be changed from “non developed” to “developed”; that proactive planning is essential for infrastructure projects in the NWT; and that holders of permits granted for the Project be required to carry out ongoing environmental monitoring.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT will develop and implement a permafrost Protection Plan (PPP) to mitigate the adverse effects of the Project on permafrost levels.</p>	<p>For information about non-traditional land use, see Section 9.9.2.</p> <p>For mitigation measures related to permafrost, refer to the PPP (Volume 5).</p>

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Comment	Source	GNWT Response	Where Addressed
<p>Sahtu Land Use Planning Board (SLUPB) provided information on the scale of potential effects of the Project on land uses, potential need for the Project to be involved in land agreements with private landowners, the potential for land and habitat disturbances, project changes on how the land and water are used by residents (including hunting), as well as aesthetics.</p>	<p>July 2021 to April 2022 Engagement</p>	<p>The GNWT will develop and implement a WMMP that will include measures related to monitoring of wildlife levels, and some measures intended to mitigate adverse effects of the Project on wildlife by restricting certain types of recreational activities and prohibiting hunting activities by Project staff during the construction phase.</p> <p>The GNWT has committed to a series of mitigation measures related to air and noise emissions associated with the Project that would have effects on aesthetics (See Section 9.5.7.2).</p> <p>To the extent possible, plan the project alignment to avoid the base of Bear Rock (Petınırah).</p>	<p>For information about non-traditional land use, see Section 9.9.2.</p> <p>For information about non-traditional resource use including recreational uses, see Section 9.9.5.</p> <p>For information about aesthetics, see Section 9.9.4.</p> <p>For mitigation measures to reduce effects of the Project on non-traditional land access, non-traditional resource use and aesthetics, see Table 9.21.</p>
<p>Municipal staff and other affected parties provided information on community improvement initiatives that may be triggered or funded due to the Project, potential effects of the Project on recreation activities (including fishing), community access to particulate materials, as well as aesthetics.</p>	<p>October to December 2022 Engagement</p>	<p>The GNWT will develop and implement a WMMP that will include measures related to monitoring of wildlife levels, and some measures intended to mitigate adverse effects of the Project on wildlife by restricting certain types of recreational activities and prohibiting hunting activities by Project staff during the construction phase.</p>	<p>For information about non-traditional use of wildlife resources, see Section 9.9.5.</p> <p>For mitigation measures to reduce effects of the Project on non-traditional land access, see Table 9.21.</p>

9.2.3 Analytical Assessment Techniques for Socio-Economic VCs

The general approach to assessing potential effects on socio-economic VCs follows the sequence and methods outlined in Chapter 4.

All socio-economic VCs were analyzed for effects of the Project through a combination of:

- Review of comments received through engagement with Indigenous Governments, Indigenous Organizations, and other affected parties about the VC (further details on parties engaged are provided in Appendix 9A)
- Review of findings and literature from similar projects
- Review of documentation related to the legislative, regulatory and policy context for each of the socio-economic VCs (as outlined in Appendix 9A)
- Review of residual effects on other socio-economic VCs
- Review of residual effects from within the socio-economic VC
- Review of residual effects on VCs related to biophysical changes that might affect existing conditions of socio-economic VCs
- Review of residual effects on the Culture and Traditional Land Use Including Harvesting VC that might affect certain socio-economic VCs

9.2.4 Potential Effects, Pathways and Measurable Parameters

Potential effects, effects pathways and measurable parameters used to characterize and assess effects of the Project on the socio-economic VCs are listed in Section 9.4.1 through Section 9.4.5. Many of the potential effects are not discrete; in other words, one effect may influence another because of the interconnections between them. This can occur between effects that are part of the same socio-economic VC, across socio-economic VCs (e.g., employment and economy and education, training and skills), or with other VCs (e.g., culture and traditional land use and human health and community wellness).

The assessment of effects on each socio-economic VC (Sections 9.5 through 9.9) includes descriptions of how the Project might interact with socio-economic VCs and produce potential positive or adverse effects. Measurable parameters have also been identified that can be used to evaluate the effect of the Project and are included as part of the effects assessment. These parameters are measurable and quantifiable (e.g., population numbers, number of traffic accidents). However, some effects on socio-economic VCs lack defined parameters to measure effects and are therefore evaluated qualitatively based on comments received through engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, experience with similar past projects, and professional judgment.

Table 9.3 through Table 9.7 provide an overview of the potential Effects, Effects Pathways and Measurable Parameters for each of the socio-economic VCs.

9.2.4.1 Human Health and Community Wellness

Table 9.3 Potential Effects, Effects Pathways and Measurable Parameters for Human Health and Community Wellness

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in population composition and migration (in/out of communities)	<ul style="list-style-type: none"> • Increase in population during construction of the Project due to the presence of temporary construction workers and/or community members working outside of the community that can return to their community for project-related employment • Reduced out-migration due to increased employment opportunities and/or increased access to services or education opportunities within the communities during operation of the Project 	<ul style="list-style-type: none"> • Number (count) and location of construction workers from outside communities • Population trends, including in/out migration
Change in population health	<ul style="list-style-type: none"> • Increase in overall population health (preventable and chronic diseases and mental health) because of easier and lower-cost access to medical and dental care and social services during project operations • Decrease in population health (communicable diseases) due to the construction of the Project because of the increased presence of non-residents • Decrease in population health (communicable diseases) due to the operations of the Project because of the increased presence of non-residents 	<ul style="list-style-type: none"> • Health data for communicable diseases (baseline versus presence of the Project) • Changes in self-perceived physical and mental health

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Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in community/family and social ties	<ul style="list-style-type: none"> • Increased participation in regional social, recreational, and cultural events due to operation of the Project because of easier and lower-cost access all-season to other communities • Reduced sense of isolation and increased connection to families and friends due to operation of the Project because of easier and lower-cost access all-season to other communities • Reduced 'sense of community'/community cohesion due to the construction of the Project because of a potential increase in presence of non-residents (construction workers) • Reduced 'sense of community'/community cohesion due to the operations of the Project because of a potential increase in presence of non-residents (visitors, tourists) and ability of residents to spend more time outside of communities 	<ul style="list-style-type: none"> • Number (count) of people reporting ability to participate in social, recreational, and cultural events outside of their community as a result of the Project • Changes in self-perceived mental health levels • Changes in reported sense of community belonging • Self-perceived sense of community cohesion • Number (count) of community members participating in community events
Change in food security	<ul style="list-style-type: none"> • Decrease in food security related to decreased ability to access some harvesting areas or reduced access to traditional foods (e.g., wildlife such as moose, caribou and birds, vegetation) due to adverse effects of project construction • Decrease in food security related to reduced access to traditional foods (e.g., wildlife such as moose, caribou and birds, vegetation) due to adverse effects of project operations • Improved food security due to operation of the Project through all-season access to greater variety of groceries (easier to access groceries in other communities as well ability for greater variety of fresh foods to be provided all-season) • Improved food security due to operation of the Project due to increased access to traditional food sources/harvesting areas 	<ul style="list-style-type: none"> • Percentage (%) of Households "Worried Not Enough Money for Food" • Cost of food (\$) • Access to lower cost (high quality) food • Access to traditional harvesting areas (See all measures under non-traditional land and resource use, Section 9.9)

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Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in social pressures	<ul style="list-style-type: none"> • Increased drug and alcohol use and abuse in communities during construction due to presence of construction workers from outside communities and potential for increased income for community members working on the Project • Increased drug and alcohol use and abuse in communities during operation of the Project due to potential for increased income for community members working on the Project, increased presence of non-residents, and easier/lower cost access to other communities and substances • Increased rates of STIs and teen pregnancies during construction due to presence of construction workers from outside communities • Increased rates of STIs and teen pregnancies during operation of the Project due to easier access to other communities, increased potential for interactions with non-residents and visitors • Increased crime during construction due to presence of construction workers from outside communities or other non-residents • Increased crime during operation of the Project due to easier/lower cost access to illicit substances, increased potential for impaired driving and potential for increase in family dysfunction 	<ul style="list-style-type: none"> • Number (count) of drug and alcohol-related crimes • Number (count) of teen pregnancies • Number (count) of violent crimes
Change in nuisance (air quality, noise)	<ul style="list-style-type: none"> • Increase in nuisance effects (noise, dust, combustion emissions) due to construction activities and operations of the Project 	<ul style="list-style-type: none"> • Air quality (See all measures under Air Quality VC [see Chapter 12]) • Noise (See all measures under Noise VC [Chapter 13])
Change in drinking and recreational water quality	<ul style="list-style-type: none"> • Change in drinking water quality due to construction activities and operation of the Project • Change in recreational water quality due to construction and operation of the Project 	<ul style="list-style-type: none"> • Drinking water quality parameters • Water and Sediment Quality (See all measures under Water and Sediment Quality VC [Chapter 16])

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Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in public safety	<ul style="list-style-type: none"> • Reduced feeling of personal safety and security during construction due to presence of construction workers from outside communities • Reduced feeling of personal safety and security during operation of the Project due to potential increase in non-residents or visitors coming into communities all-season • Increased risk of traffic accidents all-season due to operation of the Project 	<ul style="list-style-type: none"> • Perception of personal safety (including those who may be more vulnerable such as young women, youth, 2SLGBTQQIA+ and Elders) in communities • Number (count) of traffic accidents on Project
Change in SDOH	<ul style="list-style-type: none"> • Changes to a broad range of personal, social, economic and environmental factors that determine individual and population health due to construction and operation of the Project. These may include changes to: <ul style="list-style-type: none"> – Health behaviours – Physical environments – Employment and income – Education and Education Systems – Food insecurity – Community infrastructure, resources, and capacity 	<ul style="list-style-type: none"> • Percentage (%) of Persons with Low Income • Number (count) of Income Assistance Cases • Average (count) of monthly Income Assistance Cases • Percentage (%) of Lone Parent Families • Health behaviours (See measures for ‘Change in social pressures’ [Section 9.5.6]) • Physical environments (See measures for ‘Change in housing and accommodation’ under infrastructure, services and institutional capacity [Section 9.8.2]) • Employment and income (See measures for ‘Change in employment and income’ under employment and economy [Section 9.7.2]) • Education and educational systems (See all measures under education, training and skills [Section 9.6]) • Food insecurity (See measures for ‘Change in food security’ [Section 9.5.5]) • Community infrastructure, resources, and capacity (See measures for ‘Change in business development and economic opportunities’ under employment and economy [Section 9.7.4]) • See measures of ‘Change in social infrastructure and services’ under infrastructure, services and institutional capacity (Section 9.8.3)

9.2.4.2 Education, Training and Skills

Table 9.4 Potential Effects, Effects Pathways and Measurable Parameters for Education, Training and Skills

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in level of education, certification/training and skills development	<ul style="list-style-type: none"> Change in level of education, training and skills development immediately prior to construction in anticipation of project-related employment opportunities Changes in level of education, training and skills development during operations and maintenance to support ongoing project-related employment opportunities. 	<ul style="list-style-type: none"> Percent (%) of the population with a high school diploma, certification/training or more
Change in access to education, certification/training, and skills development programs	<ul style="list-style-type: none"> Change in access to education, certification and training programs due to construction of the Project Change in access to education, certification and training programs during operations and maintenance of the Project 	<ul style="list-style-type: none"> Number (count), type and location of certification/training and skills development programs offered and accessed
Change in capacity to meet demand for education, certification and training programs	<ul style="list-style-type: none"> Change in capacity to meet demand for education, certification and training programs during the construction phase in anticipation of project-related employment opportunities Change in capacity to meet demand for education, certification and training programs during operations and maintenance due to project-related employment opportunities 	<ul style="list-style-type: none"> Number (count) and type of program registrants Number of training staff required to meet demand Number of training facilities required to meet demand

9.2.4.3 Employment and Economy

Table 9.5 Potential Effects, Effects Pathways and Measurable Parameters for Employment and Economy

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in employment and income	<ul style="list-style-type: none"> Increase in level of employment and employment opportunities associated with construction of the Project Increase in level of employment and employment opportunities due to operations of the Project and as a result of all-season and lower cost access to communities 	<ul style="list-style-type: none"> Project employment Employment/unemployment rates for Indigenous/non-Indigenous labour force participants Labour force participation rates Average annual personal income

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Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in GDP government revenues	<ul style="list-style-type: none"> • Contribution to GDP in NWT and government revenues due to construction of the Project • Contribution to GDP in NWT and government revenues due to operations of the Project 	<ul style="list-style-type: none"> • Project expenditures on goods and services • NWT GDP
Change in economic development opportunities and capacity of local businesses	<ul style="list-style-type: none"> • Increases in contracts for businesses due to construction of the Project • Increases in contracts for businesses due to operations of the Project • Changes to the nature or viability of some existing local businesses (including capacity) due to operations of the Project • Enhance opportunities for economic development (e.g., enhanced tourism, arts and crafts, and existing and new businesses) all-season in communities due to operations of the Project 	<ul style="list-style-type: none"> • Value and number of project contracts issued to local, regional and NWT businesses • Indirect economic development opportunities related to the Project
Change in cost of living and consumer prices	<ul style="list-style-type: none"> • Reduced cost of living due to operation of the Project because of reduced transportation costs to bring consumer and commercial goods, services, and materials into communities 	<ul style="list-style-type: none"> • Community and/or regional food price index • Community and/or regional living cost differentials
Change in traditional economy	<ul style="list-style-type: none"> • Change in time available to participate in traditional harvesting due to employment associated with construction of the Project • Change in time available to participate in traditional harvesting due to employment associated with or as a result of operations of the Project 	<ul style="list-style-type: none"> • Participation in hunting, fishing, trapping, gathering berries, arts & crafts • Consumption of county foods • Consumption of non-traditional foods
Change in the GNWT operations employment	<ul style="list-style-type: none"> • Increase in number of the GNWT staff due to construction of the Project • Increase in number of the GNWT staff due to operations and maintenance of the Project and decreased in number of GNWT staff to maintain the MVWR 	<ul style="list-style-type: none"> • Number and type of the GNWT human resources for the construction and operation of the Project

9.2.4.4 Infrastructure, Services and Institutional Capacity

Table 9.6 Potential Effects, Effects Pathways and Measurable Parameters for Infrastructure, Services and Institutional Capacity

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in housing and accommodation (amount and type)	<ul style="list-style-type: none"> • Increased demand for temporary accommodations due to the presence of non-resident construction workers • Change in short-term accommodation due to the operation of the Project (e.g., travelers) • Change in demand for housing due to change in resident population associated with operation of the Project 	<ul style="list-style-type: none"> • Availability, affordability, adequacy, and suitability of temporary and permanent accommodations
Change in social infrastructure and services (emergency and protective services, health services, and community services)	<ul style="list-style-type: none"> • Increased demand for social infrastructure and services by non-resident construction workers due to the construction of the Project • Increased demand for social infrastructure and services by residents of formerly 'isolated' communities due to the operations of the Project • Increased demand for emergency and protective services (e.g., increased workforce population and/or accidents during construction) due to the construction of the Project • Increased access (easier and lower cost) to social infrastructure and services due to the operation of the Project 	<ul style="list-style-type: none"> • Capacity of and demand for social infrastructure and services • Duration of disruption and number/type of services that would be disrupted (number of weeks/months in disruption)
Change in public infrastructure and services (roadways, water, sewage, waste disposal, telecom, and electricity)	<ul style="list-style-type: none"> • Change in demand for public infrastructure and services due to change in resident population and presence of non-resident construction workers required for the Project • Change in demand for public infrastructure and services due to construction of the Project • Change in demand for public infrastructure and services due to operation of the Project • Temporary disruption to public infrastructure and services due to construction of the Project 	<ul style="list-style-type: none"> • Capacity, demand and cost for public infrastructure and services • Duration of disruption and location, number and type of infrastructure and services disrupted (number of weeks/months in disruption)

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Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in institutional facilities and services (educational and cultural facilities and services)	<ul style="list-style-type: none"> • Change in demand for institutional facilities and services due to change in resident population and non-resident construction workers due to the construction of the Project • Change in demand for institutional facilities and services due to change in resident population due to the operation of the Project • Increased access (easier and lower cost) to institutional facilities and services by residents due to the operation of the Project 	<ul style="list-style-type: none"> • Capacity of, and demand for, institutional facilities and services

9.2.4.5 Non-Traditional Land and Resource Use

Table 9.7 Potential Effects, Effects Pathways and Measurable Parameters for Non-Traditional Land and Resource Use

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in non-traditional land use	<ul style="list-style-type: none"> • Change in non-traditional land use designation prior to construction due to the Project • Change in non-traditional land use due to the construction of the Project • Change in non-traditional land use due to the operation of the Project 	<ul style="list-style-type: none"> • Conformity with existing land use designations/plans • Conformity to existing/planned land uses • Area of non-traditional land use affected e.g., in the project footprint
Change in access to non-traditional land use	<ul style="list-style-type: none"> • Increase in capacity to transport goods, services, and resources due to the operation of the Project • Change in access to land and surrounding lakes/rivers, environmental and culturally sensitive areas, and between communities along the Project • Disruption of transportation/movement and temporary or permanent restrictions to access due to construction of the Project 	<ul style="list-style-type: none"> • Amount of traffic/heavy truck use • Number of newly accessible non-traditional land use activities • Number and type of non-traditional land-use activities which will experience disruption

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in aesthetics	<ul style="list-style-type: none"> • Decreased aesthetics due to construction (e.g., presence of workspaces and camps) of the Project • Decreased aesthetics due to operation of the Project 	<ul style="list-style-type: none"> • Location, number and type of non- traditional land uses altered by construction and operation of the Project
Change in non-traditional resource use (including aggregate and granular resources (e.g., sand and gravel), mineral resources, forest resources, oil and gas)	<ul style="list-style-type: none"> • Increased access to resources and resource exploration due to the operation of the Project • Increase in use of available resources for the construction of the Project • Decreased access to wildlife resources due to construction of the Project • Decreased access to wildlife resources due to operation of the Project 	<ul style="list-style-type: none"> • Area/type of resources made available • Volume/area/number of resources required to construct the Project • Type of wildlife resources

9.2.5 Boundaries

9.2.5.1 Spatial Boundaries

Potential effects of the Project on existing conditions of socio-economic VCs are not necessarily bound by or limited to a highly localized spatial location. Some potential effects of the Project are instead more appropriately determined at a community level or examined by the potential effects on certain segments of the population. For example, effects of the Project on capacity of or demand on infrastructure and services are likely to be felt community-wide and should be discussed in that context. Therefore, the spatial boundaries used to assess effects of the Project on existing conditions of socio-economic VCs, including residual and cumulative effects, includes communities within representative regions surrounding the Project.

The Project Development Area (PDA), LAA, and RAA for the assessment of effects on socio-economic VCs are described in this section and shown in Figure 9.3. It is important to note that the LAA and RAA for socio-economic VCs differ considerably from the definitions of LAA and RAA used for biophysical VCs.

- **PDA:** The area of direct project disturbance within which physical works and activities will occur (footprint). This includes a new two-lane gravel highway, 60 metres (m) wide highway right-of-way (ROW), laydown and staging areas, maintenance yards, construction camps, and quarry/borrow sources with access roads on a 30 m ROW.

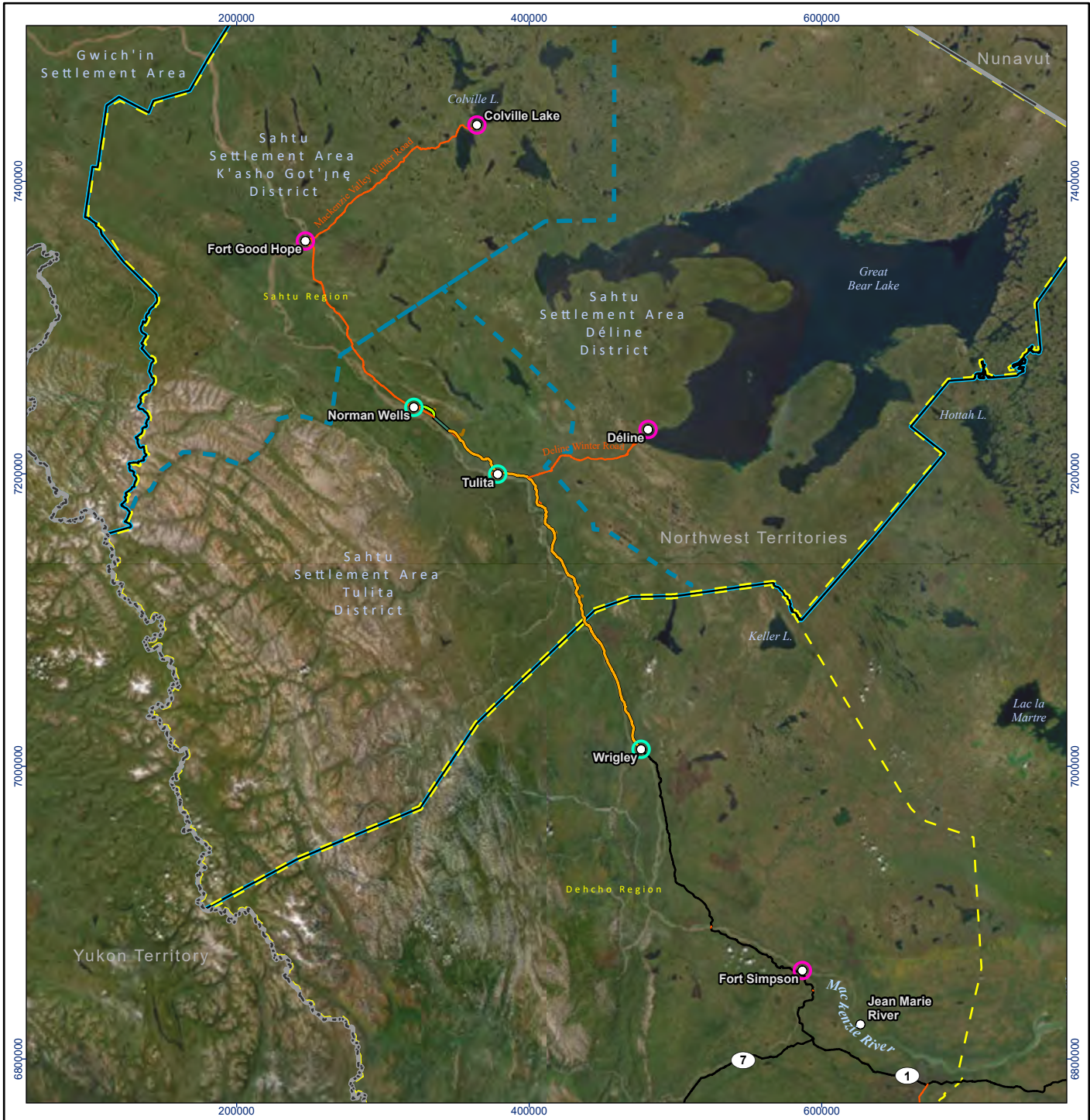
- **LAA:** The LAA is established to assess the potential direct, indirect and induced effects of the Project on the socio-economic environment for the communities to be directly connected by the Project. The LAA for socio-economic VCs consists of the communities of Wrigley, Tulita and Norman Wells.
- **RAA:** The RAA is established to assess the potential direct, indirect and induced effects of the Project on communities in the Sahtu Region outside of the LAA. The RAA includes the communities of Fort Simpson, Fort Good Hope, Délı̄ne and Colville Lake.

9.2.5.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases, which are described in more detail in Chapter 5:

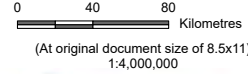
- **Construction phase:** The Project will take approximately 10 years to construct over a timeframe of up to 20 years. The conceptual schedule assumes the highway will be constructed in three consecutive segments, beginning in approximately 2027: Wrigley to the Dehcho–Sahtu border (102 km); Tulita south to the Dehcho–Sahtu border (134 km); and Tulita north to the Prohibition Creek Access Road (PCAR) (45 km). The conceptual schedule assumes the Project would be fully constructed and provide all-season connection to Norman Wells sometime between 2041 and 2046.
- **Operations and maintenance phase:** The operations and maintenance phase will commence in a staged manner once construction of each segment has been completed. The operations and maintenance phase is considered indeterminate as the highway is intended to be permanent infrastructure.

A closure and reclamation phase is not applicable to the Project. Closure and reclamation of temporary workspaces, and borrow sources and quarries used only for construction are included within the construction phase.



- Proposed Mackenzie Valley Highway Alignment
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (Permitted)
- Proposed Granular Borrow / Rock Quarry Site and Access
- Local Assessment Area
- Regional Assessment Area
- Community
- All-Season Road
- Winter Road
- District Boundary
- Region Boundary
- Settlement Area Boundary
- Territorial Boundary

Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Centre for Geomatics Government of NWT, Government of Canada, Stantec
 3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCAN
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Name: NAD 1983 UTM Zone 10N
 PCS: NAD 1983 UTM Zone 10N. Imagery date: 2021



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2022-12-16
 TR by RM on 2022-12-16

Client/Project: 144903025-0147 REVA

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No. 9.3

Socio-Economic VC Assessment Areas

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

9.2.6 Residual Effects Characterization

Table 9.8 presents definitions for the characterization of residual effects on the socio-economic VCs. Residual effects are those adverse effects that remain after mitigation measures have been implemented. Positive residual effects have been identified through the effects assessment process: they are described in the effects assessment sections (Sections 9.5 through 9.9) and summarized (in Section 9.11) but are not characterized using the framework in Table 9.8.

Table 9.8 Characterization of Residual Effects on Socio-Economic Valued Components

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	Adverse – a residual effect that moves measurable parameters of socio-economic VCs in a negative direction relative to baseline Neutral – no net change in measurable parameters for the non-traditional land and resource use relative to baseline
Likelihood	The probability that the residual effect will occur	Unlikely – the residual effect is almost certainly not to occur Possible – the residual effect could occur Certain – the residual effect will certainly occur
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	No Measurable Change – no measurable change in the VC Low – Residual effects may be noticeable and/or measurable but represent a small change relative to existing conditions. Moderate – Residual effects will adversely affect existing conditions of socio-economic VCs but represent a moderate change relative to baseline conditions. High – Residual effects will adversely affect existing conditions of socio-economic VCs to a great degree relative to baseline conditions.
Geographic Extent	The geographic area in which a residual effect occurs	PDA – Residual effects are restricted to the PDA. LAA – Residual effects extend into the LAA. RAA – Residual effects interact with those of other projects in the RAA.
Timing	Considers when the residual effect is expected to occur, where relevant to the VC	No sensitivity – residual effect is not sensitive to the timing of a project phase and/or specific project activity Sensitive – residual effect is sensitive to the timing of a project phase and/or specific project activity

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured	<p>Short-term –residual effect occurs during one segment of the construction phase, or less than 5 years</p> <p>Medium-term –residual effect extends through project construction</p> <p>Long-term –residual effect extends through project operations and maintenance</p>
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	<p>Single event</p> <p>Multiple irregular event – occurs at no set schedule</p> <p>Multiple regular event – occurs at regular intervals</p> <p>Continuous – occurs continuously</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after project activity ceases	<p>Reversible –residual effect is likely to be reversed</p> <p>Irreversible –residual effect is unlikely to be reversed</p>

9.2.7 Significance Definition

Generally speaking, an adverse residual effect is one that, following the application of mitigation measures is distinguishable from current conditions and trends and cannot be managed or mitigated through adjustments to programs, policies, plans, or through other measures.

‘Distinguishable’ means that the adverse effect is measurable, predictable, and attributable to one or more Project or cumulative interactions (i.e., it is not within the boundaries of normal variation of the measurable parameter under baseline conditions). In certain instances, and particularly for socio-economic VCs, it is not always possible to ‘measure’ changes because they are assessed in a qualitative way. Where possible, quantitative data to ‘measure’ changes are used.

In order to determine if an adverse residual effect is considered significant, a determination of significance considers:

- Measurable parameters
- Characterization of residual effects
- Magnitude, duration and reversibility of effect
- Input obtained from engagement with respect to limits of acceptable change and desired outcomes

Some specific descriptions of what is considered a significant adverse residual effect for each of the socio-economic VCs are listed in Table 9.9.

Table 9.9 Descriptions of Significant Adverse Residual Effect

Socio-economic VC	VC-Specific Description of Significant Adverse Residual Effect
Human Health and Community Wellness	The Project results in moderate (or higher) magnitude effects that cause or exacerbate adverse health and community wellness conditions, and which contribute to a long-term and/or irreversible decline in overall physical, mental and/or social health.
Education, Skills and Training	The Project results in a lack of capacity or decrease in the quality of education or training services provided.
Employment and Economy	The Project causes or leads to conditions that contribute to an overall decline in employment levels or economic activity.
Infrastructure, Services and Institutional Capacity	The Project results in a lack of available capacity, or a substantial decrease in the quality of a service provided, on a persistent and ongoing basis.
Non-Traditional Land Use	The Project does not comply with established land use plans, policies or by-laws; or The Project will create a change or disruption that restricts or degrades present land use capability to a point where the non-traditional land use activities cannot continue at or near current levels and where compensation is not possible.

Determinations of significance for residual adverse effects are provided in the Project Residual Effects section of the effects assessment for each socio-economic VC (Sections 9.5 through 9.9). An overall summary of all potential project positive effects and significance determinations for all residual adverse effects is provided in Sections 9.11 and 9.12.

9.3 Existing Conditions of Socio-Economic Condition Valued Components

9.3.1 Methods

The Existing Socio-Economic Conditions Technical Data Report (TDR) (Appendix 9C) was produced to address the ToR (MVEIRB, 2015) using a literature review of currently available information. The literature review incorporated review of information relevant to the socio-economic VCs. This was supplemented with information obtained through engagement, including through interviews with the GNWT regulators/departments/agencies, representatives of regional land and water boards, and LAA and RAA Indigenous and community representatives and other affected parties. Findings are used to characterize the existing conditions of socio-economic VCs within the LAA and RAA.

9.3.2 Overview – Local Assessment Area

The three communities in the LAA – Wrigley, Tulita, and Norman Wells – lie along the Mackenzie River (Deh Cho), hereafter referred to as Mackenzie River. Norman Wells and Tulita are within the Sahtu Region, and Wrigley is in the Dehcho Region. Brief descriptions of the existing conditions for all three communities are described in Sections 9.3.2.1, 9.3.2.2, and 9.3.2.3 and a detailed description of existing conditions for each LAA community is provided in DPRA 2023; Appendix 9C.

9.3.2.1 Wrigley (Dehcho Region)

The description of existing social and economic conditions of the community of Wrigley is based on publicly available online information and supplemented with information provided by interviews with selected regulators (GNWT staff). The GNWT did not engage with community organizations or community members in Wrigley. The GNWT has, in the interim, continued dialogue with Pehdzéh Kì First Nation leadership on approaches to facilitate a meaningful and agreeable path forward for Pehdzéh Kì First Nation's participation and remains committed to engaging with Pehdzéh Kì First Nation and Wrigley about the Project.

Wrigley (population: 126) is the smallest of the three LAA communities. Its population is 94% Indigenous (NWT Bureau of Statistics, 2022d). The community is located on the Mackenzie River, 220 km to the west (downstream) of Fort Simpson and 213 km to the south (upstream) of Tulita. It is situated at the northern termination point of the existing Mackenzie Valley Highway (Hwy 1) and has tug and barge service from mid-June to late-September. The community is a First Nations Designated Authority, administered by Pehdzéh Kì First Nation.

This mostly Indigenous community has limited community services infrastructure in comparison to the other LAA communities. Wrigley has a health cabin² with a fly-in nurse or a nurse practitioner and it also has a fire hall. It does not have its own RCMP detachment and is served by the Fort Simpson detachment. The community has one school: Chief Julian Yendo School (CJYS), which offers classes from Junior Kindergarten to Grade 9. There is no Community Learning Centre (for adult education) present in Wrigley.

In 2021, Wrigley had an employment rate of 42.1%, which is lower than the territorial average of 64.6% (Statistics Canada, 2022). Due to its small size, much of Wrigley's socio-economic statistical information has been suppressed by NWT Bureau of Statistics for data quality as well as to preserve privacy.

A detailed description of existing conditions for Wrigley is provided in DPRA 2023; Appendix 9C.

² A health cabin is the health care service provider in communities that have a population of less than 250, where services include basic assessment and treatment (source: 2022 NWT Patient Experience Report. <https://www.hss.gov.nt.ca/sites/hss/files/resources/2022-nwt-patient-experience-report.pdf>)

9.3.2.2 Tulita (Sahtu Region)

The description of existing social and economic conditions of Tulita is based on a combination of publicly available online information, and information provided by engagement with Indigenous Governments, Indigenous Organizations, and other affected parties within the community. The existing conditions information was corroborated by with Indigenous Governments, Indigenous Organizations, and other affected parties as part of the GNWT's engagement on the Project.

Tulita (population: 543) is larger than Wrigley but smaller than Norman Wells. Its population is 88% Indigenous (NWT Bureau of Statistics, 2022d). The community is located on the Mackenzie River, 213 km to the southwest (downstream) of Wrigley and 72 km to the southeast (upstream) of Norman Wells. It is accessible by road only seasonally via the MVWR (start date of December 23; end date of March 28 (20-year averages)), has tug and barge service from mid-June to late-September, and has an airport that is used all-season. The community is administered by its municipal government.

This mostly Indigenous community has a moderate quantity of services and infrastructure: it has more services available than Wrigley but fewer than Norman Wells. Health services in Tulita are delivered through the Harriet Gladue Health Centre, which is staffed with community health nurses who are supervised by a nurse in charge. The community has an ambulance to transport patients between the health centre and the airport for medevacs. The community also has a fire hall with two pumper trucks operated by volunteers and an RCMP detachment with three police officers. The community has one school: Chief Albert Wright School, which offers classes from Junior Kindergarten to Grade 12. There is also a CLC in Tulita.

In 2021, Tulita had an employment rate of 47.1%, which is lower than the territorial average of 64.6% (Statistics Canada, 2022).

A detailed description of existing conditions for Tulita is provided in DPRA 2023; Appendix 9C.

9.3.2.3 Norman Wells (Sahtu Region)

The description of existing social and economic conditions of Norman Wells is based on a combination of publicly available online information, and information provided by engagement with Indigenous Governments, Indigenous Organizations, and other affected parties within the community. The existing conditions information was corroborated by with Indigenous Governments, Indigenous Organizations, and other affected parties as part of the GNWT's engagement on the Project.

Norman Wells (population: 704) is the largest of the three LAA communities. The community's population is 37% Indigenous – which is much lower than other communities in the region (NWT Bureau of Statistics, 2022d). The community is located on the Mackenzie River, 72 km to the northwest (downstream) of Tulita. It is accessible by road only seasonally via the MVWR (start date of December 25; end date of April 1 [20-year averages]), has tug and barge service from mid-June to late-September, and has an airport that is used all-season. The community is administered by its municipal (town) government.

This community has more community services and infrastructure relative to the other two LAA communities. Health services in Norman Wells are provided by the Sahtú Got'iné Regional Health and Social Services Centre, which provides community health nursing programs, community counselling, transitional care, Elder care, long-term care, and an adult day program. Social services are provided by the Northwest Territories Health and Social Services Authority (NTHSSA); Norman Wells has mental health counsellors and social workers in the community. The community also has a fire hall equipped with two pumper trucks and one rescue truck and an RCMP detachment with three police officers. The community has one school: Mackenzie Mountain School, which offers classes from Junior Kindergarten to Grade 12. Norman Wells offers the Aurora College Adult Literacy and Basic Education program along with various other programs and training throughout the year.

In 2021, Norman Wells had an employment rate of 74.5%, which is higher than the territorial average of 64.6% (Statistics Canada, 2022). Norman Wells is unique in the region, with a long operating petroleum extraction industry.

A detailed description of existing conditions for Norman Wells is provided in Appendix 9C (DPRA, 2023).

9.3.3 Overview – Regional Assessment Area

There are four communities in the RAA: Fort Simpson in the Dehcho Region, and Délı̄nę, Colville Lake, and Fort Good Hope in the Sahtu Region. Brief descriptions of the existing conditions within the four communities that consist of the socio-economic RAA are described in Sections 9.3.3.1 through 9.3.3.4. A detailed description of the existing conditions for each RAA community is provided in Appendix 9C (DPRA 2023).

9.3.3.1 Fort Simpson (Dehcho Region)

The description of existing social and economic conditions of Fort Simpson is based on a combination of publicly available online information, and information provided by engagement with Indigenous Governments, Indigenous Organizations, and other affected parties within the community. The existing conditions information was corroborated by with Indigenous Governments, Indigenous Organizations, and other affected parties as part of the GNWT's engagement on the Project.

Fort Simpson (population: 1,230) is the largest of the four RAA communities. Its population is 72% Indigenous (NWT Bureau of Statistics, 2022d). The community is located on the Mackenzie River, 220 km to the southeast (upstream) of Wrigley. It is situated on the existing Hwy 1, has tug and barge service from mid-June to late-September, and has an airport that is used all-season. The community is administered by its municipal government.

This mostly Indigenous community has more community services infrastructure relative to the other three RAA communities. Fort Simpson has a health centre, a fire hall (with two ambulances, two engines, one rescue truck, and a fire chief pickup truck) and an RCMP detachment with six

police officers. The community has two schools: Łíídlı́ Kúćé Elementary School, which offers classes from Junior Kindergarten to Grade 6; and Łíídlı́ Kúćé Regional High School, which offers classes from Grade 7 to Grade 12. There is also a CLC in Fort Simpson that offers Adult Literacy and Basic Education.

In 2021, Fort Simpson had an employment rate of 58.2%, which is lower than the territorial average of 64.6% (Statistics Canada, 2022).

A detailed description of existing conditions for Fort Simpson is provided in Appendix 9C (DPRA 2023).

9.3.3.2 Dólı́ne (Sahtu Region)

The description of existing social and economic conditions of Dólı́ne is based on a combination of publicly available online information, and information provided by engagement with Indigenous Governments, Indigenous Organizations, and other affected parties within the community. The existing conditions information was corroborated by with Indigenous Governments, Indigenous Organizations, and other affected parties as part of the GNWT's engagement on the Project.

Dólı́ne (population: 633) is a medium-sized RAA community. Its population is 92% Indigenous (NWT Bureau of Statistics, 2022d). The community is located on the western shore of Great Bear Lake and is situated 106 km to the east of Tulita. It is accessible by road only seasonally via the Dólı́ne winter access road that links to the MVWR near Tulita (start date of January 15; end date of March 31 [20-year averages]) and has an airport that is used all-season. The community is administered by the self-governing Dólı́ne Got'ı́ne Government.

This mostly Indigenous community has a moderate quantity of services and infrastructure similar to that of Tulita and Fort Good Hope: more than Colville Lake but less than Fort Simpson. Dólı́ne has a health centre, a fire hall and an RCMP detachment with three police officers. The community has one school: ʔehtseo Ayha School, which offers classes from Junior Kindergarten to Grade 12. There is a CLC in Dólı́ne that offers Adult Literacy and Basic Education.

In 2021, Dólı́ne had an employment rate of 43.7%, which is lower than the territorial average of 64.6% (Statistics Canada, 2022).

A detailed description of existing conditions for Dólı́ne is provided in Appendix 9C (DPRA 2023).

9.3.3.3 Colville Lake (Sahtu Region)

The description of existing social and economic conditions of Colville Lake is based on a combination of publicly available online information, and information provided by engagement with Indigenous Governments, Indigenous Organizations, and other affected parties within the community. The existing conditions information was corroborated by with Indigenous Governments, Indigenous Organizations, and other affected parties as part of the GNWT's engagement on the Project.

Colville Lake (population: 161) is the smallest of the four RAA communities. Its population is 90% Indigenous (NWT Bureau of Statistics, 2022d). The community is located on the shore of Colville Lake, 142 km to the northeast of Fort Good Hope. It is accessible by road only seasonally via the Colville Lake winter road that links to the MVWR at Norman Wells (start date of December 27; end date of April 1 [20-year averages]) and has an airport that is used all-season. The community is a First Nations Designated Authority, administered by the Behdzi Ahda band government.

This mostly Indigenous community has limited infrastructure in comparison to the other RAA communities. Colville Lake has a health cabin which has three non-medical staff who are based in the community and has visiting nurses and doctors. The community does not have either a fire hall or its own RCMP detachment. The community has one school: Colville Lake School, which offers classes from Junior Kindergarten to Grade 12. There is no CLC present in Colville Lake.

In 2021, Colville Lake had an employment rate of 47.1%, which is 20 percentage points lower than the territorial average of 64.6% (Statistics Canada, 2022). Due to its small size, much of Colville Lake's socio-economic statistical information has been suppressed by NWT Bureau of Statistics and Statistics Canada for data quality and privacy concerns.

A detailed description of existing conditions for Colville Lake is provided in Appendix 9C (DPRA 2023).

9.3.3.4 Fort Good Hope (Sahtu Region)

The description of existing social and economic conditions of Fort Good Hope is based on a combination of publicly available online information, and information provided by engagement with Indigenous Governments, Indigenous Organizations, and other affected parties within the community. The existing conditions information was corroborated by with Indigenous Governments, Indigenous Organizations, and other affected parties as part of the GNWT's engagement on the Project.

Fort Good Hope (population: 628) is a medium-sized RAA community. Its population is 92% Indigenous (NWT Bureau of Statistics, 2022d). The community is located on the Mackenzie River, 136 km to the northwest (downstream) of Norman Wells. It is accessible by road only seasonally along the Colville Lake winter road that links to the MVWR at Norman Wells. It also has tug and barge service from mid-June to late-September and has an airport that is used all-season. The community is administered as a Charter Community.

This mostly Indigenous community has a moderate quantity of services and infrastructure: more than Colville Lake but less than Fort Simpson. Fort Good Hope has a health centre, a fire hall and an RCMP detachment with five police officers. The community has one school: Chief T'Selehye School, which offers classes from Junior Kindergarten to Grade 12. There is a CLC in Fort Good Hope that offers Adult Literacy and Basic Education.

In 2021, Fort Good Hope had an employment rate of 50.6%, which is lower than the territorial average of 64.6% (Statistics Canada, 2022).

A detailed description of existing conditions for Fort Good Hope is provided in Appendix 9C (DPRA 2023).

9.4 Project Interactions with the Socio-Economic Valued Components

The Project is anticipated to interact with each VC within the socio-economic environment in unique ways. Project effects can be generally described as direct, indirect or induced.

A direct effect is characterized by an interaction that occurs at the same time and place and exhibits no intermediate effects. An indirect effect is characterized by an interaction that occurs at a later time and space and with intermediary steps. An induced effect refers to an effect that may be attributable in part to the Project.

The three communities in the LAA are more likely than RAA communities to experience direct effects of the Project on socio-economic VCs because of their proximity to construction sites and the Project itself. Although some direct effects are possible for communities in the RAA, they may be different or reduced in nature due to these communities being located farther away from the construction sites and location of the Project or already having all-season road access. For example, communities in the RAA may have the opportunity for direct positive effects on employment and economy through contracts and jobs being available to residents/businesses in the RAA communities as well as the LAA communities.

The LAA community of Tulita will have all-season road access as a result of project operations and any effects associated with such road access will affect this community directly or more strongly than those in the RAA. Wrigley currently has all-season road access to the south via Hwy 1 and so of the three LAA communities, effects associated with all-season road access may be lesser in Wrigley compared to Norman Wells and Tulita.

Of the four communities in the RAA, three (Fort Good Hope, Délı̄nę and Colville Lake) do not currently have all-season road access, and this will not change as a result of the Project as they are not located on the proposed route of the Project. These three RAA communities will continue to have seasonal access via the MVWR. Fort Simpson currently has all-season road access (from the south, and north to Wrigley), and this may mean that any effects that occur as a result of the Project may be different for Fort Simpson than for the communities of Fort Good Hope, Délı̄nę or Colville Lake.

Some of the other effects that arise from all-season access, such as increased access to services, employment and social/recreational activities, may be less in the RAA than in the LAA. It is anticipated that the RAA communities may experience some benefits from the Project as a result of being closer to an all-season road, even if they will not be directly connected to an all-season road. There may be changes in the nature of how existing all-season road access is used by residents of Fort Simpson given that it already has all-season road access and the Project would extend all-season access further north of Wrigley to LAA communities.

The remainder of the section provides further highlights of the anticipated interactions between project activities and each of the VC effects (see Section 9.2.4). Summary tables have also been prepared to describe the interactions of project activities with socio-economic effects: they are provided in Appendix 9B. Detailed discussions of the effects of the Project on each VC are provided in Sections 9.5 through 9.9.

9.4.1 Human Health and Community Wellness

The Project is expected to affect human health and community wellness during both the construction and operations and maintenance phases. It is anticipated that several of the potential effects related to human health and community wellness will be linked to changes in access in and out of communities and increased interactions with and presence of non-residents or visitors. These changes are expected to produce a number of interrelated potential effects including increased rates of communicable diseases (e.g., COVID-19, STIs), increased crime and accident rates, pressure on hunting or fishing areas, decreased community cohesion or sense of community belonging, and increased drug and alcohol use and abuse. Many of these changes would be considered indirect rather than being directly linked to particular project activities during construction or operations. There are some changes in nuisance (increased air and noise emissions), which are directly linked to specific project activities during the construction and/or operations and maintenance phase.

There are several positive effects expected during the operations and maintenance phases of the Project. It is expected that the construction of the Project will positively benefit overall population health by increasing access to medical and dental care for communities. The operations and maintenance phase of the Project may also increase participation in regional social, recreational and cultural events while also increasing access to some harvesting and hunting areas.

Table 9B.1 describes the interactions of project activities with human health and community wellness VC, see Appendix 9B.

9.4.2 Education, Training and Skills

The Project is expected to affect levels of education among community members living in those communities directly affected by construction and operations and maintenance of the Project. The construction phase is likely to have a greater effect on education levels than the operations and maintenance phase. In addition, the completed Project may result in slightly increased use of education, certification and training programs as two of the three communities in the LAA (Tulita and Norman Wells) become connected all-season to Yellowknife (in the case of Norman Wells, this is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project). Community members may seek training to take advantage of employment/contracting opportunities associated with the construction or operations and maintenance phases. The increase in access may be more fully realized upon project completion, thus the increase stands to be the greatest during the operations and maintenance phase.

The Project is also expected to have an effect on the demand for educational programming, certification and training to access employment opportunities associated with the Project. Demand for educational programming and training is expected to also affect the capacity of existing education institutions (Aurora College CLCs).

In terms of physical activities during the construction and operations and maintenance phases, it is anticipated that only activities associated with employment and contracted goods and services, and operation of the Project will affect education, training and skills.

Table 9B.2 describes the interactions of project activities with education, training and skills VC, see Appendix 9B.

9.4.3 Employment and Economy

Project-related effects can influence employment and economy directly or indirectly and positively or adversely. Some interactions may positively affect certain kinds of employment or economic measures during the construction phase of the Project (e.g., expenditures by the Project on goods and services, project construction contracts to local, regional or NWT businesses), but not during the operations and maintenance phase; while others may only have a positive effect during the operations and maintenance phase (e.g., cost of living index). Some interactions may have varying degrees of adverse effects in both the construction and operations and maintenance phases (e.g., changes in the traditional economy as a result of interrupted or less time available to harvest traditional foods, which may be more adverse during project construction than during operations and maintenance of the Project) while others may have varying degrees of positive effects in both phases (e.g., NWT GDP, Project employment).

Table 9B.3 describes the interactions of project activities with the employment and economy VC, see Appendix 9B.

9.4.4 Infrastructure, Services and Institutional Capacity

Project-related effects can influence infrastructure, services and institutional capacity directly or indirectly and positively or adversely. Some interactions may adversely affect certain kinds of infrastructure, services and institutional capacity (e.g., in pressure/use of municipal utilities, demands on social infrastructure) while some other interactions may be positively affected (e.g., increased access to health care services). During the construction phase of the Project, the influx of non-resident populations to communities can be expected to put pressure on existing health and judicial infrastructure, while local populations seeking education and training for construction jobs can be expected to put pressure on community educational infrastructure. During the operations and maintenance phase, changes in resident mobility and the local economy may change the demands on various forms of infrastructure, including recreational facilities, and may produce opportunities for expansion and additions to infrastructure within the communities.

Table 9B.4 describes the interactions of project activities with infrastructure, services and institutional capacity VC, see Appendix 9B.

9.4.5 Non-Traditional Land and Resource Use

Project-related effects can influence non-traditional land and resource use directly or indirectly and positively or adversely. Most interactions may affect non-traditional land and resource use adversely during the construction phase of the Project, due to potential disruptions to the environment and to existing land and river transportation corridors. Most interactions may affect non-traditional land and resource use positively during the operations and maintenance phase, due to the Project's effect on increasing convenience and profitability for developing mineral, oil, and gas resources as well as non-extractive industries (e.g., tourism) in the region.

Employment and contracted goods and services activities are not expected to interact with non-traditional land and resource use during the Project's construction phase, because there is no pathway for these activities to affect non-traditional land and resource use; however, during the operations and maintenance phase, change in resource use (e.g., increased tourism-related recreation business activity) can be anticipated.

Table 9B.5 describes the interactions of project activities with non-traditional land and resource use VC, see Appendix 9B.

9.5 Assessment of Potential Effects on Human Health and Community Wellness

Based on project interactions with the socio-economic environment identified in Table 9B.1 (Appendix 9B), the Project may affect human health and community wellness by exacerbating existing health inequities or creating new inequities and unhealthy behaviours.

Health equity is created when all people in a community or population can reach their fullest health potential, and no one is disadvantaged from achieving this due to their social position or circumstances. When looking at potential adverse effects of the Project, a health equity lens was applied to determine if there were sections of the population/community which, by virtue of their circumstances, may be disadvantaged disproportionately by the Project, or would not benefit from the Project in the same way or to the same degree as other segments of the population/community. For example, when considering positive effects that may result from being able to leave communities all-season by road to obtain supplies or access services, it is important to acknowledge that some people may not be able to take advantage of this potential benefit for a variety of reasons such as lack of access to transportation, lack of adequate funds or income, lack of childcare or other supports. The importance of achieving equity in health outcomes has been recognized by the GNWT HSS as part of the strategic priorities for the NWT health and social services system and includes focusing on delivery of culturally safe and relationship-based health and social services and work to reduce systemic racism through cultural safety and anti-racism training and related efforts (GNWT 2022).

When working in Indigenous communities one critical inequity to consider is the effect of colonialism and intergenerational trauma, including those related to residential schools. Incorporating considerations of the effects of colonialism and systemic racism are also aligned with components of the GNWT's broader response related to implementing the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), the Truth and Reconciliation Calls to Action and efforts that the GNWT is undertaking through its Workplan to Address the Calls for Justice following the final report on the *National Inquiry into Missing and Murdered Indigenous Women and Girls* (GNWT 2021d). Youth, women, and 2SLGBTQIA+ persons are often identified as vulnerable in relation to infrastructure projects like the Project, especially in remote or isolated communities and/or in Indigenous communities. While designed to be self-contained and provide all facilities needed by temporary workers (food, accommodations, administration, and others), the creation of camps for construction workers and the increased access of outsiders/transient workers to community, as is proposed for the Project, has been linked to higher rates of sexual assault/harassment, STIs and drug and alcohol use which can disproportionately affect young women and girls (Gibson 2017). When determining appropriate mitigation for adverse effects of the Project that have been identified in the socio-economic VCs and the need for monitoring, health equity considerations have been considered as part of that process.

Potential effects, effect pathways and mitigation measures proposed to reduce or eliminate the effects on human health and community wellness are summarized in Table 9.10. Details on the potential effects anticipated in both the operations and maintenance phases of the Project and mitigations follow the table, along with a description of residual effects that remain once mitigation measures have been applied, and in cases where the residual effects are adverse, a determination of significance of the residual adverse effects is included.

It should be noted that many of the potential effects of the Project are interconnected and as such, the measurable parameters that have been identified for certain effect pathways may in some cases have some connection to other effects pathways. For example, increases in drug and alcohol use, and increases in STI rates have been identified as measurable parameters related to changes in social pressures. Section 9.5.6, Social Pressures, contains the detailed analysis and effects assessment using these parameters. It is recognized that such parameters have use as a barometer of overall population health. However, for the purposes of the effects assessment, measurable parameters are limited to inclusion with one effects pathway. As appropriate, interconnections and linkages between effects of the Project and between socio-economic VCs are highlighted in the text, with appropriate references to particular sections of Chapter 9.

Table 9.10 Potential Effects and Mitigation Measures for Human Health and Community Wellness

Effect Name	Effect Pathway	Mitigation Measures
Change in population composition and migration (in/out of communities)	<ul style="list-style-type: none"> • Increase in population during construction of the Project due to the presence of temporary construction workers and/or community members working outside of the community that can return to their community for project-related employment • Reduced out-migration due to increased employment opportunities and/or increased access to services or education opportunities within the communities during operation of the Project 	<ul style="list-style-type: none"> • Project effects are positive so no mitigation is required. However, the GNWT will develop and implement a Contractor Training and Employment Plan which includes a series of measures intended to slow out-migration and increase employment in LAA and RAA communities. These will enhance the positive effects of the Project on local employment that would affect population composition and migration.
Change in population health	<ul style="list-style-type: none"> • Increase in overall population health (preventable and chronic diseases and mental health) will likely occur because of additional ways to seek easier and lower-cost access to medical and dental care and social services during project operations • Decrease in population health (increased communicable diseases) due to the construction of the Project because of the increased presence of non-residents • Decrease in population health (increased communicable diseases) due to the operations of the Project because of the increased presence of non-residents 	<ul style="list-style-type: none"> • The effects of the Project on overall population health as a result of all-season road access via the Project are positive and so no mitigation is required. • The GNWT will develop and implement a Well-Being Adaptive Management Plan that includes measures specifically targeted towards addressing adverse effects of the Project in the areas of community wellness and community services. These measures will expand health and wellness programming in response to monitoring results and also identify vulnerable population needs to ensure they are considered. The plan will also review existing uses, gaps in and demands on health and social services and where adverse effects of the Project are exacerbating such issues, identify program and service needs.
Change in community/ family and social ties	<ul style="list-style-type: none"> • Increased participation in regional social, recreational, and cultural events due to operation of the Project, once operational, because of easier and lower-cost access all-season to other communities • Reduced sense of isolation and increased connection to families and friends due to operation of the Project, once operational, because of easier and lower-cost access all-season to other communities 	<ul style="list-style-type: none"> • The increased participation in events and reduced sense of isolation that are due to the operation of the Project are positive effects and do not require mitigation. • For the adverse effects of the Project associated with an increase in non-residents that may affect community cohesiveness or sense of belonging, there are a series of mitigation measures across the plans contained in the Community Readiness Strategy (Section 9.16.2) that have been identified.

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Effect Name	Effect Pathway	Mitigation Measures
Change in community/family and social ties (cont'd)	<ul style="list-style-type: none"> • Reduced 'sense of community'/community cohesion due to the construction of the Project because of a potential increase in presence of non-residents (construction workers) • Reduced 'sense of community'/community cohesion due to the operations of the Project because of a potential increase in presence of non-residents (visitors, tourists) and ability for residents to spend more time outside of communities 	<ul style="list-style-type: none"> • The GNWT will develop and implement a Contractor Training and Employment plan, which includes measures to increase LAA and RAA employment and minimize non-resident contractors. The GNWT will also develop and implement a Safety and Security Plan for Vulnerable Community Members that includes measures related to safety and security and mental health intended to address safety issues related to non-residents, recognizing the disproportionate effect that may be experienced by vulnerable communities. • The GNWT will develop and implement a Well-Being and Adaptive Management Plan that includes measures in the area of community safety and community wellness that can respond to adverse effects of the Project associated with increased access by non-residents that result in safety or mental health effects related to community cohesiveness and a sense of belonging.
Change in food security	<ul style="list-style-type: none"> • Decrease in food security related to decreased ability to access some harvesting areas or reduced access to and availability of traditional foods (e.g., wildlife such as moose, caribou and birds, vegetation) due to adverse effects of project construction • Decrease in food security related to reduced access to and availability of traditional foods (e.g., wildlife such as moose, caribou and birds, vegetation) due to adverse effects of project operations • Improved food security due to operation of the Project, once operational, through all-season access to greater variety of groceries (easier to access groceries in other communities as well ability for greater variety of fresh foods to be provided all-season) 	<ul style="list-style-type: none"> • Improved food security associated with project operation providing all-season access to a greater variety of food and increased access to traditional food sources are a positive effect and do not require mitigation. • For adverse effects of the Project on wildlife that leads to decreased access to harvesting areas or traditional foods, the GNWT has committed to the development and implementation of a WMMP that includes measures intended to mitigate adverse effects on wildlife: • Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities, in accordance with the WMMP.

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Effect Name	Effect Pathway	Mitigation Measures
Change in food security (cont'd)	<ul style="list-style-type: none"> • Improved food security due to operation of the Project, once operational, due to increased access to traditional food sources/harvesting areas 	<ul style="list-style-type: none"> • The GNWT will work with the Sahtu Renewable Resources Board (SRRB) and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization. • Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project. • Personnel will not feed, harass, or hunt wildlife while working on the Project. • The GNWT will develop and implement a Well-Being Adaptive Management Plan that includes measures to ensure that changes in food security do not disproportionately affect vulnerable populations.
Change in social pressures	<ul style="list-style-type: none"> • Increased drug and alcohol use and abuse in communities during construction due to presence of construction workers from outside communities and potential for increased income for community members working on the Project • Increased drug and alcohol use and abuse in communities during operation of the Project due to potential for increased income for community members working on the Project, increased presence of non-residents, and easier/lower cost access to other communities and substances • Increased rates of STIs and teen pregnancies during construction due to presence of construction workers from outside communities • Increased rates of STIs and teen pregnancies during operation of the Project due to easier access to other communities, increased potential for interactions with non-residents and visitors 	<ul style="list-style-type: none"> • The GNWT will develop and implement a Safety and Security Plan for Vulnerable Community Members that includes measures related to public safety, health and wellness programming and services that are intended to mitigate the adverse effects of the Project on drug and alcohol abuse, sexual health and associated crime and safety levels. • The GNWT will develop and implement a Well-Being Adaptive Management Plan that includes measures in the areas of community wellness, community services and substance abuse and bootlegging, which are intended to mitigate the adverse effects of the Project on social pressures.

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Effect Name	Effect Pathway	Mitigation Measures
Change in social pressures (cont'd)	<ul style="list-style-type: none"> • Increased crime during construction due to presence of construction workers from outside communities or other non-residents • Increased crime during operation of the Project due to easier/lower cost access to illicit substances, increased potential for impaired driving and potential for increase in family dysfunction. 	
Change in nuisance (air quality, noise)	<ul style="list-style-type: none"> • Increase in nuisance effects (noise, dust, combustion emissions) due to construction activities and operation of the Project 	<p>The GNWT has committed to a series of measures to mitigate the Project's adverse effects on air quality and noise levels (see Chapter 12 and Chapter 13 for assessment of air quality and noise), which would in turn have an adverse impact on nuisance levels.</p> <p>For air quality:</p> <ul style="list-style-type: none"> • A dust control program will be implemented during construction, operations and maintenance. Where applicable, dust suppression will follow the GNWT Guideline for Dust Suppression. • Cold starts of equipment will be limited to the extent possible. • Incinerators will be operated in accordance with manufacturer's specifications and emissions will meet Canadian Council of Ministers of the Environment Canada Wide Standards for Dioxins & Furans and Mercury. • Road surfaces will be repaired and maintained to reduce rolling resistance of vehicles. • The contractor will be encouraged to use modern construction equipment that has lower GHG emissions. • The contractor will be encouraged to use passenger vehicles (e.g., passenger van or bus) to move crews. • Vehicles and equipment will be maintained regularly.

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Effect Name	Effect Pathway	Mitigation Measures
<p>Change in nuisance (air quality, noise) (cont'd)</p>		<p>For noise levels:</p> <ul style="list-style-type: none"> • GNWT will engage with communities to inform them of the activities and the noise sources that will occur prior to construction. • Blasting activities will be limited to daytime hours to the extent practical. • Communities will be informed of time periods and characteristics of noise that may exceed the recommended noise threshold. • Methods to reduce the powder factor will be considered (e.g., through a combination of increased hole spacing, decreased column height of explosives, increased depth of stemming material in the blasthole, variable diameter blastholes) to reduce noise. • Project vehicles will avoid the use of residential roads, where possible. • The use of modified blasting techniques will be considered to reduce noise, including: use of electronic detonation instead of explosive detonation cord; use of air decking which involves the use of an inverted cone in the blasthole to constrain energy within the rock mass; timing sequence to develop an echelon effect; and, coordinating blast patterns towards a partially open face. • Transportation of construction materials and equipment via barge will be used to reduce the number of trucks for construction resupply along the Mackenzie Highway (Highway No. 1). • Use of residential roads by construction equipment will be limited, where possible. • Vehicles and equipment will be equipped with manufacturer recommended noise muffling equipment.

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Effect Name	Effect Pathway	Mitigation Measures
Change in drinking and recreational water quality	<ul style="list-style-type: none"> • Change in drinking water quality due to construction activities and operation of the Project. • Change in recreational water quality due to construction and operation of the Project. 	<ul style="list-style-type: none"> • The GNWT will develop and implement the following plans: <ul style="list-style-type: none"> – A project-specific Erosion and Sedimentation Control Plan (ESCP) will be developed and implemented. – A project-specific PPP will be developed and implemented. • Erosion and sedimentation control measures will be regularly inspected and maintained. Sediment and erosion control measures will be regularly inspected to confirm they are performing as intended (see Chapter 16 for assessment of water and sediment quality).
Change in public safety	<ul style="list-style-type: none"> • Reduced feeling of personal safety and security during construction due to presence of construction workers from outside communities • Reduced feeling of personal safety and security during operation of the Project due to potential increase in non-residents or visitors coming into communities all-season • Increased risk of traffic accidents all-season due to operation of the Project 	<ul style="list-style-type: none"> • The GNWT will develop and implement a Road Safety Plan to mitigate safety issues that arise as a result of both construction and operation of the Project. This includes measures related to increased traffic and all-season access that will arise when the Project is operational. • The GNWT will develop and implement a Safety and Security Plan for Vulnerable Community Members that includes measures intended to address adverse effects that Project may have on the safety of vulnerable populations (e.g., women and girls, 2SLGBTQQIA+ persons, Elders), given that they are more likely to be disproportionately affected. • Both plans include measures related to driving and using the Project but also measures related to increased access and exposure to non-residents as a result of the construction or operation of the Project.

Effect Name	Effect Pathway	Mitigation Measures
Change in SDOH	<ul style="list-style-type: none"> • Changes to a broad range of personal, social, economic and environmental factors that determine individual and population health due to construction and operation of the Project. These may include changes to: <ul style="list-style-type: none"> – Health behaviours – Physical environments – Employment and income – Education and Education Systems – Food insecurity – Community infrastructure, resources, and capacity 	<ul style="list-style-type: none"> • The GNWT has committed to develop and implement a Community Readiness Plan that includes several interconnected plans that are intended to address the adverse effects of the Project. Given the overlap in the other potential effects of the Project described in the human health and community wellness section with SDOH, no specific mitigations have been identified for this effect, as they are more fully described in other sections of Section 9.5.

Each section of the assessment of potential effects includes mitigation sections with more detailed information on specific measures and commitments, and a full summary of the mitigation measures and commitments that are part of the Community Readiness Strategy is available in Section 9.16.1, and a full summary of additional mitigations and commitments is provided in Section 9.16.3.

9.5.1 Summary of Engagement Findings on Human Health and Community Wellness

Engagement with Indigenous Governments, Indigenous Organizations, and other affected parties in both the LAA and RAA communities included discussions on the Project’s potential effects on human health and community wellness. Potential effects of the Project on human health and community wellness were of high interest to those who participated in engagement. Information on overall engagement efforts related to the Project are contained in Chapter 2.

Many potential positive effects of the Project including better physical and mental health outcomes associated with being able to access health services, the ability to visit friends and family, participate in events, reduced isolation and access goods and supplies (including food). Increased access to traditional hunting and fishing areas were linked to the ability of residents in the LAA communities to be able to travel by road between LAA communities and to other larger centres on an all-season basis.

Residents from the RAA communities commented that many of these potential effects would extend to some extent to their communities by virtue of being closer to communities that were connected to all-season road infrastructure. Members from both RAA and LAA communities spoke about the Project increasing the ability of youth to participate in social and sporting events outside of their home community.

A number of potential adverse effects associated with the Project were identified. Many adverse effects are linked to increased access by and interactions with non-residents entering communities, including non-resident workers during construction, and visitors, tourists and transient workers

once the Project is operational. Potential effects as a result of increased access by non-residents included increased rates of communicable diseases (e.g., COVID-19, STIs), increased crime and accident rates, pressure on hunting or fishing areas, decreased community cohesion or sense of community belonging, and increased drug and alcohol use and abuse.

Most LAA and RAA representatives indicated that drugs and alcohol were already present in their communities, and addiction is already a serious existing issue. These community members indicated that the Project is likely to exacerbate drug and alcohol use and abuse as a result of all-season road access facilitating access to communities and community members by non-residents and community members being able to obtain drugs and alcohol from sources outside the community. Representatives also noted the link of increased drug and alcohol use to other social issues such as increases in crime rates, family violence, vehicle accidents, pressure on health services and decreases in family or social cohesion and personal safety. Concerns were also expressed about potential adverse effects related to safety on the all-season road, including increased accidents, and increased opportunities for women and youth to be at risk of violent crimes such as kidnappings or sexual assault, especially for sex workers.

In summary, while individuals identified a number of potential positive effects as a result of the Project, a number of serious concerns and potential adverse effects were also raised. Many individuals from the LAA communities, and several from RAA communities indicated there was a need for communities to have the time to prepare for the Project. This would provide opportunities to put measures in place that will support the realization of potential positive effects of the Project, and reduce the potential adverse effects. Interviewees also noted that the current service gaps related to health, emergency and project safety services needed to be addressed prior to the demands from project construction or operations and maintenance becoming a reality and potentially exacerbating the effects these gaps have on communities.

Additional details of engagement are integrated into Sections 9.5.2 to 9.5.10.

9.5.2 Change in Population Composition and Migration

9.5.2.1 Effects Pathways

The potential effect of the Project on change in population composition and migration has two effects pathways that have been identified:

- Increase in population during construction of the Project due to the presence of temporary construction workers and/or community members working outside of the community that can return to their community for project-related employment.
- Reduced out-migration due to increased employment opportunities and/or increased access to services or education opportunities within the communities during operation of the Project.

9.5.2.1.1 Construction

Increase in population during construction of the Project due to the presence of temporary construction workers

The population of the LAA and RAA communities, in general, is mostly Indigenous and has increased in recent years. Norman Wells is the exception, with a mostly non-Indigenous population and a decreasing in overall population in recent years. Most LAA communities are projected to experience a population decrease between 2022 and 2037, while Norman Wells is projected to increase in population during the same projected time period. Details of population composition are provided in Appendix 9C, Section 5.5.

It is assumed that two dedicated Project construction camps would be established for each Project segment, which would house non-resident construction workers (see Section 9.7.2 and Chapter 5 for further details on project labour camps). As outlined in the Project Description (Chapter 5), no locations have been confirmed for these camps, but could include:

- Existing camp facilities within Norman Wells
- Dedicated camp locations within municipal boundaries of Norman Wells, Tulita and/or Wrigley
- Locations outside of municipal boundaries such as at one or more borrow sources or quarries to be accessed from the MVWR, including Source 9.002 near Big Smith Creek

It is estimated that a construction workforce of 40 to 70 persons per crew will be required for the Project, with two crews per project segment, working on a rotational basis, over the construction phase. Each construction camp will consist of mobile trailers for accommodations, office, kitchen, laundry and washroom facilities, and first aid facilities. Each camp will include parking for light vehicles, waste transfer, and temporary waste management facilities. Camps are assumed to supply their own heating and power for lighting and auxiliary equipment using diesel fueled generators and heaters. Given this, it is not anticipated that communities in the LAA or the RAA will experience measurable short-term increases in population as a result of non-resident construction workers requiring accommodation or housing. In Norman Wells, engagement participants asked that consideration be given to repurposing construction camps to provide housing given the ongoing need for housing in the community.

It is possible that outside construction workers will visit/access communities for recreation purposes or for other services on a time-limited or short-term basis that will not have an effect on population levels. However, such visits/access may have effects on human health and community wellness, many of which were identified as being potentially adverse. During engagement in Tulita, participants indicated that they did not want camps within the community in part because of the potential increase in visits or increased access by non-resident construction workers and that this was a safety concern. These other potential effects and effect pathways are described in more detail in later sections of the human health and community wellness effects assessment including Population Health, (Section 9.5.3), Community/Family and Social Ties (Section 9.5.4), Social Pressures (Section 9.5.6) and Public Safety (Section 9.5.9).

Increase in population during construction of the Project due to community members working outside of the community that can return to their community for project-related employment

An increase in population levels during construction of the Project may occur, stemming from a greater retention or return of local residents to their home communities. The Project Description (Chapter 5) has estimated the direct construction workforce for the Project, including the number of construction personnel, supervisors, environmental / wildlife monitors, camp services personnel and construction administration and management personnel. More information on the potential employment and income effects of the Project can be found in Section 9.7.2.

Construction will take place over approximately 10 years and be completed in three different segments with two years between each segment over a total time period of 20 years. Construction work is also likely to be seasonal in nature and the positions will not be permanent. Given the nature of the employment positions, the number of jobs and the 10-year time frame over which those jobs are anticipated to be available (i.e., not all positions will be hired at the same time) it is not anticipated that large numbers of former residents will return to communities to take on Project related employment (see Section 9.7.2 for discussion of employment).

Reduced out-migration due to increased employment opportunities and/or increased access to services or education opportunities within the communities during operation of the Project

In the absence of the Project, both Tulita and Wrigley are forecasted to see future population declines by 2037 (4% and 11%, respectively). This is a reversal of the trend in these communities over the past five years, which has seen small increases in population in each community since 2018. By comparison, Norman Wells has shown a year over year decrease in population since 2018, but forecasts a population increase of almost 7% by 2037³ (Northwest Territories Bureau of Statistics, 2023: Population Projections by Community, 2018 to 2037).

Decreases in population levels can be driven by a number of factors, including demographics (aging populations with declining birth rates), changes in local employers (e.g., opening or closure of large employers that employ local residents), and out-migration of residents to other places. Out-migration may occur for different reasons and can include people leaving communities for other locations (which are generally larger population centres) that have better access to services, better affordability (e.g., less expensive goods and services, less expensive housing), education facilities, or employment opportunities. No information is available on the reasons for population changes and projections and to what extent population levels are affected by in/out migration. Norman Wells' 2021 Community Plan does not have details on in/out migration but does note that population levels are sensitive to changes in resource-based industries (e.g., mining) and that forecasts need to be treated with caution.

³ See Appendix C, Existing Socio-Economic Conditions Report for details on population levels and projections.

During the construction phase, there is the potential that employment opportunities associated with construction of the Project may be a factor in some community residents choosing to remain in communities for work, rather than leaving to seek work elsewhere. This could therefore temporarily slow out-migration from smaller communities to larger centres for the purposes of seeking employment during the construction phase. Given the proximity of the LAA communities to the construction of the Project, any potential slowing of out-migration is likely to be seen in LAA communities and to a lesser extent to the RAA communities.

Additionally, given that there would be no all-season access to Norman Wells and Tulita during construction, whether or not residents consider or choose to migrate out to access services or education is not likely to be affected by project construction. Please refer to Section 9.5.2.1.2 for more information on potential effects of the Project on population levels and out-migration as a result of the Project becoming operational and providing all-season road access to Norman Wells and Tulita.

During engagement, residents of Tulita indicated that if the cost of living remained high, employment would not be enough to keep people from leaving permanently or encourage them to relocate back to their home community. Residents of Colville Lake indicated that employment opportunities may not be enough to keep youth from leaving.

Overall, the effects of Project construction on population levels and migration are anticipated to be neutral to low.

9.5.2.1.2 Operations and Maintenance

Reduced out-migration due to increased employment opportunities and/or increased access to services or education opportunities within the communities during operation of the Project

The LAA and RAA communities are small communities with limited services (e.g., limited adult education and skills training facilities, small health centres) and local employment opportunities. Currently, access to larger centres that may have better services and increased employment opportunities, such as Yellowknife or Hay River (Kát'odeh, hereafter referred to as Hay River), is limited to the time that the MVWR is operational and requires air or boat transportation (for some communities such as Tulita and Norman Wells) at other times of the year. The lack of all-season access to most communities in the LAA and RAA means that residents seeking employment or access to education and services often have to relocate on a long-term or permanent basis to other communities where these services or opportunities are available.

When operational, the Project will provide all-season road-based access from the communities in the LAA to each other and for Norman Wells⁴ and Tulita, to larger centres such as Yellowknife and Hay River (Wrigley already has such access because of being previously connected to Hwy 1 to the

⁴ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

south). This improved access to services may result in some people choosing to remain in communities instead of relocating to other larger centres. However, given the long driving distances from Norman Wells or Tulita to such centres as Yellowknife and Hay River, the effect of all-season access on out-migration is anticipated to be limited, as the distances make regular commuting from the LAA communities to Yellowknife or Hay River impractical. For residents of Tulita, all-season access to Norman Wells that is provided by the Project may allow them to access some health/social services, education or employment opportunities in Norman Wells (approximately 75km away), which is closer than driving out to Hay River or Yellowknife (distances of approximately 800 km and 1,000 km respectively).

It is anticipated that the Project will also provide some ongoing employment opportunities related to road maintenance. It is estimated that there will be approximately 25 direct full-time equivalents (FTEs)⁵, seven indirect FTEs and three induced FTEs associated with operations and maintenance of the Project. Refer to the Employment and Income section (Section 9.7.2) for more information on the possible project-related employment effects. There will no longer be workers or economic activity associated with the construction and maintenance of the segments of the MVWR replaced by the Project. Although the new employment opportunities associated with operations and maintenance for the Project are expected to exceed the loss of employment associated with annual MVWR construction and maintenance the number of employment opportunities is small. The number of employment opportunities associated with operations and maintenance of the Project will also be smaller than the number of employment opportunities during the construction phase. The Project may also result in business and employment opportunities in the LAA communities as a result of new or expanded tourism opportunities, which may lead to some changes in population levels or a slowing of out-migration as people will choose to remain in communities to take advantage of local employment or business opportunities.

Given the relatively small numbers of project employment opportunities and potential new employment opportunities within the LAA communities during operations and maintenance, people may still choose to or need to relocate for employment. As such, the anticipated effect of the Project's operations on population out-migration in the LAA communities is anticipated to be low.

For the RAA communities, the Project may still result in decreased costs and time needed to access services as residents would not need to fly as far to access an all-season road that could then take them to needed services. The effect of the Project on out-migration is anticipated to be very low or not measurable, given the time to travel and potential expense of leaving and returning to communities will remain high and given there will likely be few employment opportunities that could accommodate residents who do not live close enough to be present on a regular basis for work.

The proportion of population decline that can be attributed to employment-related needs is not available in the data, and findings from engagement indicated that employment opportunities may not be enough to slow or stop population out-migration. Although the Norman Wells Community Plan notes that the effects of resource-based industries can have effects on the population, the

⁵ FTEs are not actual jobs but equivalent to full-time jobs (including part-time jobs).

Project is not specifically included in its forecasts. By way of comparison, prior to the opening Inuvik-Tuktoyaktuk Project in 2017, the community of Tuktoyaktuk was accessible only by air in the summer and by ice road in the winter⁶. Looking at changes in population before and after the all-season Project opened, it is unclear if the road had a measurable effect on population levels or trends. In 2011, Tuktoyaktuk's population was 854 and it increased to 898 in 2016, an increase of 5.2% (Statistics Canada 2016 Census Profile, 2016). From 2016 to 2021, the population increased to 937, which represents a slower rate of increase of 4.3% (Statistics Canada 2021 Census Profile, 2022).

The ability of Norman Wells and Tulita to house additional residents that may seek to relocate as a result of new business or employment opportunities associated with tourism may be limited due to an ongoing need for housing in communities. This may be the case even if the potential number of new residents is low. Engagement in Norman Wells indicates that there was a desire for construction camps to be repurposed for use as housing once construction was complete. For more information on the potential effects of the Project on housing demand, please refer to Section 9.8.2.

For the RAA communities, the Project may still result in decreased costs and time needed to access services as residents would not need to fly as far to access an all-season road that could then take them to needed services. The effects of the Project on out-migration is anticipated to be very low or not measurable, given the time to travel and potential expense of leaving and returning to communities will remain high and given there will likely be few employment opportunities that could accommodate residents who do not live close enough to be present on a regular basis for work.

9.5.2.2 Mitigation

Given the interconnections between effects of the Project on socio-economic VCs and the potential for some mitigation measures to be linked to more than one effect of the Project, the GNWT will establish a Mackenzie Valley Highway Corridor Working Group (MVHCWG) that will develop and oversee a Community Readiness Strategy. The Community Readiness Strategy will outline an overall approach to mitigation that considers the holistic and interconnectedness of benefits for communities as well as adverse effects on existing conditions of socio-economic VCs and is summarized in Section 9.16.1. The implementation of the Strategy would be supported by three sub-working groups. Two of the sub-working groups, a Road Safety and Security Sub-Working Group and a Contractor Training and Employment Sub-Working Group, would be responsible for the development and implementation of focused plans that include specific commitments and mitigation measures, and the third, the Social Monitoring and Adaptive Management Sub-Working Group, would be responsible for overseeing monitoring and developing a Well-Being Adaptive Management Plan that identifies additional activities measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

⁶ <https://www.inf.gov.nt.ca/en/ITH>

The effects of the Project on population composition and migration are either positive or neutral, so no mitigation is required. However, there are measures contained in the Contractor Training and Employment Plan that are the responsibility of the Training and Employment Sub-Working Group that would enhance local employment levels, which in turn may contribute to potential slowing of out-migration. These include:

- Identifying education, skills and training programs and courses required to address lack of available skilled labour for construction and operations in each of the communities, including sharing information about Labour Market Programs that can support communities, employers and organizations
- Developing plans for employment and local opportunity catchment to reduce a surge in the required labour force during construction, reducing the potential for in-migration to the region
- Ensuring all communities are supported to prepare the workforce for employment opportunities through coverage of existing ECE programs and positions (e.g., Career Development Officers)
- Communities will be encouraged to develop community labour market plans to evaluate their needs in relation to the Project.

9.5.2.3 Project Residual Effect

While out-migration or population reduction may still occur as a result of decisions made by residents regardless of the existence of the Project, the Project is expected to have a neutral or positive effect. The Project may potentially stabilize populations in LAA communities, especially once the Project is operational and the temporary effects associated with project construction have completed.

9.5.2.3.1 Construction, Operations and Maintenance

Overall effects for change in population composition during construction, operations and maintenance are characterized as neutral or positive and any potential slowing of out-migration and population decline will be negligible given the scale of the employment effects for local populations.

9.5.2.4 Determination of Significance for Population Composition and Migration

For all phases of the Project, the effects on population composition and migration in the LAA, are expected to be neutral or positive. The Project may result in temporary slowing of population out-migration during construction as a result of employment opportunities available to local residents. It is anticipated that operations and maintenance phase project employment opportunities will be fewer than during construction and that all-season road access will result in easier access to employment opportunities and programs and services in the LAA which may reduce resident out-migration. In conclusion, the Project's potential effects on population composition and migration are neutral or moderately positive.

As the residual effects are anticipated to be neutral or positive, no determination of significance is required.

9.5.3 Change in Population Health

9.5.3.1 Effects Pathways

The potential effect of the Project on change in population health has three effect pathways that are discussed in this section:

- Increase in overall population health (preventable and chronic diseases and mental health) because of easier and lower-cost access to medical and dental care and social services during project operations and maintenance
- Decrease in population health (increased communicable diseases) due to the construction of the Project because of the increased presence of non-residents
- Decrease in population health (increased communicable diseases) due to the operations of the Project because of the increased presence of non-residents

9.5.3.1.1 Construction

Decrease in population health (increased communicable diseases) due to the construction of the Project because of the increased presence of non-residents

The presence of non-resident workers (i.e., workers who do not live in the community where the construction camp is located) during construction may increase the spread of communicable diseases such as COVID-19, influenza or STIs. Even though non-resident construction workers are anticipated to be housed in construction camps located away from communities, they may visit/access the LAA communities on a temporary or short-term basis. Residents of Norman Wells and Tulita expressed concerns about non-resident workers contributing to the spread of infectious diseases like COVID-19. Health staff in Délı̄ne indicated that this was a possibility but also indicated that communicable diseases are already present in communities. While community level data on the current rates of communicable diseases are unavailable, changes in physical health levels as a result of increased communicable disease rates may be reflected in decreases in the self-assessment of physical health among residents. Based on 2019 data, Wrigley and Tulita generally have lower proportions of their residents that perceive their physical health as 'very good' or 'excellent' (i.e., ranging from 28% to 39%) compared to territorial levels where 48% of residents overall self-assess their physical health to be very good or excellent. The RAA communities also report that lower proportions of resident (i.e., ranging from 25%-38%) perceive their physical health as very good or excellent. Norman Wells is an exception in that it generally shows higher proportions of residents reporting very good or excellent physical health (58%) compared to the territorial rate. The Project may worsen already relatively poor self-perceived health conditions among residents in Wrigley and Tulita and worsen higher levels in Norman Wells.

As identified in other similar projects, some human health effects may be disproportionately felt by more vulnerable segments of the population, such as youth, women, and girls, 2SLGBTQIA+ persons and/or lone parents. Vulnerable populations have been identified as being more likely to experience adverse effects as a result of greater levels of interactions with non-residents and increased access in and out of communities that could lead to changes in factors that influence population health (e.g., drugs, alcohol, sexual health) (Golder, 2017).

Other adverse effects associated with non-resident construction workers may also be seen in changes in Social Pressures (Section 9.5.6) (e.g., increases in drug and alcohol use and abuse, increases in teen pregnancies), Public Safety (Section 9.5.9) (e.g., increases in crime levels, violence) and Population Composition and Migration (Section 9.5.2). The Social Pressure and Public Safety sections provide more details on potential adverse effects of the Project associated with the presence of non-resident construction workers.

The construction of the Project may also lead to adverse physical health effects from increased air emissions or water contaminants if not properly mitigated. Residents of Tulita, Fort Good Hope and Colville Lake all indicated during engagement that they had health concerns about increased dust levels associated with the Project, with some noting the potential adverse effects of dust (and the Project more generally) on wildlife. More details on potential adverse effects associated with increased accident rates or air emissions are discussed in the Public Safety (Section 9.5.9) and Nuisance (Section 9.5.7) sections. Engagement findings did not specifically mention concerns with access to food in the context of population health but did reference concerns about access to traditional foods being affected by the Project more generally, and these findings are discussed in the Food Security section (Section 9.5.5).

Community level data on population health is limited or unavailable but self-assessments of physical and mental health levels may change as a result of the effects of the Project described above. Additional details on existing conditions related to physical and mental health are provided in Appendix 9C, Section 5.5.

9.5.3.1.2 Operations and Maintenance

Increase in overall population health (preventable and chronic diseases and mental health) will likely occur because of additional ways to seek easier and lower-cost access to medical and dental care and social services during project operations and maintenance

Once operational, the Project would provide all-season road access for residents of Norman Wells⁷ and Tulita to health and social services located outside the LAA communities. For residents of Tulita and Wrigley, all-season road access provided by the Project would allow for all-season access to the Norman Wells Sahtú Got'iné Regional Health and Social Services Centre. The Project would also allow for more affordable all-season access to health services in Yellowknife or Hay River.

⁷ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

Residents in the RAA communities, although not directly connected to the Project, may also benefit from less expensive or less time-consuming travel needed to access health and social services because they could take advantage of all-season access being available at a point closer to their own communities.

Residents and health care staff from Norman Wells and Tulita anticipate that the positive effects of all-season road access would be more pronounced for Tulita residents, in part because of all-season access to health services, including long-term care in Norman Wells. They also commented that all-season access to Norman Wells may encourage residents to seek out preventative care more regularly (e.g., through regular screenings and check-ups) as opposed to waiting for health issues to become serious enough to justify spending funds on more expensive air travel when the MVWR is not operational.

As well, they noted that the ability to drive to Norman Wells and to larger centres (e.g., Hay River or Yellowknife) would allow for escorts to accompany patients more easily than when restricted to air travel. For medical needs beyond what can be provided in Norman Wells, there would still be a need to medevac patients to Yellowknife or beyond. Residents and health care staff in Colville Lake and Fort Good Hope noted that the communities would still remain isolated for most of the year, and this would limit any positive effects associated with accessing health care services.

It is anticipated that any positive effects associated with all-season road access would be less pronounced in Wrigley and Fort Simpson, which already have all-season road access to larger centres with a greater number of health and social services.

This increased access to health care and preventative care may result in greater proportions of residents in LAA communities reporting that their self-perceived physical or mental health levels are very good or excellent. As RAA communities will continue to remain isolated for most of the year, it is not anticipated that increases in self-perceived physical or mental health will be as pronounced in these communities. Additional details on existing conditions related to physical and mental health are provided in Appendix 9C, Section 5.5.

Community members from Tulita, Colville Lake and Fort Good Hope identified concerns with the current level of community health services, such as staff shortages, gaps in some services, and lack of facilities to meet certain needs (e.g., addictions, mental health). There were also concerns that if all-season road access resulted in increased demand on health services due to increased health incidents or accidents on account of increased drug and alcohol use by community members, increased inter-community travel and/or visitors and tourists from outside the region requiring health services, this would have adverse effects on population health, especially in Tulita. For more information on effects related to capacity of services within the LAA and RAA communities, refer to infrastructure, services and institutional capacity (Section 9.8).

As noted in more detail in the section on Community/Family and Social Ties (see Section 9.5.4), all-season road access may improve the ability of residents in LAA communities to participate in social, recreational or cultural events, which could have positive effects on mental health and well-being. All-season access and the ability for LAA residents to 'just be able to get out' was mentioned as having a potential positive effect on mental health.

Examination of food basket costs before and after opening of similar all-season roads (e.g., the all-season road from Inuvik to Tuktoyaktuk) indicate that the cost of food is unlikely to noticeably decrease as a result of all-season road access (see Section 9.5.5 for analysis, which includes discussion of food basket cost changes). However, all-season road access associated with the Project may result in increased availability of, or a greater variety of, fresh and perishable food, and potentially increased access to traditional foods, through easier access to traditional harvesting locations. These changes in food availability may result in positive changes in health indicators such as rates of diabetes and obesity and self-assessments of physical health. More details are discussed in the Food Security section (see Section 9.5.5), including discussion of the findings from engagement.

Decrease in population health (communicable diseases) due to the operations of the Project because of the increased presence of non-residents

Once operational, the Project could lead to increased numbers of non-residents or visitors coming to communities that may have adverse population health effects as a result of increased spread of communicable diseases such as COVID-19, influenza or STIs. Residents of Norman Wells and Tulita expressed concerns about non-resident workers contributing to the spread of infectious diseases like COVID-19. During engagement, health staff in Délı̄ne indicated that this was a possibility but also indicated that communicable diseases are already present in communities.

As described in the construction section above, community level data on population health is limited or unavailable but self-assessments of physical and mental health levels may change as a result of the Project leading to increased access by non-residents that result in greater rates of communicable diseases or other health effects. Additional details on existing conditions related to physical and mental health are provided in Appendix 9C, Section 5.5. As identified in other similar projects, some human health effects may be disproportionately felt by more vulnerable segments of the population, such as youth, women and girls, 2SLGBTQIA+ persons, and/or lone parents. Vulnerable populations have been identified as being more likely to experience adverse effects as a result of greater levels of interactions with non-residents and increased access in and out of communities that could lead to changes in factors that influence population health (e.g., drugs, alcohol, sexual health) (Golder, 2017).

Other adverse effects associated with non-residents being present in communities may also be seen in the areas of Social Pressures (Section 9.5.6) (e.g., increases in drug and alcohol use and abuse, increases in teen pregnancies), Public Safety (Section 9.5.9) (e.g., increases in crime levels, violence) and Population Composition and Migration (Section 9.5.2). The Social Pressures and Public Safety sections provide more details on potential adverse effects of the Project associated with the presence of non-resident construction workers.

9.5.3.2 Mitigation

During engagement, community members and leadership in Norman Wells and Tulita indicated there was a need to address existing health needs and health service issues (e.g., staff shortages, the lack of some services associated with mental health, the need for on-the-land treatments) before the Project was operational.

In response to the comments provided during engagement, the GNWT will establish a MVHCWG to develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy, the GNWT will develop and implement a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The GNWT will establish a Well-Being Adaptive Management Plan, which will be collaboratively developed by subject matter experts and community members. The plan includes the following commitments in the Community Services section related to managing effects on existing service levels:

- Reviews existing uses and demands on health and social services and identify service needs and gaps associated with health and wellness that are being exacerbated as a result of adverse effects of the Project (e.g., increased drug and alcohol use may require additional health promotion efforts regarding HSS supports for individuals seeking treatment as well as options for On-the-Land healing in the community or region)

These mitigations are intended to help address the effects of the Project on health-related service levels that could in turn affect population health levels.

The Project's potential adverse effects on population health related to the increased presence of non-residents contributing to increased prevalence of communicable diseases are anticipated to be addressed by the following mitigations that are part of the Community Wellness section of the Adaptive Management Plan:

- As a part of community readiness, work with communities to ensure that Community Wellness Plans consider project activities, potential effects, and are well positioned to enhance potential benefits and mitigate potential adverse effects associated with the Project during both construction and operations
- In response to negative changes in monitoring indicators, expand health and wellness related programming in the areas of: drug and alcohol use and abuse, sexual and reproductive health, communicable diseases (e.g. COVID, flu, STIs), healthy relationships, mental health, culture and identity as outlined in the adaptive management plan
- Identify vulnerable segments of the population that may experience particular barriers or adverse effects related to the Project (e.g., Elders, youth, women, 2SLGBTQIA+ persons) and ensure that their specific needs are considered in the planning and design of wellness mitigations

The potential effects of the Project related to improved population health as a result of residents having all-season road access to health services is a positive effect and therefore no mitigations are required.

9.5.3.3 Project Residual Effect

9.5.3.3.1 Construction

Following the implementation of mitigation measures and adaptive management described in Section 9.5.3.2, residual effects for population health are summarized in Table 9.24 and overall residual effects for change in population health during construction are characterized by the following:

- **Direction is adverse:** there will be an adverse effect on population health as a result of non-resident construction workers accessing communities and contributing to increases in communicable diseases or other health issues, which could lead to lower scores of self-perceived mental or physical health.
- **Likelihood is possible:** it is possible that some non-resident workers will transmit a communicable disease or contribute to lower scores of mental or physical health within a community at some point.
- **Magnitude is low:** the effects on population health will be low as the result of non-residents or visitors being present in higher numbers than baseline as a result of construction activities.
- **Geographic extent is the RAA:** the higher number of non-residents or visitors is likely to be seen in LAA communities due to proximity to construction sites and camps but effects may extend to some RAA communities.
- **Timing is no sensitivity:** the timing of project activities have no influence on the effect.
- **Duration is short-term:** population health effects associated with the presence of outside construction workers will not extend past the construction phase.
- **Frequency is irregular:** the presence of outside construction workers in LAA communities will occur at irregular intervals, which will be influenced by the construction schedule and location of camps but not predictable.
- **Change is reversible:** population health levels effected by the presence of non-resident construction workers will likely return to previous levels once construction is complete.

9.5.3.3.2 Operations and Maintenance

For the neutral or positive effects that are anticipated to occur during operation of the Project because of all-season road access to community and social services and increased food security, no mitigation measures are required and there is no residual adverse effect.

Following the implementation of mitigation measures described in Section 9.5.3.2, residual effects for population health are summarized in Table 9.24 and overall residual effects for change in population health during operations and maintenance are characterized as positive. Population health and self-perception of mental and physical health will improve as access to health services increases, provided that the appropriate mitigation measures related to community wellness are implemented and current gaps in existing services are addressed. All-season road access to health services will have a moderate effect as residents will be able to receive more timely health interventions and participate in health screening activities that might otherwise may be cost-prohibitive without road access.

9.5.3.4 Determination of Significance for Change in Population Health

During the construction phase of the Project, it is expected that the presence of non-resident construction workers may lead to increased rates of communicable diseases and lower self-assessments of physical or mental health. These adverse effects are distinguishable but are considered low in magnitude and reversible when the construction phase is completed, and so these effects are therefore considered to be not significant. During the operations and maintenance phase, the Project is expected to result in positive changes to population health.

9.5.4 Change in Community/Family and Social Ties

9.5.4.1 Effects Pathways

The potential effect of the Project on change in community/family and social ties has three effects pathways that are discussed in this section:

- Increased participation in regional social, recreational, and cultural events due to operation of the Project because of easier and lower-cost access all-season to and from other communities
- Reduced sense of isolation and increased connection to families and friends due to operation of the Project because of easier and lower-cost access all-season to and from other communities
- Reduced 'sense of community'/community cohesion due to the construction of the Project because of a potential increase in presence of non-residents (construction workers).
- Reduced 'sense of community'/community cohesion due to the operations of the Project because of a potential increase in presence of non-residents (visitors, tourists) and ability of residents to spend more time outside of communities

9.5.4.1.1 Construction

Reduced 'sense of community'/community cohesion due to construction of the Project because of a potential increase in presence of non-residents (construction workers)

Construction of the Project could result in an increase in non-resident workers accessing the communities, which may lead to a reduced sense of community belonging, community cohesion or community safety among residents. It is not necessarily straightforward to determine how an increased presence of non-residents due to the Project might affect community cohesion as this is dependent to some extent on individual responses. However, given the size of many of the LAA and RAA communities, increased access by non-residents especially if it results in adverse effects such as increased availability of drugs, alcohol or increased crime, may lead people to feel that this is an effect caused or made worse by the Project. Changes in community cohesion as a result of non-resident access may be seen in changes in measurable parameters related to the sense of community belonging, as reflected by residents. This is anticipated to have a greater effect in the LAA communities compared to the RAA communities, as the construction camps where non-resident workers will be housed will be closer to those communities. Generally, the sense of community belonging varies considerably among LAA and RAA communities. In the LAA, Wrigley and Tulita show lower proportions of community belonging (16% and 22% respectively) compared to the territory levels that indicate 40% of residents feel a very strong sense of community belonging. Norman Wells shows a higher proportion of residents feeling a very strong sense of community belonging compared to territorial levels. Generally, in most RAA communities, greater proportions of the population report a very strong sense of community belonging compared to the territory levels, with the exception of Fort Good Hope, which shows a lower proportion of residents reporting a very strong sense of belonging (31%) compared to the territory as a whole. Additional details on measures of the sense of community belonging are provided in Appendix 9C, Section 5.5.

As noted in the Population Composition and Migration (Section 9.5.2) and Population Health (Section 9.5.3) sections, increased presence of non-resident construction workers in communities is anticipated to have other potential adverse effects on human health and community wellness. These effects are also described in the Social Pressures (Section 9.5.6) and Public Safety (Section 9.5.9) sections later in the document.

9.5.4.1.2 Operations and Maintenance

Increased participation in regional social, recreational, and cultural events due to operation of the Project because of easier and lower-cost access all-season to and from other communities

Reduced sense of isolation and increased connection to families and friends due to operation of the Project because of easier and lower-cost access all-season to and from other communities

All-season access could increase opportunities for residents in the LAA communities to participate in social, recreational, and cultural events in other communities due to the reduced costs and more travel flexibility (e.g., not dependent on flight schedules). All-season access will also allow residents

in LAA communities to visit family and friends in other communities, receive visitors more easily and at lower cost, and participate in social and recreational events in other communities, which may increase family and community cohesion. For those with mobility or health concerns (e.g., Elders), all-season road access may facilitate their ability to leave the community.

Additionally, all-season road access would allow enhanced youth participation in social and sporting events and for youth and families to be engaged more with other communities in the NWT and beyond, both of which were noted during engagement in Tulita. This increased access may lead residents in LAA communities to report higher levels of community satisfaction and community belonging. During engagement in Norman Wells and Tulita, residents noted the positive mental health effects that could occur as a result of people feeling as though they had the ability to get out of communities and travel to other places. As referenced in the construction section above, the sense of community belonging varies considerably among LAA and RAA communities. LAA communities are generally lower than territorial levels, with the exception of Norman Wells, while in RAA communities, most communities are higher than territorial levels with the exception of Fort Good Hope. Increased access to other communities may lead those in LAA communities to report greater levels of satisfaction with regard to community and recreational activities. Data is limited for Wrigley, but both Tulita and Norman Wells residents reported in 2019 higher levels of satisfaction with the variety of community and recreational activities (52% and 51% respectively) compared to the territorial value of 48%. Additional details on measures of the sense of community belonging and community satisfaction are provided in Appendix 9C, Section 5.5.

The Project may also benefit the RAA communities by providing a point closer to their communities where an all-season road can be accessed. Residents in Colville Lake and Fort Good Hope indicated that being able to travel to Norman Wells⁸ and then drive on an all-season road to other communities would make it easier to visit friends and family. They also commented that youth would benefit through their ability to more easily participate in sports and recreational activities outside of their community and this was referenced as a very positive effect. Although Wrigley and Fort Simpson already have all-season access to some communities, they may benefit from a new all-season road connection to communities to the north in the LAA where family, social or recreational activities occur and would be accessible all-season. This may result in increased measures of the sense of community belonging (outlined in the construction section above) or community satisfaction in RAA communities. The variation in community satisfaction levels with regard to the variety of community and recreational activities varies widely among RRA communities, with most having lower levels of satisfaction (19-42%) than the territorial levels of 48%, and Fort Good Hope having a higher level of satisfaction than the territory at 51%. Additional details on measures of the sense of community belonging and community satisfaction are provided in Appendix 9C, Section 5.5.

⁸ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

Reduced 'sense of community'/community cohesion due to the operations of the Project because of a potential increase in presence of non-residents (visitors, tourists) and ability of residents to spend more time outside of communities

Once operational and similar to the effects of the Project that may take place during construction, the Project could result in an increase in non-residents accessing LAA communities as a result of being connected to a road all-season, which may lead to a reduced sense of community belonging, community cohesion or community safety among residents.

As noted, with winter road operations in the community of Whatì, prior to the opening of the Tłı̄chǝ Highway, the concentrated seasonal movement of residents out of the community led to adverse effects on family and social cohesion (e.g., children and Elders without care, school absenteeism, drug and alcohol use and the associated family and community problems) (Golder, 2017). Given the short time available for access via a winter road, there is often a concentration of movement out of communities when it first becomes operational each year, leading to sharp increases in family and community problems due to a large proportion of absent community members during a short period of time. Having all-season access may mitigate these issues by spreading out the time that residents in LAA communities are absent from the community.

However, some residents in Tulita noted that adverse effects may actually become more pronounced if the ability for people to leave is available all-season. Some community members also indicated that not all gatherings or family get-togethers might be healthy and all-season access might lead to a greater number of "drunk parties". Some residents in Colville Lake indicated similar concerns that if it becomes easier to leave communities all-season (even if the road will not extend all the way to their community) it might lead to situations in which parents leave their children unattended. As noted with the Tłı̄chǝ Highway project, the ability to leave the community all-season may increase disruptions as a result of residents spending more time away from communities, which contribute to decreased community cohesion. As discussed elsewhere (Section 9.6 Education, Training and Skills and 9.7 Employment and Economy), the distances from the LAA communities to larger cities like Yellowknife are not necessarily conducive to regular commuting or time away to larger centres compared to the community of Whatì with the Tłı̄chǝ Highway.

The all-season road access provided by the Project could also result in an increase in non-residents or visitors accessing the community, associated with new tourism opportunities or seeking access to harvesting locations (e.g., for subsistence or recreational hunting or fishing). This may lead to a reduced sense of community belonging or community safety among residents in the LAA communities, and to a lesser extent people in the more northern RAA communities. Residents in Norman Wells and Tulita expressed concerns about visitors and non-residents coming more frequently to communities to hunt, fish or participate in other recreational activities as tourists. They noted that communities are generally unprepared to accommodate tourists and that increased access by outsiders to hunt and fish might adversely affect community members, traditional sites and wildlife. see Section 9.8.2 for discussion of Housing and Accommodation which includes discussion of temporary accommodations related to increased visitors and tourists.

9.5.4.2 Mitigation

Community members and Elders in Tulita said it was important for communities in the Sahtu Region to be supported to plan and prepare for the Project and the effects of all-season road access to ensure that the positive effects outweigh the negative. Residents suggested mitigation measures including increased education and supports about healthy behaviours for residents, as well as education and protocols for non-residents to let them know the rules and requirements regarding hunting and fishing, as well as community safety in the LAA and RAA. Residents also spoke about funding to support activities related to retaining and building culture and identity, such as on-the-land activities, which can also be important for mental health and treatment of substance abuse.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The anticipated effects of the Project associated with increased access of non-residents to communities during both construction and operation that result in decreases in reported levels of community cohesion or a sense of community belonging can be mitigated through the implementation of several measures that are part of the Community Readiness Strategy.

The Contractor Training and Employment Plan includes the following measures that are meant to minimize the use of non-resident labour and help communities prepare for increased levels of visitors/tourists accessing communities all-season, which may mitigate the adverse effects associated with increased levels of non-residents:

- Develops plans for employment and local opportunity catchment to reduce a surge in required labour force during construction, reducing the potential for in-migration to the region
- ITI staff are available to discuss tourism readiness with communities and has funding available in various programs that can be used by communities to develop community led initiatives such as tourism plans as communities identify a need or desire to create a specific plan related to maximizing benefits and mitigating adverse effects associated with the operation of the Project, including:
 - Identifying barriers or gaps in the current state that need to be addressed to fully realize benefits from tourism
 - Identifying future potential for tourism development and promotion, and
 - Identifies additional needs and supports needed and available to mitigate adverse effects related to tourism as a result of the Project

In addition to these measures, the following measures associated with the Safety and Security Plan for Vulnerable Community Members have also been identified as partially responsive to the concerns raised during engagement related to community safety and its role in supporting community cohesiveness:

- Will consider findings from the social and well-being monitoring program for the Thçq Highway and the Social Monitoring and Adaptive Management Plan for the period of construction and a period of five years of operations after project construction is completed. It will also consider findings and approaches from other jurisdictions (e.g., the 'Community Safety Toolkit' developed by the Carrier Sekani Family Services (2006) along the Highway of Tears)

For adverse effects of the Project associated with community members engaging in unsafe or unhealthy behaviour that decreases community cohesiveness or a sense of community belonging, facilitated by having all-season road access, the following measures from the Community Safety section of the Well-Being Adaptive Management Plan are responsive:

- Identify additional safety related resources to support and develop at the community-level (e.g., education about safe behaviour, creation of community bylaws)
- Verify that there is increased enforcement and monitoring of security and safety by-laws in the first year of operation of the Project

As is the following commitment from the Community Wellness section of the Well-Being Adaptive Management Plan:

- In response to negative changes in monitoring indicators, expand health and wellness related programming in the areas of: drug and alcohol use and abuse, sexual and reproductive health, communicable diseases (e.g. COVID-19, influenza, STIs), healthy relationships, mental health, culture and identity as outlined in the adaptive management plan.

The positive effects that are anticipated to arise during operation of the Project as a result of community members being able to travel to other communities all-season by road to visit friends and family and/or participate in cultural, recreational or social events do not require mitigation.

9.5.4.3 Project Residual Effect

Even with mitigation measures being implemented successfully, it is not possible to completely remove the risk of non-residents or visitors interacting with community members in ways that could have an adverse effect on community/family and social ties.

Perceptions of residents that may be concerned about non-residents or visitors contributing to a decreased sense of community or belonging may persist, even with mitigation measures being successfully applied, as the perception may not always be driven by trends or data related to actual incidents taking place.

9.5.4.3.1 Construction

Following the implementation of mitigation measures described in Section 9.5.4.2, residual effects on community/family and social ties due to construction of the Project are summarized in Table 9.24 and overall residual effects during construction are characterized by the following:

- **Direction is adverse:** there will be an adverse effect on community/family and social ties as a result of the increased number of non-resident construction workers accessing LAA communities.
- **Likelihood is possible:** non-residents are almost certain to access communities during construction or operations, and it is possible that this will contribute to community members reporting decreased community cohesion or a decreased sense of community belonging.
- **Magnitude is low:** the effects on community/family and social ties will be minor as the result of non-residents or visitors being present in higher numbers than baseline as a result of construction activities, which may contribute to overall decreases in self-perceived levels of mental health and self-reported sense of community belonging.
- **Geographic extent is the RAA:** the higher number of non-residents or visitors is likely to be seen in LAA communities due to proximity to construction sites and camps, but effects may extend to some RAA communities.
- **Timing is no sensitivity:** as the timing of project activities have no influence on the effect.
- **Duration is short-term:** effects on community belonging and community/family/social ties associated with the presence of outside construction workers will not extend past the construction phase.
- **Frequency is irregular:** the presence of outside construction workers in LAA communities will occur at irregular intervals, which will be influenced by the construction schedule and location of camps but not predictable.
- **Change is reversible:** community/family and social ties affected by the presence of outside construction workers will likely return to previous levels once construction is complete.

9.5.4.3.2 Operations and Maintenance

Following the implementation of mitigation measures described in Section 9.5.4.2, residual effects for community/family and social ties are summarized in Table 9.24 and overall residual effects during operations and maintenance are characterized by the following:

- **Direction is adverse:** community/family and social ties will be adversely affected by the increased presence of non-residents or visitors facilitated by the Project.
- **Likelihood is possible:** non-residents are almost certain to access communities during construction or operations, and it is possible that this will contribute to community members reporting decreased community cohesion or a decreased sense of community belonging.

- Magnitude is low: the adverse effect will be of low magnitude as the numbers of non-residents or visitors visiting LAA communities is expected to be low, which may contribute to overall decreases in self-perceived levels of mental health and self-reported sense of community belonging.
- Geographic extent is the RAA: effects will be focused in the LAA communities as they will be directly connected to an all-season road as a result of the Project, but some positive effects may extend to RAA communities.
- Timing is moderate sensitivity as the Project will contribute to stronger effects at times of year when social or cultural events may be scheduled.
- Duration is long-term: changes in community/family and social ties due to all-season road access to health services will persist throughout operation of the Project.
- Frequency is regular: effects will occur throughout the operations and maintenance phase as a result of regular social and cultural events.
- Change is reversible: adverse effects community/family and social ties effects associated with increased presence of non-residents due to the Project will decrease as community capacity to deal with effects will increase as mitigation measures are implemented and adaptive management is carried out.

The effects of the Project during operation of the Project as a result of community members being able to leave communities all-season to visit family/friends or participate in cultural, recreational or social events are positive and are therefore not characterized.

9.5.4.4 Determination of Significance for Change in Community/Family and Social Ties

For all phases of the Project, all-season road access is expected to increase access to family and friends in other communities which leads to increases in sense of community/belonging and perceived mental health. This effect is anticipated to be stronger in the LAA communities, but may extend to RAA communities. Conversely, all-season access could result in increases in family problems or adverse effects on family or community cohesion (e.g., absenteeism and lack of child and Elder care) due to residents leaving the community (as already occurs during the winter road season) and increases in non-residents or visitors accessing the communities which leads to decreases in sense of community/ belonging, safety and perceived mental health. While the mitigation measures may not fully address the adverse effects, they can be managed to some extent, and as such, the Project's adverse effects on community/family and social ties are not significant.

9.5.5 Change in Food Security

9.5.5.1 Effects Pathways

The potential effect of the Project on change in food security has four effect pathways that are discussed in this section:

- Decrease in food security related to decreased ability to access some harvesting areas or reduced access to or availability of traditional foods (e.g., wildlife such as moose, caribou and birds, vegetation) due to adverse effects of project construction
- Decrease in food security related to reduced access to and availability of traditional foods (e.g., wildlife such as moose, caribou and birds, vegetation) due to adverse effects of project operations and maintenance
- Improved food security due to operation of the Project through all-season access to greater variety of groceries (easier to access groceries in other communities as well ability for greater variety of fresh foods to be provided all-season)
- Improved food security due to operation of the Project due to increased access to traditional food sources/harvesting areas

9.5.5.1.1 Construction

Decrease in food security related to decreased ability to access some harvesting areas or reduced access to or availability of traditional foods (e.g., wildlife such as moose, caribou and birds, vegetation) due to adverse effects of project construction

The assessment of potential effects on Culture and Traditional Land Use Including Harvesting (cultural use) in Chapter 11 identifies a number of wildlife and vegetation species that are used or relied upon by Indigenous residents as a source of traditional foods. These include birds, fish, a variety of plants, among others, with particular attention paid to the importance of moose and caribou. The cultural use assessment (Chapter 11) is also noted as being linked to the effects on wildlife and wildlife habitat (Chapter 19).

As noted in the assessment for wildlife and wildlife habitat (Chapter 19), the Project is anticipated to have residual adverse effects on wildlife movement, habitat, health and mortality risk. Similar residual adverse effects were also identified during the construction phase for birds, fish, moose and caribou in the specific effects assessments for those areas (Chapters 20, 17 and 10 respectively). For most effects, the magnitude is low and restricted to the LAA, but are also medium- to long-term in duration and irreversible.

The assessment of potential effects on cultural use (Chapter 11) indicates that the Project is anticipated to have residual adverse effects on both the availability of resources (including traditional foods) for cultural and traditional use, and the access of resources and areas for cultural and traditional use. Cultural use is noted as including sites used for hunting, fishing and medicinal plant gathering, among other spiritual and traditional uses. More details on the identification of cultural and spiritual sites are contained in (Chapter 11).

The effects assessment notes that some areas that are located within areas of physical disturbance in the PDA will have a high magnitude residual adverse effect because of the potential for sites to be permanently removed or otherwise become permanently unavailable. Cultural or traditional sites located outside of the PDA and within the LAA are identified as being adversely affected but the magnitude of the effect is low or moderate. In all cases, assessment cultural use (Chapter 11) indicates that all of the residual adverse effects are long-term, continuous and irreversible.

These effects would in turn have an adverse effect on food security, especially for communities where a high proportion of the population relies on traditional foods as part of their overall food consumption (e.g., Pehdzéh Kì First Nation located in Wrigley and Dehcho First Nations, engagement in Colville Lake confirmed that many people in the community depend on traditional foods). Given that the adverse effects, noted in the chapters dealing with Culture and Traditional Use and Wildlife, are irreversible, continuous and largely limited to the PDA and LAA, it is anticipated that the adverse effect on food security due to adverse effects on traditional food access and availability during project construction would be similar. It may be possible for individuals to augment their food consumption with store-bought food if access to traditional areas or the ability to obtain traditional foods was adversely affected by the Project. However, given the cultural importance placed on hunting, fishing and on-the-land activities, this may not be a desirable mitigation.

Additionally, engagement in Tulita and Norman Wells indicated that the price and availability of store-bought food is a challenge for many people, especially those with limited or no income and so the ability to augment their food consumption with store-bought foods may be limited.

9.5.5.1.2 Operations and Maintenance

Decrease in food security related to reduced access to or availability of traditional foods (e.g., wildlife such as moose, caribou and birds, vegetation) due to adverse effects of project operations and maintenance

Once operational, the Project may disturb the land or adversely affect wildlife. Similar to the construction phase, the cultural use (Chapter 11) and wildlife and wildlife habitat (Chapter 19) effects assessments anticipate there will be residual adverse effects on the ability to access cultural or traditional areas, or in the availability of wildlife species that are considered traditional foods. Similar to the construction phase, these residual adverse effects during project operations and maintenance would be mostly low in magnitude, limited to the PDA or LAA and would be continuous, long-term and irreversible.

This is anticipated to have an adverse effect on food security, especially for those communities and segments of the population that have a high reliance on traditional foods. As noted in the construction phase, while a decrease in the availability of or access to traditional foods might be mitigated through the purchase of store-bought food, the general cost and limitations of store-bought food and the importance of obtaining traditional foods from a cultural perspective may limit the ability to mitigate food security concerns. This adverse effect may be mitigated by the potential positive effect on food security associated with easier access to some hunting and fishing sites provided as a result of the Project becoming operational.

All-season road access provided by the operation of the Project may have potential neutral or positive effects on different aspects of food security:

- General overall reduction in prices of food in communities and affordability of foods, as measured by food price indices (which measure community food prices in relation to Yellowknife) and household reporting related to concerns about having enough money for food
- Increase in the variety and amount of fresh foods and perishables that would not be present when communities are dependent on a winter road or having to bring food in by air or boat
- Easier access or all-season to hunting and fishing areas that facilitate the ability to obtain traditional foods

Improved food security due to operation of the Project through all-season access to greater variety of groceries (easier to access groceries in other communities as well ability for greater variety of fresh foods to be provided all-season)

Community members from Norman Wells and Tulita had mixed feelings about whether or not the Project might decrease the cost of groceries or otherwise improve food security. Some indicated that being able to bring in food by truck all year would result in decreased food costs in communities. However, others noted that the presence of an all-season road would likely eliminate the Nutrition North subsidy, thus limiting the possible cost savings on store-bought food in communities. Many communities in the NWT receive the Nutrition North subsidy, which is a program that provides a subsidy on certain nutritious foods and is provided to registered retailers. Eligibility is generally restricted to communities that do not have all-season road access but some communities with an all-season road connection that still experience seasonal isolation (such as Fort Simpson and Tuktoyaktuk) receive the subsidy, which may be decreasing food price indices. Some also mentioned that food cost savings might not be passed down to residents by store owners, and in Tulita, concerns were raised that outsiders might be able to more easily access the community and afford to buy large amounts of food once the Project was operational, which could have adverse effects for local residents given the limited selection and stock in the local store, and affect availability of store bought food for residents. All three communities in the LAA are reported as having some percentage of households being worried about having enough money for food, but the rates vary. In Wrigley, the majority of households report being worried and being worried 'often', which is a higher rate than is seen at the regional or territorial level. The rates in Tulita are lower than Wrigley and the regional rates, but still higher than the territory, while Norman Wells rates of households expressing they are worried or worried 'often' are the lowest of the three LAA communities and are also lower than the regional and territory rates (See Appendix 9C, Tables 145, 159, 173, Households "Worried Not Enough Money for Food", 2018).

Food price indices in the three LAA communities generally do not show a clear trend in food prices over the last 15 years, with the exception of Norman Wells showing a decrease since 2004. Some communities that currently have all-season road access do show lower community food price indices than communities with only winter road access (see Appendix 9C, Tables 18 and 70 versus Tables 38, 58, 81, 92, and 103). However, there are differences. For example, Fort Simpson does have lower food price indices than most communities in the Sahtu Region (which only have winter

road access and also receive Nutrition North subsidies). However, Wrigley shows comparable food price indices to the communities in the Sahtu Region that only have winter road access, even though it is connected to Hwy 1. It is unclear to what extent any difference in community food prices is due to communities being connected to an all-season road.

Research was conducted on food price indices and subsidy levels in other NWT communities connected to all-season roads to determine if there was a measurable decrease in food price indices that might be attributable to a connection to an all-season road (Northwest Territories Bureau of Statistics, Historic Food Price Indices, 1982-2019). Tuktoyaktuk, which was connected to an all-season road in 2017, still receives Nutrition North subsidies during periods of isolation. Data for the food price index in Tuktoyaktuk in the years leading up to the opening of the all-season road between Inuvik and Tuktoyaktuk do not show a clear trend in food price indices – there are large fluctuations from year to year, and only one year of data for the years after the road opened. Although the food price index went down between 2015 (the last year of data available before the road was opened) and 2019 (the first year that data is available after the road was opened), the decrease was modest. Given there is only one post-road-opening data point and there is a lack of an overall clear trend in food price index for Tuktoyaktuk, it is difficult to link lower food prices to the presence of an all-season road.

Wrigley, which was connected to Hwy 1 in 1994, does not receive the Nutrition North subsidy, as there is no grocery store in the community. There is no clear trend in food price indices in Wrigley in the years before and after the road opened and since 2000, the food price index has fluctuated. The community of Whatì was connected to an all-season road in 2021, and so no data on food price indices are currently available for comparison.

Given all of this information, it is not anticipated that the food price indices for the LAA communities will show a clear decrease as a result of the Project, which in turn would not lead to an associated increase in food security. For those that have the ability to drive out to other larger centres, such as Yellowknife or Edmonton, and obtain a greater variety of food or obtain food at cheaper prices, they may experience improved food security. Community members in Norman Wells and Tulita noted that the ability to leave communities all-season would allow people to drive to larger centres like Yellowknife or Edmonton and stock up on supplies, including food, at potentially cheaper prices. However, for those that cannot drive out to other locations (e.g., do not have a vehicle, have obligations that prevent them from leaving communities, cannot afford transportation or to purchase food elsewhere), the Project may further inequities among populations in communities.

Although the RAA communities of Colville Lake, Fort Good Hope and Délı̄ne will not be connected directly to an all-season road as a result of the Project, residents in these communities raised the possibility of a positive effect on food security due to a decrease in the distance and expense needed to access goods (i.e., all-season road access starting from Norman Wells may still have some benefits to these communities in relation to access to food and supplies). However, given that it is anticipated that food price indices will not show a clear decrease in LAA communities connected to an all-season road due to the Project, the potential effect in RAA communities is also not anticipated to result in a decrease in food price indices and an associated increase in food security. For more

information on the potential effects of the Project on the cost of living and consumer prices generally (i.e., not specific to food prices and food security) please refer to the Cost of Living and Consumer Prices section (Section 9.7.5).

Improved food security due to operation of the Project providing increased access to traditional food sources/harvesting areas

For communities in the LAA, all-season road access due to the Project may also provide more reliable and consistent access to harvesting areas, potentially increasing the ability of residents to obtain traditional foods, thus contributing positively to food security and health status through access to a better diet. These potential effects were also noted in the assessment of potential effects on cultural use (Chapter 11).

For residents in Fort Simpson that may traditionally access harvesting areas that are currently beyond Wrigley to the north (but still within the Dehcho Region), all-season access may also provide more reliable and consistent access to these areas as well. Residents in Tulita indicated that even if all-season road access did not extend all the way to some hunting or fishing locations, the ability to get closer to these sites via the Project would be a benefit. Some residents in Norman Wells indicated that all-season road access would make it less expensive to hunt. On the other hand, community members in Tulita also expressed concern that the Project might adversely affect existing hunting camps, or that non-residents would also be able to access hunting and fishing sites more easily, which might adversely affect the ability of community members to obtain traditional foods.

The Project is not anticipated to result in easier access to hunting grounds for most residents of RAA communities. Residents in Colville Lake and Fort Good Hope indicated that effects on access to hunting and fishing areas would be limited, but they did express concern about non-residents being able to access hunting and fishing sites more easily, which may result in it being harder for community members to obtain traditional foods.

Overall, there is not anticipated to be a measurable decrease in food price indices in communities, but there may be those that see improved food security levels by virtue of being able to travel out to other locations all-season and obtain food or are able to more easily access traditional food locations. This may result in a positive effect which is reflected in lower rates of households indicating that they are worried about being able to afford food. However, this positive effect on food security may not be realized by all groups within a community due to different social circumstances or income levels that may act as a barrier to leaving the community to obtain store-bought food. This may mitigate to some extent the adverse effect that the Project is anticipated to have on the ability to access and obtain traditional foods because of the disturbance to wildlife, fish, birds and vegetation. However, the magnitude of the adverse effect on wildlife may be larger than the positive effect on access to store bought foods, which may result in a net adverse effect on food security.

9.5.5.2 Mitigation

During engagement, no specific mitigation measures were suggested regarding food security effects. Most individuals who commented on the potential for the Project to provide easier access to hunting and fishing sites indicated that the effect would be positive. Many residents in the LAA and RAA communities did provide general suggestions for mitigation related to the need for communities to be supported in planning and getting prepared for the potential adverse effects that may come with the Project, which in some cases were linked to the potential adverse effects that are linked to increased access/visits by non-residents and pressure on hunting and fishing sites that may lead to decreased availability of traditional foods.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

For those adverse effects of the Project on wildlife or vegetation that in turn reduce access to or availability of traditional foods, there are several mitigation measures that have been identified in the WMMP:

- Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities, in accordance with the WMMP.
- The GNWT will work with the SRRB and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization.
- Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project.
- Personnel will not feed, harass, or hunt wildlife while working on the Project.

The Well-Being Adaptive Management Plan includes the following commitment in the Community Wellness section that is responsive to issues raised about potential inequities in food security levels associated with Project:

- Identify vulnerable segments of the population that may experience particular barriers or adverse effects related to the Project (e.g., Elders, youth, women, 2SLGBTQQIA+ persons) and ensure that their specific needs are considered in the planning and design of wellness mitigations

For the effects of the Project associated with potential improved food security as a result of lower-cost or easier/all-season access to store-bought food, or easier access to traditional hunting and harvesting areas, these effects are either neutral or positive and so no mitigations are required.

9.5.5.3 Project Residual Effect

9.5.5.3.1 Construction, Operations and Maintenance

As noted, the effects assessment for cultural use (Chapter 11) and wildlife and wildlife habitat (Chapter 19) identified residual adverse effects for access to and availability of traditional areas and wildlife species which in turn would lead to a similar adverse effect for food security. These would be present for both construction and operations:

- Direction is adverse: there will be an adverse effect on food security as a result of the residual adverse effect in the access to and availability of traditional foods due to disturbances of the construction and operation of the Project.
- Likelihood is possible: the Project could affect food security as a result of the residual adverse effect in the access to and availability of traditional foods.
- Magnitude is low: Project activities and design have considered the information provided about wildlife, vegetation and traditional land use and harvesting into account.
- Geographic extent is the LAA and in some cases are limited to the PDA.
- Timing is moderate: as outlined in the wildlife and wildlife habitat effects assessment (Chapter 19).
- Duration is medium-term to long-term: the effects of the Project associated with construction will be present throughout construction and continuously during operations.
- Frequency is continuous: the adverse effects will be present throughout the construction of the Project and continuously during operations.
- Change is irreversible: will extend through construction into the operation of the Project, which has an indefinite end point.

9.5.5.4 Determination of Significance for Change in Food Security

Food security associated with the cost of store-bought food has been determined to be neutral and so no determination of significance is required. However, construction and operations of the Project may disturb the migratory patterns of traditional food sources (e.g., caribou, moose), reduce the availability of local flora and fauna, result in contamination of drinking and recreational water, and increase noise disturbances which may adversely affect the food chain and lead to decreases in food security. The residual adverse effects identified in the effects assessments for cultural use (Chapter 11) and wildlife and wildlife habitat (Chapter 19) were determined to be not significant, and for the same reasons, are considered not significant as they related to food security.

9.5.6 Change in Social Pressures

9.5.6.1 Effects Pathways

The potential effect of the Project on change in social pressures has six effects pathways that are discussed in this section:

- Increased drug and alcohol use and abuse in communities during construction due to presence of construction workers from outside communities and potential for increased income for community members working on the Project
- Increased drug and alcohol use and abuse in communities during operation of the Project due to potential for increased income for community members working on the Project, increased presence of non-residents, and easier/lower cost access to other communities and substances
- Increased rates of STIs and teen pregnancies during construction due to presence of construction workers from outside communities
- Increased rates of STIs and teen pregnancies during operation of the Project due to easier access to other communities, increased potential for interactions with non-residents and visitors
- Increased crime during construction due to presence of construction workers from outside communities or other non-residents
- Increased crime during operation of the Project due to easier/lower cost access to illicit substances, increased potential for impaired driving and potential for increase in family dysfunction

9.5.6.1.1 Construction

The presence of outside construction workers may have potentially adverse effects on social pressures due to increased access to drugs and alcohol for community members, increased rates of STIs and teen pregnancies among community members, and increased crime rates. Previous studies have found that workers living in remote industrial work camps have been found to engage in harmful behaviours such as acts of sexual violence against local women and girls, excessive drug and alcohol use, and non-violent criminal behaviours (Gibson, 2017; Vecchio, 2022).

Discussion of the specific effects pathways related to the presence of outside construction workers are outlined in this section, but it should be noted that there is interconnection between the effects pathways identified for social pressures which can make it challenging to limit discussion of potential effects of the Project to only one effect pathway (e.g., effects related to drugs and alcohol lead to or are associated with changes in crime levels). Interconnections between effects are identified if and as appropriate.

Increased drug and alcohol use and abuse in communities during construction due to presence of construction workers from outside communities and potential for increased income for community members working on the Project

While the construction camps associated with the Project will be designed to be self-contained and provide all facilities needed by temporary construction workers (food, accommodations, administration, and others), it is possible non-resident construction workers may visit Norman Wells, Tulita or Wrigley when they are not working on site (e.g., seeking social or recreational opportunities in off-periods). As identified in other sections of the effects assessment (Population Composition and Migration, Population Health, Community/Family and Social Ties, and Public Safety) the presence of non-resident construction workers is anticipated to result in several potentially adverse effects on human health and community wellness.

It should be noted that increased levels of drug and alcohol abuse can often result in increased rates of domestic violence, sexual violence, family dysfunction, and accidents, which can also all contribute to additional social pressures. Increased use and abuse of drugs and alcohol and increased addiction rates may also have disproportionate effects on vulnerable populations such as Elders, Indigenous women and girls, youth, 2SLGBTQQIA+ persons, single parents, or people with abusive partners, as they may more readily be victims of financial or domestic abuse from those who are experiencing addictions or spending more funds on substances.

Drug and alcohol abuse was identified during engagement with local health authorities and staff as a serious issue requiring attention and action in both LAA and RAA communities, but no community-level data is currently available. Of the three communities in the LAA, Tulita is currently the only community that has restrictions on alcohol being brought into the community⁹. Neither Wrigley nor Norman Wells have restrictions in place related to alcohol purchase and Norman Wells has a liquor store in the town limits. Currently, drugs and alcohol can be accessed through several different channels. When the MVWR is in operations, it provides one pathway for people to bring drugs and alcohol into communities or for community members to leave to obtain drugs and alcohol.

Increased rates of STIs and teen pregnancies during construction due to presence of construction workers from outside communities

For projects where the creation of industrial/construction camps are a feature, concerns have been raised about increased rates of STIs and teen pregnancies as a result of interactions between non-local construction workers and young women, given the vulnerabilities of Indigenous women and children due to long-standing socio-economic challenges in Indigenous communities (Gibson, 2017). During engagement in Tulita, community members, leadership and health care staff noted that the Project may result in increase rates of STIs as they see this happening already with some transient workers. There are no community-level data on existing conditions for STIs. Regarding teen pregnancies, between the years of 2008 and 2017, there is no clearly observable trend in teen

⁹ <https://www.fin.gov.nt.ca/en/services/contr%C3%B4le-de-l%E2%80%99alcool-par-la-collectivit%C3%A9/community-restrictions-and-prohibitions>

births in most communities. There seems to be a general decrease over the ten-year period but there are no clear links to population size of communities. Details of teen birth rates are provided in Appendix 9C, Section 5.5.

None of the Community Wellness Plans make specific reference to sexual or reproductive health concerns or programming, other than Fort Good Hope's.

Although limited due to the nature of how the construction camps will be constructed and operated, it is possible that there will be interactions between non-resident construction workers and community members that could increase the rate of STIs and teen pregnancies in LAA communities, and to a lesser extent RAA communities. Concerns of this nature have been raised for similar projects (e.g., Tłı̄chǔ Highway), and so having a workforce drawn in large part from local residents, as is anticipated for the Project, could mitigate the risks.

Increased crime during construction due to presence of construction workers from outside communities or other non-residents

When the MVWR is not operational, drugs and alcohol can be brought in by plane, ATV, snowmobile or boat. In the community wellness plans for the LAA and RAA communities, all of them identified drug and alcohol use and misuse as a topic where programming should be directed, with Wrigley, Fort Good Hope and Délı̄ne noting that drug and alcohol addiction is a priority health area for further action. The presence of outside temporary construction workers could lead to an increase in access to drugs and alcohol which could exacerbate an already serious situation in the LAA or RAA, and the increased access could also lead to an increase in drug and alcohol related crimes (including sexual assaults and sex trafficking). Trends of crime rates in LAA and RAA communities, which include measures of violent crime, property crimes, traffic crimes, as well as federal statutes and other crimes, vary by community. It is difficult to determine which of the crimes for which there is community-level data may be linked to increased drug and alcohol availability but generally violent crimes as well as traffic violations were identified during engagement with community residents, health centre staff and protective services staff as being linked to drug and alcohol use. Most communities experienced an overall increase between 2004 and 2009, followed by a decrease after 2009. Details of crime rates are provided in Appendix 9C, Section 5.5.

9.5.6.1.2 Operations and Maintenance

Increased drug and alcohol use and abuse in communities during operation of the Project due to potential for increased income for community members working on the Project, increased presence of non-residents, and easier/lower cost access to other communities and substances

Concerns related to increased access to drugs and alcohol as a result of all-season road access have been noted in engagement for similar projects such as the Tłı̄chǔ Highway, especially as it relates to effects on vulnerable populations and even when there are existing drug or alcohol issues in communities (Golder, 2017).

Currently, alcohol and drugs are entering communities all-season by means other than the MVWR, but when the MVWR is in operation, it provides a lower-cost and easier way to bring substances into communities all-season than other mechanisms (e.g., air, snowmobile, all-terrain vehicle, boat). The MVWR also provides a lower-cost and easier way for community members to travel to other centres to access drugs and alcohol and to have interactions with non-residents or visitors that may also result in risky behaviours, increases in sex trafficking, increased danger to Indigenous women and girls and sex workers, and increases in STIs or teen pregnancies. The Project would provide the ability for residents in the LAA to leave their communities all-season, which may also provide increased access to drugs and alcohol or increased interactions that may result in increased rates of STIs and teen pregnancies. While no community-level data is available, engagement indicated that drug and alcohol use in communities is an existing serious issue. Early evidence from the Tłı̨ch̨ Highway suggests that the new all-season road indicates that a spike in harmful behaviours and adverse health outcomes has occurred following the completion of the Tłı̨ch̨ Highway (GNWT, 2022b)

Increased rates of STIs and teen pregnancies during operation of the Project due to easier access to other communities, increased potential for interactions with non-residents and visitors

As in the construction phase, some of the concerns are driven by non-residents or visitors having increased access to communities and interactions with community members, which may contribute to increases in rates of STIs and teen pregnancies, and increased access to drugs and alcohol as well as increased incidents of drug and alcohol related crime. For similar projects all-season access has been identified as a concern related to an increase STIs, teen pregnancies, and crime rates. The RCMP staff in Norman Wells, Tulita, and Fort Good Hope all noted that they had concerns about increased crime rates in the communities as a result of the Project because of their experience with the winter road and the Tłı̨ch̨ Highway project. As described in the construction section, there is no clear trend for teen birth data, but changes in these rates may result due to project effects that result in increased access from non-residents or all-season access to other communities, Additional details on teen births and crime rates are available in Appendix 9C, Section 5.5.

As discussed in more detail in the Public Safety (see Section 9.5.9) and the Community/Family and Social Ties (see Section 9.5.4) sections, the current operation of the MVWR results in a concentrated outflow of community members due to the limited amount of time that the road is open, which exacerbates adverse effects that might arise as a result of residents travelling outside the community by road. Having all-season access may reduce the need or desire for residents to leave communities during a short, concentrated window of time, and make it easier for communities to manage or prevent potential adverse effects by spreading travel out over the whole year, even if the overall risk due to all-season access is greater as a result of the Project. This was noted as a potential effect for the Tłı̨ch̨ Highway as well (Golder, 2017).

Increased crime during operation of the Project due to easier/lower cost access to illicit substances, increased potential for impaired driving and potential for increase in family dysfunction

Residents in Norman Wells, Tulita, Fort Good Hope and Colville Lake indicated that all-season road access to Norman Wells¹⁰ as a result of the Project would increase the rates of drug and alcohol use and abuse. Community members in Norman Wells and Tulita indicated that the Project would allow community members in Tulita to travel to Norman Wells to obtain alcohol. Health centre staff in Délı̄ne noted that more drugs and alcohol in Tulita would result in more drugs and alcohol in Délı̄ne, due to the proximity of the communities to each other. RCMP staff and community members in Fort Good Hope and health staff in Colville Lake indicated that all-season road access to Norman Wells could make it easier and less expensive for bootleggers to get drugs and alcohol in from Norman Wells, and that it may result in an increase in 'harder drugs' such as methamphetamine and cocaine in the communities. As discussed in the construction section above, it is difficult to definitively state which of the crimes for which community-level rates are available are linked to drug and alcohol use, but violent crimes and traffic violations were noted during engagement as having links to drug and alcohol use. Additional details on crime rates are provided in Appendix 9C, Section 5.5.

Since the opening of the Tł̄cho Highway, the community of Whatı̄ has noted increases in negative behaviours and incidents due to increased alcohol and substance abuse that have had adverse effects on the community and community members (Williams, 2022). This was anticipated in the effects assessment and incorporated into monitoring and mitigation plans. In August 2022 the RCMP released a statement about significantly higher crime rates in the community and linked it to the first year of operations of the all-season road (Williams, 2022). Community members in Tulita and Norman Wells expressed concern about the increased drug and alcohol abuse in Whatı̄ as a result of the Tł̄cho Highway and worry that the same pattern of behaviour would occur in their communities once they had access to an all-season road (Tucker & Dulewich, 2022).

9.5.6.2 Mitigation

As outlined in the effects assessment, individuals in both LAA and RAA communities identified concerns about the potential for the Project to exacerbate already serious issues related to drug and alcohol use and abuse in their communities. Residents in Norman Wells, Tulita, Fort Good Hope, Colville Lake all indicated that time to plan and prepare for adverse effects, especially related to drugs and alcohol, was needed as a mitigation.

¹⁰ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

Other mitigation suggested included more education, program and financial supports related to addiction and STIs. Additional mitigation included exploring a ration system as exists in other places (e.g., some communities in Nunavut) and getting supports for on-the-land¹¹ healing and culture revitalization programming. Community members, Elders and leadership in Tulita all mentioned the need for local treatment programs and facilities to deal with existing issues before they become worse.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The Community Readiness Strategy includes a commitment to develop a Safety and Security Plan for Vulnerable Community Members that is intended to address the concerns and adverse effects of the Project that are anticipated to occur. This plan, as it relates to the Project, will be developed in collaboration with the GNWT Interdepartmental Missing and Murder Indigenous Women and Girls (MMIWG) Working Group¹² and community-based organizations that are focused on protecting women, children, youth, and vulnerable populations (e.g., 2SLGBTQIA+, homeless or underhoused) from gender-based violence, family abuse, and family neglect. The plan will:

- Be based on a trauma-informed approach in order to be flexible enough to allow for the uniqueness of each community's and person's situation
- Align with the GNWT's response to Missing and Murdered Indigenous Women and Girls (MMIWG) – *Doing Our Part: Initial Response to 'Reclaiming Power And Place: The Final Report of the National Inquiry into Missing And Murdered Indigenous Women And Girls'*
- Consider findings from the social and well-being monitoring program for the Tẖcẖ Highway and the Social Monitoring and Adaptive Management Plan for the period of construction and a period of five years of operations after project construction is completed. It will also consider findings and approaches from other jurisdictions (e.g., the 'Community Safety Toolkit' developed by the Carrier Sekani Family Services (2006) along the Highway of Tears)¹³.

¹¹ On-the-land healing programs, as defined in NWT's On-The-Land Healing Fund Program, include activities that are a blend of traditional activities, outdoor recreation and spiritual or cultural healing with content related to mental wellness and/or healing from the root causes of substance abuse.

¹² Chaired by the Special Advisor to the Minister Responsible for the Status of Women, the working group includes appointed representatives from the departments of Executive and Indigenous Affairs (EIA), Health and Social Services (HSS), Justice (JUS), Education, Culture and Employment (ECE), and Housing NWT.

¹³ The Highway of Tears Community Safety Toolkit includes fourteen resources to promote community safety and increase education and awareness in areas such as violence against women, personal safety, addiction, community violence as well as specific resources targeted at empowering men to stand up against violence. Further information is available at <https://highwayoftears.org/community-safety-toolkit/>

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- Support the provision of safety education to women, youth and children to help them identify and assess risks of violence (physical, sexual, emotional) and reduce harms
- Support the provision of public safety information throughout the community to build a culture of safety
- Support the implementation and coordination of health and wellness promotional campaigns that target preparedness for change, addressing safety and security risks associated with the highway and health behaviour change as a result of the highway (e.g., STIs, family violence, mental health and addictions services) to women, children, 2SLGBTQQIA+ persons and vulnerable populations
- Support increased access to: emergency shelters; safe and affordable transportation (along the highway); communication along the road; education and training opportunities; employment opportunities; and culturally-based (on the land) mental health and addictions programs

The Community Wellness and Substance Abuse and Bootlegging sections of the Well-Being Adaptive Management Plan were also identified in order to respond to the concerns raised by communities related to the Project:

- Community Wellness
 - As a part of community readiness, work with communities to ensure that Community Wellness Plans consider project activities, potential effects, and are well positioned to enhance potential benefits and mitigate potential adverse effects associated with the Project during both construction and operations
 - In response to negative changes in monitoring indicators, expand health and wellness related programming in the areas of: drug and alcohol use and abuse, sexual and reproductive health, communicable diseases (e.g. COVID-19, influenza, STIs), healthy relationships, mental health, culture and identity as part of adaptive management
 - Identify vulnerable segments of the population that may experience particular barriers or adverse effects related to the Project (e.g., Elders, youth, 2SLGBTQQIA+ persons, women) and ensure that their specific needs are considered in the planning and design of wellness mitigations
- Community Services
 - Reviews existing uses and demands on services including childcare, schools and recreational facilities and identifies needs associated with any increased demands that may be associated with the Project (e.g., expansion of services)
 - Explore the development of recreational use management plans to manage and control access to formerly inaccessible places, if and as appropriate
 - Reviews existing uses and demands on health and social services and identify service needs and gaps associated with health and wellness that are being exacerbated as a result of adverse effects of the Project (e.g., increased drug and alcohol use may require additional health promotion efforts regarding HSS supports for individuals seeking treatment as well as options for On-the-Land healing in the community or region).

- Substance Abuse and Bootlegging
 - Support access to on-the-land treatment funding program and facilitate promotion of other addictions treatment and aftercare options
 - It is recommended that the Nishi Program be introduced - the training through this program provides counsellors, health care workers, social workers, educators, community service agencies, government agencies, and others with tools and resources to help heal the trauma caused by addictions and abuse.
 - Review existing policies on prohibition of alcohol, and through consultation with communities, RCMP and health staff, explore other strategies for managing alcohol and drug use in communities
 - Review the Tẖchq̱ Highway monitoring report(s) and consider report results, including spikes in indicators, mitigative responses and adaptive management measures, and incorporate lessons learned where appropriate
 - HSS continue to provide education and awareness campaigns on the harms of alcohol and drug use, including specifically provide more information for local health nurses and counsellors on treatment and awareness of substance abuse
 - The RCMP will continue to assess needs and allocate resources accordingly with any increased demands. There are no JUS commitments to the increase the existing Victim Services funding agreement related to the Project. Agreements are made with community organizations and the Government of Canada and are reviewed periodically.

9.5.6.3 Project Residual Effects

Some of the identified mitigation measures have the potential to reduce the risk of adverse effects or social pressures and also provide the opportunity to identify and address additional issues as they may arise or as conditions change. However, none of these measures can eliminate the risk of increased social pressures that arise as a result of the Project. Even with these mitigation measures applied, there may still be a risk of increased access to drugs and alcohol, increased crime, or interactions that lead to increased rates of STIs and teen pregnancies. Many of these social pressures could disproportionately affect vulnerable populations within communities, including Indigenous women and girls, youth, or sex workers and 2SLGBTQIA+.

The effectiveness of mitigation related to the provision of health and wellness programming will be limited by both the uptake and by the response of individuals to the programming. It is not possible to definitively state that the development or expansion of health and wellness programming will influence the choices that individuals might make or eliminate the risks associated with interactions with non-residents or visitors. There may still be adverse social pressures that result from the Project even with these mitigation measures in place, which may persist long-term if youth are exposed to drug use.

9.5.6.3.1 Construction

Following the implementation of mitigation measures described in Section 9.5.6.2, residual effects on social pressures are summarized in Table 9.24 and overall residual effects during construction are characterized by the following:

- Direction is adverse: there will be an adverse effect on social pressures as a result of the increased number of non-residents or visitors accessing LAA communities leading to increased rates of drug and alcohol use and misuse, STIs, teen pregnancies and crime.
- Likelihood is possible: Increased rates of drug and alcohol use and misuse, STIs, teen pregnancies and crime may occur as a result of project construction, depending to some extent on individual responses.
- Magnitude is high: the effects on social pressures will be an exacerbation of an already serious situation in LAA communities.
- Geographic extent is the LAA: the effects will be focused on the LAA communities.
- Timing is no sensitivity as the timing of project activities have no influence on the effect.
- Duration is short-term: social pressure effects associated with the presence of outside construction workers will not extend past the construction phase, however there will be similar effects in the operations and maintenance phase related to increased access by non-residents.
- Frequency is continuous: the presence of outside construction workers in LAA communities may provide ongoing opportunities for interactions throughout the construction phase that have an adverse effect on social pressures.
- Change is reversible: social pressures affected by the presence of non-resident construction workers will likely return to previous levels once construction is complete.

9.5.6.3.2 Operations and Maintenance

Following the implementation of mitigation measures described in Section 9.5.6.2, residual effects for social pressures are summarized in Table 9.24 and overall residual effects during operations and maintenance are characterized by the following:

- Direction is adverse: social pressures will be adversely affected by the increased number of interactions with non-residents (both inside the communities and as a result of travel by residents out to other locations) and access to drugs and alcohol facilitated by the Project.
- Likelihood is possible: Increased rates of drug and alcohol use and misuse, STIs, teen pregnancies and crime may occur as a result of project operation, depending to some extent on individual responses.
- Magnitude is high: the effects on social pressures will be an exacerbation of an already serious situation in LAA communities.
- Geographic extent is the LAA: the effects will be focused on the LAA communities.

- Timing is no sensitivity as the timing of project activities have no influence on the effect.
- Duration is medium- to long-term: social pressure effects associated with the presence of non-residents or visitors is likely to persist throughout operations of the Project but will decrease over time.
- Frequency is continuous: the increased access and number of interactions with non-residents or visitors that occur as a result of all-season road access that have an adverse effect on social pressures.
- Change is reversible: social pressures affected by the increased number of interactions with non-residents or visitors and the increased access by residents to drugs and alcohol will decrease over time as mitigation measures are implemented and adaptive management is carried out and community capacity to respond to issues increases.

9.5.6.4 Determination of Significance for Change in Social Pressures

The Project is expected to exacerbate an already serious drug and alcohol problem that exists in the LAA and RAA communities.

During the construction phase of the Project, the presence of construction camps in close proximity to the LAA communities is anticipated to potentially increase access to drugs and alcohol, and increase rates of STIs, teen pregnancies, sex trafficking, violent crimes and abuse (in part due to drugs and alcohol) and increase the overall vulnerability of Indigenous women and girls and other vulnerable groups, including sex workers, and those identifying as 2SLGBTQQIA+.

During the operations and maintenance phase, it is expected that the Project may continue to result in increased rates of STIs, teen pregnancies, crime and violent crimes and abuse (due to drugs and alcohol), and increased availability of drugs and alcohol generally because of the all-season road access that facilitates residents leaving communities and having greater numbers of interactions with non-residents and increased numbers of non-residents and visitors having access to LAA communities.

It is anticipated that increased access to drugs and alcohol may also extend to the RAA communities even if they are not connected to the Project directly or are in close proximity to construction camps, as will the associated behaviours and effects related to increased drug and alcohol use.

It is not expected that mitigation measures will be able to eliminate or manage the increasing adverse effects on social pressures associated with the Project. Based on the data, engagement for the Project, other similar projects, and information provided by the GNWT, it has been determined that the potential effects of the Project on change in social pressures will be significant.

9.5.7 Change in Nuisance (Air Quality and Noise)

9.5.7.1 Effects Pathways

The potential effect of the Project on change in nuisance has one effects pathway that is discussed in this section:

- Increase in nuisance effects (noise, dust, combustion emissions) due to construction activities and operations of the Project.

9.5.7.1.1 Construction

Increase in nuisance effects (noise, dust, combustion emissions) due to construction activities and operations of the Project

Both the construction and operations and maintenance phases of the Project may result in increased release of greenhouse gas (GHG) emissions (carbon dioxide, methane, nitrous oxide) and criteria air contaminants (CAC) (Particulate Matter – PM₁₀, PM₂₅ and dust, sulphur dioxide, carbon monoxide, nitrogen dioxide), which may adversely affect air quality and produce a nuisance effect. See Chapter 12 (air quality) for additional details on the sources and nature of air emissions, including identification of effects of the Project on CAC and GHG emissions and details on mitigation measures. The assessment indicates that the effects of the Project on CAC and GHG emissions have been determined to have residual effects which are adverse, of moderate magnitude and will occur either regularly (during construction) or continuously (during operations). It is anticipated that the CAC emissions will be reversible, but the GHG emissions will be irreversible. In both cases, the change in CAC and GHG emissions were assessed as being not significant.

Residents in the LAA may experience poorer air quality during construction that would generate a nuisance effect which may interfere with residents' ability to participate in traditional or cultural activities on the land and/or lead to residents indicating lower self-perceived scores of physical or mental health. Due to the distance from project construction activities, changes in CAC emission will not extend to RAA communities. For GHG emissions, the effect is determined at the provincial, national and global scales and would not have effects localized to the RAA.

As referenced in the Population Health section, Tulita community members expressed concern about dust being generated by the Project which could adversely affect population health and potentially have an adverse effect on wildlife that is a source of traditional foods. Community members in Colville Lake and Fort Good Hope expressed concern about dust levels as a result of the Project. No distinction was made between the potential effect of dust being associated specifically with construction or operations of the Project and so this finding has been included in both sections.

The construction phase of the Project will produce noise through a number of activities and as outlined in Chapter 13 (noise) it is anticipated that there will be noise levels associated with some construction activities that will either meet or exceed Short-Term Community Annoyance and Low-

Frequency Noise thresholds. As these noise levels have been determined to have residual effects which are adverse, of moderate magnitude, and would be of regular frequency, those LAA community residents located within 450 m of construction sites may experience increased nuisance effects due to noise than what they have typically experienced during the 12-hour daylight daily period used for construction. The effects are reversible and would cease when the construction of the Project is completed. This nuisance effect may lead to residents indicating lower self-perceived scores of physical or mental health and/or interfere with their ability to participate in recreational, traditional or cultural activities on the land. Due to the distance from project construction activities, the noise levels in the RAA communities will not be affected.

9.5.7.1.2 Operations and Maintenance

Increase in nuisance effects (noise, dust, combustion emissions) due to construction activities and operations of the Project

The operations and maintenance of the Project may result in nuisance effects associated with the presence of vehicle traffic all-season. In the case of CAC and GHG emissions, the expected traffic volume of 50 vehicles per day will result in increased levels of particulate matter, which have been determined to have residual effects which are adverse, but are of low magnitude and irregular frequency. The nature of the GHG and CAC emission are not anticipated to have a nuisance effect that would lead to residents indicating lower self-perceived scores of physical or mental health and/or interfere with their ability to participate in recreational, traditional or cultural activities on the land. As referenced in the construction section 9.5.7.1.1, engagement findings indicated some concern about dust being generated by the Project, but concerns were not specific to either the construction or operations and maintenance phase.

It is anticipated that the noise levels for the operations and maintenance phases will not exceed threshold of Long-Term Community Annoyance, Low-Frequency Noise, or Traffic Noise. The changes in noise levels have been determined to have residual effects that are adverse and long-term and would be low for all types of noise except low-frequency noise, which would be moderate, but is still noted as being within the noise threshold. Therefore, noise levels associated with the Project during the operations and maintenance phase are not expected to exceed thresholds and so may not have a nuisance effect on residents of LAA communities.

Due to the distance from Project, the noise and air quality levels in the RAA communities will not be affected and so there will be no nuisance effect in those communities.

The operations and maintenance of the Project may also affect the ability of residents obtain traditional foods because air emissions or noise may result in reduced presence or health of wildlife (including birds and fish). Chapter 11 (cultural use) and Chapter 19 (wildlife and wildlife habitat) effects assessments both indicate that noise and air emissions associated with construction and operations of the Project contribute to the residual adverse effects seen in that assessment.

Although engagement findings indicated some concern about dust being generated as a result of the Project, there were no specific mitigation suggested related to the elimination or reduction of dust or noise beyond some general comments that the environmental effects of the Project needed to be addressed.

9.5.7.2 Mitigation

The GNWT has committed to a series of measures to mitigate the Project's adverse effects on air quality and noise levels, which would in turn have an adverse impact on nuisance levels.

For air quality:

- Cold starts of equipment will be limited to the extent possible.
- Incinerators will be operated in accordance with manufacturer's specifications and emissions will meet Canadian Council of Ministers of the Environment Canada Wide Standards for Dioxins & Furans and Mercury.
- Road surfaces will be repaired and maintained to reduce rolling resistance of vehicles.
- The contractor will be encouraged to use modern construction equipment that has lower GHG emissions.
- The contractor will be encouraged to use passenger vehicles (e.g., passenger van or bus) to move crews.
- Vehicles and equipment will be maintained regularly.

For noise levels:

- The GNWT will engage with communities to inform them of the activities and the noise sources that will occur prior to construction.
- The GNWT will develop a system to track complaints and responses to manage and mitigate feedback from the public regarding noise concerns.
- Blasting activities will be limited to daytime hours to the extent practical.
- Communities will be informed of time periods and characteristics of noise that may exceed the recommended noise threshold.
- Methods to reduce the powder factor will be considered (e.g., through a combination of increased hole spacing, decreased column height of explosives, increased depth of stemming material in the blasthole, variable diameter blastholes) to reduce noise.
- Project vehicles will avoid the use of residential roads, where possible.
- The use of modified blasting techniques will be considered to reduce noise, including: use of electronic detonation instead of explosive detonation cord; use of air decking which involves the use of an inverted cone in the blasthole to constrain energy within the rock mass; timing sequence to develop an echelon effect; and, coordinating blast patterns towards a partially open face.

- Transportation of construction materials and equipment via barge will be used to reduce the number of trucks for construction resupply along Hwy 1.
- Use of residential roads by construction equipment will be limited, where possible.
- Vehicles and equipment will be equipped with manufacturer recommended noise muffling equipment.

It is anticipated that these will address nuisance levels by address the air and noise emission levels to the extent possible that are the source of nuisance levels.

For those adverse effects of the Project associated with air emissions or noise levels that have an effect on wildlife or vegetation, there are several mitigation measures that have been identified in the WMMP:

- Wildlife monitors will assess for the presence of wildlife on or near the PDA during Project activities, in accordance with the WMMP.

9.5.7.3 Project Residual Effect

Overall, air and noise effects would be mitigated to some extent by the measures outlined in Section 9.5.7.2 and described in Chapters 12 and 13. However, there will be a residual effect on nuisance in both the construction and operations and maintenance phase as emissions contributing to nuisance cannot be entirely eliminated.

9.5.7.3.1 Construction

Following the implementation of mitigation measures described in Chapters 12 and 13, residual effects on nuisance are summarized in Table 9.24 and overall residual effects during construction are characterized by the following:

- Direction is adverse: construction activities will result in an increase in nuisance effects such as air emissions and noise.
- Likelihood is certain: construction activities will result in nuisance effects related to both air quality and noise.
- Magnitude is moderate: the residual effect for GHG and CAC emissions during construction is assessed as moderate, and the residual effect for noise levels is moderate, with some high magnitude effects (e.g., above acceptable noise thresholds) for a very short period of time during construction. Given this, the anticipated effects on nuisance levels attributable to noise levels and GHG/CAC emissions during construction is moderate.
- Geographic extent is the LAA: the effects will be focused on the LAA communities (with the exception of GHG emissions which cannot be localized only to the area of the Project's RAA).
- Timing is moderate sensitivity: the timing of construction activities may have a greater or lesser effect if they coincide with times of year where traditional or cultural activities on the land typically take place.

- Duration is short-term: nuisance effects associated with construction activities will not extend past the construction phase.
- Frequency is irregular: air emissions and noise that lead to nuisance effects will be related to irregular activities during the construction phase.
- Change is reversible: nuisance levels will return to previous levels once construction is complete.

9.5.7.3.2 Operations and Maintenance

Following the implementation of mitigation measures described in Chapters 12 and 13, residual effects for nuisance are summarized in Table 9.24 and overall residual effects during operations and maintenance are characterized by the following:

- Direction is adverse: operation of the project activities will result in an increase in nuisance effects such as noise levels and CAC/GHG emissions as a result of increased traffic all-season.
- Likelihood is certain: operation of the Project is certain to release air emissions and produce noise that will be considered a nuisance.
- Magnitude is low: the CAC and GHG emissions effects as a result of operations are anticipated to be moderate once mitigation is applied and changes in noise levels are low or moderate once mitigation is applied, which will mean low levels of effect on nuisance to LAA residents.
- Geographic extent is the LAA: the effects will be focused on the LAA communities.
- Timing is no sensitivity: the timing of project activities have no influence on the effect.
- Duration is long-term: nuisance effects associated with operation of the Project will persist for the lifetime of the Project.
- Frequency is continuous: air emissions that lead to nuisance effects will be related operation of the Project due to increased traffic all-season.
- Change is irreversible: nuisance levels will persist throughout the operation of the Project.

9.5.7.4 Determination of Significance for Change in Nuisance (Air Quality, Noise)

The Project may result in nuisance effects as a result of increased noise levels during construction because of construction activities and during operations as a result of increased traffic all-season.

The effects assessment for both air quality and noise have indicated that the changes in CAC/GHG emissions and noise levels are not significant. With mitigation measures, the effects would be reduced to the extent possible and would be within acceptable limits and as such the nuisance effects are not significant.

9.5.8 Change in Drinking and Recreational Water Quality

9.5.8.1 Effects Pathways

The potential effect of the Project on change in drinking and recreational water quality has two effects pathways that are discussed in this section:

- Change in drinking water quality due to construction activities and operation of the Project
- Change in recreational water quality due to construction and operation of the Project

9.5.8.1.1 Construction, Operations and Maintenance

Change in drinking water quality due to construction activities and operation of the Project

Change in recreational water quality due to construction and operation of the Project

The Project has the potential to affect water and sediment quality during both the construction and operations and maintenance phases of the Project but are not anticipated to extend past the LAA. This may have effects on drinking water and recreational water quality in the LAA. All three communities in the LAA report high figures of drinking water quality compliance (Wrigley's 92% compliance in 2015 is the lowest figure seen) and decreases in compliance may result if there decreases in water quality that may occur as a result of construction or operations and maintenance of the Project.

Chapter 16 (water and sediment quality) contains details on the existing conditions of water sources, pathways of potential effects of the Project on water and sediment quality and includes the findings from engagement related to water quality. The assessment indicates that there will be changes in surface water and sediment quality during the construction phase that are neutral in direction and low in magnitude, medium-term in duration and reversible as they will be associated with activities that will end after the construction phase. These effects are assessed as being neutral as there will be no measurable long-term trend in surface water and sediment quality compared to existing conditions. During construction and operations and maintenance, the Project is anticipated to have adverse effects on groundwater quality that range from no measurable change to moderate, which will be long-term in duration, continuous and irreversible. For both changes in surface water and sediment quality and groundwater quality, the residual effects of the Project are anticipated to be not significant. It is therefore anticipated that the Project effects will also be minimal on drinking water and recreational water quality.

Additionally, changes in water quality may also have an effect on fish and fish habitat and wildlife and wildlife habitat, both of which may have effects on food security levels due to changes in the availability of access to traditional foods. For more information on potential effects of the Project associated with food security, refer to Section 9.5.5, Food Security.

9.5.8.2 Mitigation

Chapter 16 (water and sediment quality) outlines a series of mitigation measures intended to reduce or eliminate the risk of changes in water and sediment quality, which in turn would mitigate effects on drinking water and recreational water quality. These measures are part of the GNWT's commitments that:

- A project-specific ESCP will be developed and implemented.
- A project-specific PPP will be developed and implemented.

As outlined in Chapter 16, if the mitigation measures contained in these plans are implemented, it is anticipated that there would be negligible change in water and sediment quality. This in turn would mean no negligible change in drinking and recreational water quality. The GNWT has also committed to monitoring water and sediment quality to verify the effectiveness of mitigation measures and carry out adaptive management activities as needed.

A detailed list of the specific mitigation measures that are part of the ESCP and PPP are contained in Chapter 16.

9.5.8.3 Project Residual Effect

9.5.8.3.1 Construction

Following the implementation of mitigation measures described in Chapter 16, residual effects on drinking and recreational water are summarized in Table 9.24 and overall residual effects during construction are characterized by the following:

- Direction is neutral: construction activities are not anticipated to effect drinking and recreational water quality adversely or positively as surface water and sediment quality levels are anticipated to remain within the variability of existing conditions.
- Likelihood is possible: it is possible that the construction of the Project could result in changes in water quality.
- Magnitude is no measurable change to low in magnitude: as discussed in Chapter 16, changes in groundwater, if measurable will be limited as there are no identified groundwater users in the PDA, LAA or RAA.
- Geographic extent is the LAA: the effects will be limited to the LAA communities.
- Timing is no sensitivity: there will be no measurable effect.
- Duration is short-term: effects associated with construction activities will not extend past the construction phase.
- Frequency is irregular: effects will be related to irregular activities during the construction phase.
- Change is reversible: any changes to water quality due to construction activities will revert once construction is complete.

9.5.8.3.2 Operations and Maintenance

Following the implementation of mitigation measures described in Chapter 16, residual effects on drinking and recreational water quality are summarized in Table 9.24 and overall residual effects during operations and maintenance are characterized by the following:

- Direction is adverse: operations and maintenance activities are not anticipated to effect drinking and recreational water quality adversely or positively as water quality levels are anticipated to remain within the variability of existing conditions.
- Likelihood is possible: the operation of the Project may result in changes in water quality.
- Magnitude is no measurable change to low: effects on drinking water and recreational water quality will be low.
- Geographic extent is the LAA: the effects will be limited to the LAA communities.
- Timing is no sensitivity as the Project will be in operations continuously.
- Duration is long-term: effects associated with operations will not extend past the operations and maintenance phase.
- Frequency is continuous: effects on water quality related to the presence of the Project will occur throughout operations and maintenance.
- Change is irreversible: as the project operations will be indeterminant, any changes in water quality as a result of the Project will be irreversible.

9.5.8.4 Determination of Significance for Change in Drinking and Recreational Water Quality

The Project is expected to potentially result in low magnitude adverse effects on drinking water and recreational water quality in the LAA. However, these adverse effects are not anticipated to result in measurable changes to water quality levels change outside of ranges seen in existing conditions and are therefore considered not significant.

9.5.9 Change in Public Safety

9.5.9.1 Effects Pathways

The potential effect of the Project on change in public safety has three effects pathways that are discussed in this section:

- Reduced feeling of personal safety and security during construction due to presence of construction workers from outside communities
- Reduced feeling of personal safety and security during operation of the Project due to potential increase in non-residents or visitors coming into communities all-season
- Increased risk of traffic accidents all-season due to operation of the Project

9.5.9.1.1 Construction

Reduced feeling of personal safety and security during construction due to presence of construction workers from outside communities

As referenced in the sections on Population Composition and Migration (Section 9.5.2), Population Health (Section 9.5.3), Community/Family and Social Ties (Section 9.5.4), and Social Pressures (Section 9.5.6), the construction phase of the Project may result in the presence of non-resident construction workers in communities in the LAA, and to a lesser extent in the RAA. While the construction camps will be designed to be self-contained and provide all facilities needed by temporary construction workers, it is possible that there will be interactions between outside construction workers and residents of the LAA and RAA communities. As referenced in the Social Pressures section, these interactions may contribute to increased access to drugs and alcohol, and/or increases in crime levels. These potential effects may contribute to reduced feelings of personal safety and security by residents.

Engagement in Tulita indicated serious concerns about the potential effect that increased numbers of non-residents might have on young women and girls, with representatives from the community and service providers (e.g., health services and RCMP) highlighting potential risks of kidnapping, increased rates of family violence and sexual assault, and increased rates of women and girls entering the sex trade. Similar concerns were raised during engagement in Colville Lake, Fort Good Hope, Délı̄ne and Fort Simpson by members of the communities and health service providers. The link between such risks and increased levels of drug and alcohol access and use were also mentioned. Trends of crime rates in LAA and RAA communities, which include measures of violent crime, property crimes, traffic crimes, as well as federal statutes and other crimes, vary by community. It is difficult to determine which of the crimes for which there is community-level data may be linked to increased in drug and alcohol availability, but generally violent crimes were identified during engagement with community residents, health centre staff and protective services staff as being linked to drug and alcohol use. Most communities experienced an overall increase between 2004 and 2009, followed by a decrease after 2009. Details of crime rates are provided in Appendix 9C, Section 5.5.

Increased risks for young women and girls, especially Indigenous women and girls, associated with resource extraction projects and other development projects are a well documented issue. The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls (MMIWG)(National Inquiry in Missing and Murdered Indigenous Women and Girls, (n.d.)) provides an overview of the risks of racial and sexual violence and harassment associated with the resource extraction industry. These were informed by testimony of witnesses and review of relevant literature and identify that these risks are attributable in large part to an influx of transient workers, rotational shift work and increases in alcohol and drug abuse associated with extractive industries. The adverse effects of development projects involving the use of construction camps to house non-resident workers has also been seen in other projects (Gibson, 2017). The GNWT has made a commitment as part of its Changing the Relationship Action Plan in response to the calls for justice on MMIWG (Government of Northwest Territories, 2021d), to consider the safety and security of Indigenous women, girls and 2SLGBTQIA+ people at all stages of resource extraction

planning, assessment, implementation, management and monitoring. While the proposed Project is not a resource extraction project, it shares many similarities that are risk factors for Indigenous women and girls, such as a transient workforce, increased access by non-residents, and increases in alcohol and drug abuse.

In all three communities in the LAA, most residents reported feeling that local crime rates are lower than other communities (Appendix 9C, Tables 144, 158, 172 in Existing Conditions Report, Perceived Crime, 2019). Norman Wells has seen increasing crime rates in all categories between 2009 and 2019, Tulita has seen an overall decrease in crime rate with the exception of traffic crimes, and there is no clear trend in Wrigley's crime rate other than violent crime has been trending upwards. If interactions between residents and outside construction workers result in increased drug and alcohol offenses, STI rates and/or teen pregnancies, more residents may report feeling that their communities are less safe than others in the region even if actual crime rates do not measurably change.

9.5.9.1.2 Operations and Maintenance

Reduced feeling of personal safety and security during operation of the Project due to potential increase in non-residents or visitors coming into communities all-season

With similar projects such as the Tłı̨ch̨o Highway, concerns have been raised about all-season access leading to disproportionately higher adverse effects on the safety of young women and girls due in part to increased interactions with non-residents. These are described in additional detail in the Construction section (Section 9.5.9.1.1). Additionally, the risks to Indigenous women and girls associated with travel on long stretches of highways (e.g., the Highway of Tears in British Columbia) (Lheidli T'enneh First Nation et al, 2006) have been documented and are associated with decreased economic and social outcomes facing Indigenous women and girls and youth that contribute to increased risks of hitchhiking. As discussed in the Social Pressures section (see Section 9.5.6), there is a potential for increased interactions between residents and non-residents or visitors as a result of the Project, which could lead to STIs or teen pregnancies, or contribute to drug and alcohol use and abuse. Further concerns were identified during engagement on the Tłı̨ch̨o Highway related to the potential for abduction or sexual assault of young women along the project route, especially those who are hitchhiking, which resulted in mitigation measures and monitoring being put in place to address issues that arise (Golder 2017). These mitigation measures and monitoring have proven effective. Per the 2021 Annual Environmental Assessment Measures Report, no incidents of sexual assault or harassment in work camps or adjacent communities have been reported (GNWT, 2022b). Community members in Norman Wells and Tulita expressed concern about the potential for women and youth to be at risk of violent crime such as kidnappings or sexual assault, especially for sex workers. These concerns were also echoed during engagement in Fort Good Hope and Colville Lake and by health centre staff in Délı̨ne and Fort Simpson.

Increased risk of traffic accidents all-season due to operation of the Project

Once operational, the Project is expected to increase all-season traffic from communities in the LAA to other communities in the form of passenger, cargo and industrial/commercial vehicles. The project design is based on an average of 50 vehicles per day that includes a mix of vehicle types. The operation of the Project may result in both adverse and positive effects related to traffic.

Currently, the MVWR is generally operational between two and four months a year (concentrated in February and March but sometimes operating as early as January and as late as April), which is dependent on average temperature and construction time. There are two winter road counters, operated by the GNWT INF, which are located on the route that would be replaced by the Project. Traffic counts available for the years 2010 to 2019 indicate that the highest average daily vehicle count was 164 at the counter just south of Norman Wells (in 2013), and the lowest average daily vehicle count was 20 at the counter between Tulita and Wrigley (in 2010) (GNWT, 2020).

It is reasonable to assume that these average daily counts are to some extent driven by the short duration of the MVWR. If all-season access as a result of the Project were available, the average daily counts may likely decrease as travel could be spread out over the entire year instead of being limited to two to four months during the winter. As discussed in other sections, all-season access may result in increased traffic because residents would choose to remain living in their communities and make use of the Project to access activities, services and employment in other communities rather than migrating out, and the number of visitors and non-residents or visitors to communities in the LAA may increase.

Concerns have been raised about the possibility of an increased number of traffic accidents that result in serious injury or death as a result of increased traffic. Norman Wells and Tulita community members, RCMP officers, health staff and leadership spoke about increased risk of car accidents, including hitting wildlife. No community-level data about accident rates on the MVWR exists but could be monitored on a go forward basis. They also mentioned risks and concerns associated with insufficient communications infrastructure or emergency and highway rescue services available on the all-season road. This is a current concern on the MVWR and all roads and highways in the NWT and interviewees emphasized that current gaps in services need to be more fully met and the gaps in services to be addressed before any pressures associated with the operations of the Project may be added to community services. It is important to note, however, that there is no territorial legislation requiring emergency services to be made available in all communities or on NWT highways. Decisions regarding what emergency services are provided for community residents and whether to extend those services beyond municipal boundaries are made by the communities.

With similar projects, concerns have been raised about the length of the trips that residents and visitors would be taking (sometimes hundreds of kilometres (km)) and the potential risk of traffic accidents due to inclement weather, fatigue or having to travel at night on such long trips (Golder, 2017). The length of vehicle routes would not decrease as a result of the Project because it would generally follow the route of the MVWR.

Currently, with vehicle traffic being limited to use when the MVWR is open, residents and visitors may be choosing to travel in poor conditions or when traffic is heavy, because there is only a limited window in which to make use of the MVWR. Having all-season vehicle access available could reduce the risk of traffic accidents because residents and visitors could more easily schedule their travel to avoid poor conditions or times of heavy traffic. In Tulita, some community members indicated that the Project may result in safer travel than on the winter road because there would be less chance of being stranded if the winter road starts to melt or the road quality is poor.

For additional information on the risk of transportation related accidents, refer to the Accidents and Malfunctions chapter (Chapter 25).

9.5.9.2 Mitigation

Engagement in Norman Wells and Tulita with community members, leadership, Elders, RCMP and health staff identified safety concerns associated with the Project, both in terms of accidents as well as increases in crime. Many interviewees noted particular concerns related to danger or adverse effects being disproportionately experienced by youth and women.

A number of mitigation measures were suggested to reduce accidents and encouraging safe driving. These included making satellite phones available to drivers to allow them to keep in touch while driving long distances, and looking at ways to include additional signage, lighting, pullouts and shelters along the route of the Project. Other mitigation measures included education and awareness campaigns to encourage safe and healthy behaviour as well as safe driving; some would target vulnerable populations (e.g., youth, 2SLGBTQIA+ persons, and women) and others would focus on the population at large. Interviewees also emphasized the need to address current gaps in health, emergency and project rescue services before any potential demands from the operation of the Project affect services in communities.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT, where they exist.

The GNWT has committed to the development of a Road Safety Plan as part of the Community Readiness Strategy in order to address the potential adverse effects of the Project identified. The plan, which would align with the NWT Road Safety Plan, 2015, is intended to support safety along the Project by addressing the following needs:

- Improving communication along the highway (e.g., signage, communications)
- Raising public awareness about highway safety
 - Conducting highway safety information campaigns on topics such as: drinking/drugs and driving, hitchhiking risks, wildlife risks, winter driving risks, speed, and seat belts

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- Identifying segments of the population that are most at risk on the road (e.g., youth, women, new drivers) to consider their unique circumstances and appropriately target education and awareness efforts and materials
- Enforcing highway safety via implementation of standard practice patrols and check stops along the Project once operational

The management and delivery of ground ambulance and highway rescue services in the Northwest Territories (NWT) is challenged by the social and geographic conditions that exist for communities and highways in the territory. A large geographic area, low population base, extensive distances between communities, the small size and remoteness of many communities, a limited communications network, harsh climatic conditions and lack of an all-season territorial-wide transportation network are factors that impact the effectiveness and efficiency of the provision of these services. The GNWT will continue to build safe roads and focus highway safety education and enforcement where community emergency service capacity is either limited or not available. Alternative mitigation measures identified and implemented from past highway projects focused on highway safety education and enforcement where community emergency service capacity is either limited or not available.

The Safety and Security Plan for Vulnerable Community Members includes a series of measures intended to address adverse effects of the Project on changes in public safety that may disproportionately affect young women, girls and other vulnerable populations, including the following commitments of note:

- Will consider findings from the social and well-being monitoring program for the Tłı̨chǫ Highway and the Social Monitoring and Adaptive Management Plan for the period of construction and a period of five years of operations after project construction is completed. It will also consider findings and approaches from other jurisdictions (e.g., the 'Community Safety Toolkit' developed by the Carrier Sekani Family Services (2006) along the Highway of Tears).
- Support the provision of safety education to women, youth and children to help them identify and assess risks of violence (physical, sexual, emotional) and reduce harms

Chapter 25, Accidents and Malfunctions, includes several commitments related to operation of the Project that are intended to reduce the potential for transportation accidents. These in turn would mitigate the effects of traffic accidents on public safety. These measures include:

- Regular public updates on road conditions and closures via the GNWT INF website. Road closure signage will be posted at the physical site where appropriate
- On-going maintenance of the road to repair degraded areas will provide safer driving conditions
- Operational use of the road will include highway enforcement of speed limits and safe driving laws.
- Signage will be posted to identify known animal crossings or key habitat areas to prevent animal collisions with vehicles.

Additionally, the GNWT will require that contractors provide medical transportation services to its own workers, and this will be reflected in the Emergency Response Plan.

9.5.9.3 Project Residual Effect

Some of the identified mitigation measures have the potential to reduce the risk of adverse effects on public safety as such measures may reduce the presence of non-residents or visitors and associated adverse effects given increased community security, restrictions and enforcement. However, none of these measures can effectively eliminate the risk of increased effects on public safety that arise as a result of the Project.

The effectiveness of mitigation measures related to the provision of health and wellness programming will be limited by both the uptake and by the response of individuals to the programming (e.g., whether or not someone chooses to hitchhike). It is not possible to be definitive that the development or expansion of health and wellness programming will influence the choices that individuals might make or eliminate the risks associated with interactions with non-residents or visitors.

9.5.9.3.1 Construction

Following the implementation of mitigation measures described in Section 9.5.9.2, residual effects on public safety are summarized in Table 9.24 and overall residual effects during construction are characterized by the following:

- Direction is adverse: there will be an adverse effect on public safety as a result of the increased number of non-residents or visitors accessing LAA communities.
- Likelihood is possible: increased presence of non-resident construction workers is very likely to occur, but adverse effects on public safety would not occur with every instance, but could occur.
- Magnitude is moderate to moderate-high: the effects on public safety will be moderate generally as the interactions with non-resident construction workers will be limited, however for vulnerable populations including youth, 2SLGBTQIA+ persons, and women, the magnitude will be moderate-to-high given the disproportionate effects that may be felt by these groups.
- Geographic extent is the LAA: the higher number of non-residents or visitors is likely to be seen in LAA communities due to proximity to construction sites and camps, and access of construction sites by local residents is likely to be contained to residents of LAA communities.
- Timing is no sensitivity as the timing of project activities will not have an influence on the effect.
- Duration is short-term: public safety effects associated with the presence of outside construction workers will not extend past the construction phase.

- Frequency is irregular: the presence of non-resident construction workers in LAA communities will occur at irregular intervals.
- Change is reversible: public safety levels affected by the presence of non-resident construction workers will likely return to previous levels once construction is complete.

9.5.9.3.2 Operations and Maintenance

Following the implementation of mitigation measures described in Section 9.5.9.2, residual effects for public safety are summarized in Table 9.24 and overall residual effects during operations and maintenance are characterized by the following:

- Direction is adverse: public safety will be adversely affected by the increased presence of non-residents facilitated by the Project and the increased traffic leading to higher numbers of traffic accidents and associated effects.
- Likelihood is possible: increased presence of non-residents is almost certain to occur, but adverse effects on public safety would not occur with every instance, but could occur.
- Magnitude is moderate to moderate-high: the adverse effect will be of moderate magnitude as the numbers of non-residents visiting LAA communities is expected to be low and the increased traffic all-season leading to accidents may be moderated to some extent by all-season access making it possible for residents to plan vehicle trips for safe conditions which is not always an option if dependent on the MVWR and its relatively short window of operation. However for vulnerable populations including youth and women, the magnitude will be moderate-to-high given the disproportionate effects that may be felt by these groups.
- Geographic extent is the LAA: effects will be focused in the LAA communities as they will be directly connected to an all-season road as a result of the Project.
- Timing is no sensitivity: the timing of project activities will not have an influence on the effect.
- Duration is long-term: changes in public safety due to all-season road will persist throughout operation of the Project.
- Frequency is continuous: effects will occur throughout the operations and maintenance phase.
- Change is reversible: public safety effects associated with all-season access provided by the Project will decrease over time as mitigation measures are implemented and adaptive management is carried out and have an effect on community capacity and health behaviours.

9.5.9.4 Determination of Significance for Change in Public Safety

During the construction phase of the Project, the presence of non-residents (e.g., construction workers) who interact with residents in the LAA communities, and increased access to drugs and alcohol as a result of such interactions, may lead to increased rates of crime, violent crime and abuse as well as increasing vulnerability of Indigenous women and girls, 2SLGBTQQIA+ persons, or other vulnerable populations. This situation may decrease feelings of personal safety and decrease perceived/actual mental health.

During the operations and maintenance phase, there will be increases in road traffic as residents leave their communities/as non-residents or visitors enter the LAA via the new all-season road, to access programs and services, employment, or visit family and friends that results in an increased rate of injury (serious or otherwise) and death due to traffic accidents. There will also be increased risk of danger to Indigenous women and girls or other vulnerable populations due to the Project, which were raised during engagement as being of serious concern.

Some of the effects could be mitigated, but it is not possible to reduce all adverse public safety effects associated with the Project, especially considering the lack of ground ambulance and highway rescue services. As such, the effects of the Project on public safety are significant.

9.5.10 Change in Social Determinants of Health

9.5.10.1 Effects Pathways

Changes in the SDOH refers to changes to a broad range of personal, social, economic and environmental factors that determine individual and population health due to construction and operation of the Project. These may include potential changes to:

- Health behaviours
- Physical environments
- Employment and income
- Education and Educational Systems
- Food insecurity
- Community infrastructure, resources, and capacity

While the Population Health section (Section 9.5.3) identifies some measurable parameters by which the potential effects of the Project on population health can be assessed, there are other parts of the effects assessment that look at the potential effects of the Project on these broader components of the SDOH. Effects and mitigation measures for several of the changes that are part of SDOH have been discussed in detail in sections of the human health and community wellness portion of the effects assessment and the effects assessment of other socio-economic VCs such as infrastructure, services and institutional capacity, education, training and skills, and employment and economy. Additional details on which sections of the socio-economic effects assessment contain more details about potential effects of the Project that are recognized as components of SDOH are contained in Table 9.11.

Table 9.11 Overview of Interconnections between SDOH and Other Chapter Sections

Social Determinant of Health Component	Chapter Section where Project Effects are Discussed
Health Behaviours (including drug and alcohol use)	<ul style="list-style-type: none"> • Community, Family and Social Ties (Section 9.5.4) • Social Pressures (Section 9.5.6)
Physical environments (e.g., housing)	<ul style="list-style-type: none"> • Nuisance (Section 9.5.7) • Public Safety (Section 9.5.9) • Housing and Accommodation (Section 9.8.2)
Employment and Income	<ul style="list-style-type: none"> • Employment and Income (Section 9.7.2) • Economic Opportunities and Capacity of Local Businesses (Section 9.7.4)
Education and Educational Systems	<ul style="list-style-type: none"> • Level of Education, Certification and Training Programs (Section 9.6.2) • Access to Education, Certification and Training Programs (Section 9.6.3) • Capacity to Meet Demand for Education, Certification and Training Programs (Section 9.6.4)
Food Insecurity	<ul style="list-style-type: none"> • Food Security (Section 9.5.5) • Traditional Economy (Section 9.7.6)
Community Infrastructure, Resources and Capacity	<ul style="list-style-type: none"> • Public Safety (Section 9.5.9) • Social Infrastructure and Services (Section 9.8.3) • Public Infrastructure and Services (Section 9.8.4) • Institutional Facilities and Services (Section 9.8.5)

9.5.10.1.1 Construction, Operations and Maintenance

As indicated, there are a number of sections in the human health and community wellness, education, training and skills and employment and economy socio-economic VCs that include discussion of effects that are considered SDOH. Many of these potential effects are linked to each other. For example, and as discussed in the Social Pressures section (see Section 9.5.6), increased drug and alcohol use and abuse can also contribute to other effects that have an adverse effect on overall health levels and the SDOH, such as increased family violence, increased rates of disease or crime levels.

During engagement in LAA communities (Norman Wells and Tulita) and RAA communities (Fort Good Hope, Délı̄ne and Colville Lake), the linkage between potential effects of the Project were highlighted. For example, the link between education and training and the ability to access employment opportunities, which in turn were linked to positive effects on income levels and mental health and in some case, adverse effects such as increased drug and alcohol use because of higher income levels facilitating purchase and access. As well, all-season road access was mentioned as having positive effects on the ability to access health services in other communities but was also identified as putting additional pressure on existing health services shortages in those communities, and potentially increasing demand due to increased drug and alcohol use associated with all-season road access.

One potential effect related to the Project that has not been discussed elsewhere but can be considered a social determinant of health is dependence on income assistance. In addition to assessing the effects of project employment on communities, how this is linked to income assistance is a component of SDOH. Since 2010, Wrigley has seen a relatively constant income assistance caseload, while both Tulita and Norman Wells have seen their caseloads increase in recent years. Tulita has a higher proportion of low-income residents (ranging between 21.3% and 28.3%) than Norman Wells (where the range has been 9.0%-11.8%)¹⁴. Increases in employment levels among residents in LAA communities may lead to a reduction in the need for income assistance and a decrease in the number of low-income residents. For those individuals that are currently receiving income assistance or are considered low income, they may be receiving additional support in the form of housing subsidies or eligibility for public housing. If their income levels rise as a result of employment opportunities associated with the Project, this may have unintended adverse effects in that it may change or eliminate eligibility for these supports. In the case of housing-based supports, this may mean that individuals would be in the position of having to locate and obtain other housing (e.g., market-based or private rentals as opposed to public housing) as a result of increased income levels, which could place additional pressure on housing availability in some communities. When considering whether or not to pursue employment opportunities associated with the Project, individuals may have to consider their overall income and need to for supports and determine if the income provided by employment is greater than the current supports they are receiving.

In the case of employment opportunities that are linked to the construction phase, these positions are not permanent and so it is possible that any positive effects on low-income levels or income assistance rates may revert back to current levels once construction is complete. It is possible that the experience gained because of working on the Project may increase employability of some residents, allowing them to find work elsewhere once the construction jobs are no longer available.

For employment directly due to project operations and maintenance, or those that are indirect or induced business or employment opportunities (e.g., expanded or new businesses as a result of all-season road access provided by the Project), these positions are likely to be longer-term. These positions or opportunities may lead to some residents earning higher incomes or being able to exit income assistance permanently. For more information on the employment and economy opportunities and effects, refer to the employment and economy VC (see Section 9.7). Associated effects with additional employment or business opportunities outside of the Project are also discussed in the non-traditional land use VC (see Section 9.9).

¹⁴ Low-income figures and data were provided by the NWT Bureau of Statistics, which reflect the Statistics Canada definition and method of calculating low income. Low income is generally defined as a relative measure of low income based on the median and income distribution of a population.

The ability of residents to obtain employment on the Project may be dependent on having the appropriate skills and training. Some employment opportunities may be restricted to those with a minimum education level (e.g., high school diploma) or with specialized training (e.g., in the trades). For those residents who are low income or on income assistance, their ability to participate in education and skills training opportunities that would make them eligible for certain employment opportunities may be limited by a lack of funds or necessary prerequisites (e.g., high school diploma) or their ability to access or eligibility for support programs. Additionally, those who are the parent in a lone parent household may also have particular barriers to participate in education, skills, training or employment opportunities unless additional supports are available (e.g., childcare, provision of a living allowance). The GNWT-ECE provides funding to eligible clients to support access to short-term (one year or less) skills development and upgrading programming. Supports provided include funding for tuition, course fees, books and required materials, travel, living allowance and childcare. For more information on education and training effects related to the Project, refer to education, training and skills (Section 9.6).

9.5.10.2 Mitigation

Effects on SDOH are mitigated by the measures outlined in Sections 9.5.2 through 9.5.9 in this chapter, as well as those mitigation measures identified in employment and economy (Section 9.7) and education, training and skills (Section 9.6).

9.5.10.3 Project Residual Effect

9.5.10.3.1 Construction, Operations and Maintenance

As the changes in SDOH are included in other sections in this chapter or in other chapters, no residual effects are identified here. Additional information on the mitigation sections that are related to each of the SDOH are contained in the table below. Only those sections where there are residual adverse effects are listed below. Those sections where the Project effects are anticipated to be positive are not included in Table 9.12.

Table 9.12 Listing of Chapter Sections Where Mitigations for Social Determinants of Health-Related Effects are Discussed

Social Determinant of Health Component	Chapter Section where Mitigations for Project Effects are Discussed
Health Behaviours (including drug and alcohol use)	<ul style="list-style-type: none"> • Community, Family and Social Ties (Section 9.5.4.2) • Social Pressures (Section 9.5.6.2)
Physical environments (e.g., housing)	<ul style="list-style-type: none"> • Nuisance (Section 9.5.7.2) • Public Safety (Section 9.5.9.2) • Housing and Accommodation (Section 9.8.2.2)
Employment and Income	<ul style="list-style-type: none"> • Economic Opportunities and Capacity of Local Businesses (Section 9.7.4.2)

Social Determinant of Health Component	Chapter Section where Mitigations for Project Effects are Discussed
Education and Educational Systems	<ul style="list-style-type: none"> • Capacity to Meet Demand for Education, Certification and Training Programs (Section 9.6.4.2)
Food Insecurity	<ul style="list-style-type: none"> • Food Security (Section 9.5.5.2) • Traditional Economy (Section 9.7.6.2)
Community Infrastructure, Resources and Capacity	<ul style="list-style-type: none"> • Public Safety (Section 9.5.9.2) • Social Infrastructure and Services (Section 9.8.3.2) • Public Infrastructure and Services (Section 9.8.4.2) • Institutional Facilities and Services (Section 9.8.5.2)

9.5.10.4 Determination of Significance for Change in Social Determinants of Health

The Project is expected to result in positive effects on certain SDOH such as: increasing employment opportunities; increasing income/decreasing rates of income assistance; increasing access to health and wellness programs and services; and increasing access to education and training opportunities and supports. Adverse residual effects are discussed in the appropriate potential effects sections as outlined in Table 9.11.

9.5.11 Summary of Positive Project Effects for Human Health and Community Wellness

The assessment of effects of the Project on the various effects pathways of this VC has identified several positive potential effects and they are summarized in this section.

Increased ability for residents to travel to other communities all-season to access services

During the operations and maintenance of the Project, the residents of the LAA communities will have the ability to travel to other communities in the LAA all-season to participate in events, visit family and social connections or access some services. For Tulita and Norman Wells¹⁵ residents (who do not currently have any all-season road access), they will have the ability to travel to larger centers (e.g., Yellowknife or Hay River) outside the LAA to access services that are not available in the LAA communities and visit family or social connections or participate in events in those larger centres more easily.

¹⁵ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

This may have positive effects on community/family and social ties (including the ability to participate in activities and experiences outside of communities) and population health and may slow some out-migration driven by the need to access services or employment. All-season access may facilitate employment and business opportunities for LAA residents which may also have a positive effect on population composition and growth. Increased access to other locations within the LAA may also increase food security by providing more regular and easier access to harvesting locations.

Increased access to resources and goods due to all-season road access

All-season road access will provide easier and lower-cost access to food and goods, which will positively affect food security. It may also facilitate the growth or development of new businesses that would lead to additional employment opportunities for residents of LAA communities, contributing positively to population composition by slowing or stopping some out-migration driven by the need to access employment elsewhere.

Increased employment opportunities associated with the Project

The increased direct employment opportunities that exist during both the construction and operations and maintenance phases of the Project may lead to slowing of out-migration in LAA communities, and to a lesser extent, RAA communities, that is driven by the need to seek employment elsewhere as there will be new employment opportunities available to residents.

9.5.12 Overall Determination of Significance for Human Health and Community Wellness

The majority of the effects on the human health and community wellness VC have been determined to be not significant or neutral/positive. Change in social pressure has been identified as being significant due in large part to the potential exacerbation of issues associated with increased access to drugs and alcohol, including increased crime, family dysfunction, and violence. As noted in the discussion of residual effects for change in social pressures, drug and alcohol use and abuse is an existing serious condition in LAA and RAA communities that was emphasized during engagement and has been identified as an action area at the community level. Changes in public safety have also been identified as significant due to the potential magnitude of effects, especially to vulnerable populations, as well as the lack of ground ambulance and highway rescue services in NWT that could respond to accidents associated with operation of the Project. It is difficult to comment with certainty on the duration of the effects on social pressures public safety, given the timing and long duration of the Project. However, when all effects are considered along with the commitment to develop a monitoring plan and well-being adaptive management plan, the effects on human health and community wellness overall are not significant.

9.6 Assessment of Potential Effects on Education, Training and Skills

Based on project interactions with the socio-economic environment identified in Appendix 9B, Table 9B.2, the Project may affect education, training and skills.

Potential effects, effect pathways and mitigation measures proposed to enhance, reduce or eliminate the effects on education, training and skills are identified in Table 9.13. More details on the potential effects anticipated in both the construction and operations and maintenance phases of the Project and mitigation measures follow the table, along with a description of any residual effects that remain once mitigation measures have been applied, and in cases where the residual effects are adverse, a determination of significance of the residual adverse effects is included.

Most of the potential effects on education, training and skills are positive. It is anticipated that direct employment opportunities from the Project will generate increased interest in education and skills training among local residents. This effect is expected to be strongest in the construction phase and weaker in the operations and maintenance phases. The Project is also expected to positively benefit access to education programming and training during the operations and maintenance phase by allowing local residents greater, all-season access to education and training opportunities offered outside their immediate communities. Finally, it is expected that the Project will positively affect the ability of local communities to attract and retain teachers and adult educators due to decreased travel costs.

An adverse effect is anticipated related to the capacity of CLCs to meet the expected increased demand for learning and training programs. Existing CLCs may not have the capacity or the full range of course offerings to deliver training programs that allow local residents to take advantage of employment opportunities resulting from the Project. This potential adverse effect is to be mitigated through the creation of a Contractor Training and Employment Plan developed by the planned MVHCWG.

It should be noted that many of the potential effects of the Project are interconnected and as such, the measurable parameters that have been identified for certain effect pathways may in some cases have some connection to other effects pathways. However, for the purposes of the effects assessment, measurable parameters are limited to inclusion with one effects pathway. As appropriate, interconnections and linkages between effects of the Project and between socio-economic VCs are highlighted in the text, with appropriate references to particular sections of Chapter 9.

Table 9.13 Potential Effects and Mitigation Measures for Education, Skills and Training

Effect Name	Effect Pathway	Mitigation Measures
Change in level of education, certification/training and skills development	<ul style="list-style-type: none"> • Change in level of education, training and skills development immediately prior to construction in anticipation of project-related employment opportunities • Changes in level of education, training and skills development during operations and maintenance to support ongoing project-related employment opportunities 	<ul style="list-style-type: none"> • The effects of the Project on the change in the level of education is positive, and no mitigation is required. However, the GNWT will develop and implement a Contractor Training and Employment Plan that includes measures that are intended to enhance the positive effects of the Project related to level of education. These measures include measures to ensure that employment needs are clearly understood and linked to planning and implementation of education and training programs.
Change in access to education, certification/training, and skills development programs	<ul style="list-style-type: none"> • Change in access to education, certification and training programs due to construction of the Project • Change in access to education, certification and training programs during operations and maintenance of the Project 	<ul style="list-style-type: none"> • The effects of the Project on the change in access to education is positive, and no mitigation is required. However, the GNWT will develop and implement a Contractor Training and Employment Plan that includes measures that are intended to enhance the positive effects of the Project related to access to training and education. These measures include measures to ensure that employment needs are clearly understood and linked to planning and implementation of education and training programs.
Change in capacity to meet demand for education, certification and training programs	<ul style="list-style-type: none"> • Change in capacity to meet demand for education, certification and training programs during the construction phase in anticipation of project-related employment opportunities • Change in capacity to meet demand for education, certification and training programs during operations and maintenance due to project-related employment opportunities 	<ul style="list-style-type: none"> • The GNWT will develop and implement a Contractor Training and Employment Plan that includes supports for students related to seeking and obtaining education and training and identifies existing programs and services (i.e. Virtual Learning Strategist and Build Your Skills) that can be used to support education and training needs. • The GNWT will also develop and implement a Well-Being Adaptive Management Plan that includes measures related to community services, which are intended to respond to negative monitoring indicators related to increased demand on education and training services and put programming and services in place to mitigate adverse effects of the Project.

Each section of the assessment of potential effects includes mitigation sections with more detailed information on specific measures and commitments, and a full summary of the mitigation measures and commitments that are part of the Community Readiness Strategy is available in Section 9.16.1, and a full summary of additional mitigations and commitments is provided in Section 9.16.3.

9.6.1 Summary of Engagement Findings on Education, Training and Skills

During engagement in the LAA and RAA communities, several observations and views were expressed by representatives of Indigenous Governments, Indigenous Organizations, and other affected parties, including school administration, adult educators, youth, and women on the topic of education, training and skills.

Many of those who were engaged stated that adult education programs in the communities are limited in terms of range of programs and the capacity to provide additional programs. Residents were concerned that educational upgrading will be necessary in order for community members to pass trades entrance exams or otherwise obtain the qualifications necessary for project construction jobs. Community members also stated that many people in the region want construction-oriented skills training but that the costs associated with the training can be an impediment.

It was suggested during engagement that a satellite campus of Aurora College be established in Norman Wells to allow individuals to take part in new/more education and training opportunities close to home and at a much lower cost.

Community members believe that once operational, the Project may attract and retain educators as a result of the increased ease and decreased travel costs associated with accessing the communities.

Details of engagement are integrated into the effects pathways described in Sections 9.6.2 through 9.6.6.

9.6.2 Change in Level of Education, Certification/Training and Skills Development

9.6.2.1 Effects Pathways

The potential effect of the Project on change in level of education, training and skills development has two effect pathways that are discussed in this section:

- Change in level of education, training and skills development prior to construction in anticipation of project-related employment opportunities
- Changes in level of education, training and skills development during operations and maintenance to support ongoing project-related employment opportunities

9.6.2.1.1 Construction

Change in level of education, training and skills development prior to construction in anticipation of project-related employment opportunities

In anticipation of upcoming construction work, an increased proportion of the population may complete high school and continue to pursue trades-based training and skills development programs at the college or community learning centers (CLCs) to secure project employment. In general, the populations of the LAA and RAA communities have lower educational attainment than the territorial average. Among the LAA communities in 2021, both Wrigley and Tulita had a lower percentage of population with high school diploma or more than the territorial average of 74% (in the case of Wrigley, more than 30 percentage points lower), while Norman Wells had a higher percentage of the population with a high school diploma than the territorial average. All RAA communities have a lower percentage of the population with a high school diploma than the territorial average. Generally, the gap between educational attainment rates in the LAA and RAA communities and the territorial average has reduced over time, but still remains as of 2021. Enrollment in education and training programs will depend on the level of interest from community members and the qualifications and certifications needed for project employment opportunities. As noted by Elders in Tulita, the capacity of young people to participate in education and training programs and become employed will also depend on their overall health and wellness, *“How many young people will pass the tests and actually get jobs with all the mental health problems, addictions, homelessness, unemployment, and lack of training? These need to be dealt with before the road comes to the community.”*

Refer to Section 9.5.6.1 for more detailed engagement information on the potential of the Project to exacerbate existing adverse social conditions in the LAA and RAA communities and the need for additional services and supports to help mitigate this effect.

The Project Description (Chapter 5) has estimated the direct construction workforce for the Project, including the number of construction personnel, supervisors, environmental / wildlife monitors, camp services personnel and construction administration and management personnel. More information on the potential employment and income effects of the Project can be found in Section 9.7.2 of this chapter.

Based on lessons learned from past development project with training agreements (e.g., Enbridge and the Mackenzie Valley Gas Project) Tulita residents suggested that community members *“be very vigilant and put their foot down”* and that leadership *“needs to say very strongly that they want a certain number of people trained and qualified”*.

Enrolment demands may be affected by the timing and duration of project phases. For example, construction of the Project is expected to occur over a 20-year timeframe, consisting of three segments, and spanning approximately 10 years. The conceptual schedule assumes the Project would be fully constructed between 2041 and 2046. It may be assumed that demand for trades training related to construction phase employment will be higher before construction begins so that residents can receive maximum employment benefits for the duration of the construction

period. If training requires the completion of a high school diploma, this may limit the ability of residents to undertake needed education or training upgrading to obtain employment.

Community members from Norman Wells and Tulita commented on the need for upgrading since many people with a high school diploma will not be able to pass the trades entrance exam. ECE provided additional information on two kinds of online or web-based supports for individuals needing assistance with apprenticeship coursework and exams that are currently available:

- **Virtual Learning Strategist (VLS):** For registered apprentices, participants work with a Learning Strategist to address a range of areas including possible skill gaps, learning disabilities, exam anxieties, and other factors affecting performance, such as sensory challenges and deficits in study skills and motivation. This program includes development of customized learning plans, delivery of support services, or referrals to other entities for formal assessments and academic supports.
- **Build Your Skills:** An online support using trade-specific assessments to navigate on the job and technical training. This program provides academic supports and assistance for pre-apprentices and apprentices to build the foundational skills necessary to pass the Trade Entrance Exam or improve their technical training outcomes.

Community members also identified a range of training courses/certificates they felt should be made available to support immediate employment opportunities (e.g., heavy equipment operators, pre-trades, safety (e.g., transportation of dangerous goods, chainsaw safety), surveyors, camp staff, general labourers). A resident from Fort Good Hope also spoke about the importance of the Building Trades Helper courses for preparing local people to take part in employment opportunities through the Project. ECE staff indicated that the Building Trades Helper course is not suited to road construction; rather, it provides an introduction to the trades involved in building construction. Such courses help individuals prepare for the workplace by gaining skills in areas such as mechanical, electrical, tools and materials and carpentry. Community members from Tulita also spoke about the need to address restricted driver's licences (i.e., NWT Class 5 Probationary licence, or 'learner's licence'), which currently prohibit individuals from taking part in heavy equipment operator training, prior to construction. These programs and courses are currently available and can be financially supported through ECE Labour Market Programs.

It is anticipated that the Project will have a positive effect within the LAA (i.e., within the communities of Wrigley, Tulita and Norman Wells) on education prior to and during the construction phase. Changes in the level of education are expected to be highly time sensitive in that the delivery of educational programming and training, and subsequent increases in education levels, will be realized at times relative to the Project's life cycle. For example, educational programming and training must be provided a minimum of one-year prior to the start of construction of the Project to adequately support the Project and position community members to take advantage of employment opportunities. Residents from Norman Wells and Tulita suggested that contractor training begin at least a year before construction. For some apprenticeable trades (e.g., Heavy Equipment Technician), training would need to start four years before needed on the Project.

9.6.2.1.2 Operations and Maintenance

Changes in level of education, training and skills development during operations and maintenance to support ongoing project-related employment opportunities

It is anticipated that the Project will have a positive effect within the LAA during the operations and maintenance phase of the Project with regards to education and training levels of community residents. It is expected that education levels will increase slightly in the long-term as a result of the on-going employment opportunities associated with the Project. Residents from Norman Wells and Tulita identified a range of training courses/certificates they felt should be made available to support employment opportunities for the Project (e.g., wildlife, environmental, and heritage resource monitoring; GIS, maintenance) during the operations and maintenance phase and that could be transferred to other projects and jobs. This would be shown as potential increases in the high school diploma attainment rate, driven by the need to obtain a diploma to go on to trades training or obtain a job with minimum high school education level required.

9.6.2.2 Mitigation

Several enhancement initiatives were proposed during engagement with Indigenous Governments, Indigenous Organizations, and other affected parties:

- Engagement in Norman Wells with CLC staff indicated that it will be important to provide funds for local training and ensure that local jobs are a component of hiring so as to encourage people to take part in education and upgrade or develop their skills.
- Community members from Norman Wells and Tulita commented that contracts to complete work on the Project must include agreements to provide training to local residents, particularly training that is directly linked to employment. As one resident commented, *“the contractors shouldn’t have contracts if they don’t make a commitment to training and apprenticeship”*. It was recommended that contractors create their own training plan outlining how people are to be trained.
- Community members from Norman Wells and Tulita spoke about the importance of developing an overall training plan prior to project construction, identifying training funds, and initiating education, training and skills building needed to participate in job opportunities at the start of construction. Comments included: *“We would like to be involved. There needs to be a training fund to deal with the road and bridge. We need to put something in place before the construction. We need a training plan for the road.”*

Readiness to participate in job opportunities and benefit more generally from the Project is considered instrumental to success of the Project. As one resident from Fort Good Hope remarked, *“if the highway has no benefits for Indigenous people, then it’s just a highway. Without proper programs to ensure Indigenous success, then it’s just a road.”*

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9.0 Socio-Economic Impact Assessment

October 2023

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

As indicated in the construction section, the training for some apprenticeable trades would need to begin well in advance of construction to ensure that people are employment ready. Due to the sensitive nature of the timing and interconnectedness to project life cycle and timing, the Contractor Training and Employment Plan includes the following measures that are intended to enhance the positive effects of the Project related to level of education and ensure that people are employment ready to take advantage of opportunities:

- Identifies employment opportunities (types, numbers, timing/schedule and employment hiring requirements) during construction and operations, informed by information from the GNWT about the project schedule and well in advance of the beginning of construction
- Identifies availability of and gaps in skilled labour for construction employment opportunities in each of the communities including the creation of skill inventories and seeks to address these to support optimizing training and employment opportunities
- Identifies barriers to increasing uptake in education and training courses (e.g., restricted licences in Tulita) and develops potential solutions to implement
- Identifies education, skills and training programs and courses required to address lack of available skilled labour for construction and operations in each of the communities, including sharing information about Labour Market Programs that can support communities, employers and organizations
- Identifies education, training programs, and courses currently available, (local CLC or campus) and how they are offered (in-person, remote, or blended) and new programs and courses required to meet local need (as well as whether or not additional staffing and space requirements are necessary). This could include the Virtual Learning Strategist and Build Your Skills services/programs currently offered by ECE.
- Identifies potential funding to support education and training prior to construction, during construction and operations
- Explores feasibility of building workshops in each community to support hands-on learning opportunities
- Ensure all communities are supported to prepare the workforce for employment opportunities through coverage of existing ECE programs and positions (e.g., Career Development Officers)
- Communities will be encouraged to develop Community Labour Market Plans to evaluate their needs in relation to the Project.

9.6.2.3 Project Residual Effect

The residual effect on education levels in the LAA during construction and operations and maintenance is positive. No determination of significance of effects is required.

9.6.3 Change in Access to Education, Certification and Training Programs

9.6.3.1 Effects Pathways

The potential effect of the Project on change in access to education, certification and training programs has two effects pathways that are discussed in this section:

- Change in access to education, certification and training programs due to construction of the Project
- Change in access to education, certification and training programs during operations and maintenance of the Project

9.6.3.1.1 Construction

Change in access to education, certification and training programs due to construction of the Project

It is anticipated that there may be a positive effect on access to education, certification, and training programs within the LAA during the construction phase. The increase in access will be limited to the communities that are connected all-season to Yellowknife as a result of the Project (i.e., Wrigley at the outset of construction). While ECE offers two online learning services and programs (Virtual Learning Strategist and Build Your Skills) that support apprenticeship and training students, it is unclear if these services and programs will have the full capacity to support increased demand resulting from the Project. Aurora College does offer a limited number of continuing education courses; however, it is not known how many of these are targeted toward apprenticeship or construction training. Thus, it should be assumed that access to education, certificate, and training programs will remain limited to in-person learning. Access will increase accordingly, each time an additional community is connected. To support education and training efforts, it was recommended during engagement that an Aurora College satellite campus be established in Norman Wells to provide Sahtu Region residents improved local access to training programs. Engagement with staff at the Norman Wells CLC indicated that those wanting to upgrade for grades 10, 11 and 12 have to leave the community to attend classes at one of the campuses.

9.6.3.1.2 Operations and Maintenance

Change in access to education, certification and training programs during operations and maintenance of the Project

The Project, once operational, will create all-season access for local communities to the Aurora College CLCs in Tulita and Norman Wells¹⁶. For Tulita and Norman Wells, the Project will create all-season access to centres in Yellowknife. The improved access could result in more residents from the LAA accessing trades-based training programs, including construction basics and heavy equipment operation, increasing in the overall level of education, certification, and skills development in the Sahtu Region. In the long term, having greater access to Yellowknife as a result of the Project will create access to educational programming and training that currently requires travel by air or relocation.

With that being said, it is acknowledged that the three LAA communities are very far from Yellowknife, requiring many hours of travel to and from it. It may be unlikely that residents from the three communities would be willing to travel to Yellowknife via the proposed Project to access educational programming and training. Thus, if there is any increase in access, it is likely minimal. Members from the RAA communities of Fort Good Hope and Colville Lake and the LAA community of Tulita said that if new/more training opportunities were available in Norman Wells, people would access them more readily than travelling to Yellowknife because not all residents are willing/able to be so far from home. A typical statement was, *“people are not willing to travel just for educational purposes but going to Norman Wells might be more viable than going to one of the Aurora campuses.”*

It is anticipated that the Project will have a positive effect on access to education, certification, and training programs within the LAA during its operations and maintenance phase. Upon project completion, by being connected to Yellowknife, it is expected that members from all three communities in the LAA will enjoy greater access to educational programming and training. Residents from Norman Wells and Tulita believe that the Project will reduce the cost of educational supplies and equipment as well as the overall delivery of courses. This, in turn, will allow more courses to be taught. For example, the Project will allow the Aurora College’s mobile trades truck to travel to the Sahtu Region providing more hands-on training opportunities for locals. It was also recommended that workshops be built in each community to further support experiential learning.

¹⁶ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

9.6.3.2 Mitigation

Engagement in Tulita suggested that allowing for non-restricted drivers licences to be offered would remove a barrier to accessing training. Another mitigation that was identified was building additional accommodations in Norman Wells that could be used for students to support them coming to Norman Wells for education and training. Elders in Tulita noted that many of social and health issues that are facing the community's youth (e.g., addictions, mental health) are a barrier to youth accessing either education or employment, and these need to be dealt with prior to construction and during construction and operation of the Project.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16).

The GNWT currently offers programs and services designed to support students in obtaining education and training and facilitate their participation, which extends to students that may not have access to a local educational institution or local training facilities. While the GNWT is not committing to an establishment of a satellite Aurora College campus at this time, mitigation measures have been identified to enhance the positive effects of the Project on education and training through the leveraging of existing programs and supports (see Section 9A.3 for details on existing programs and policies) and respond to educational and training needs that are identified and linked to the Project. Although the effects of the Project on the change in the level of education are positive, and no mitigation is required, the Contractor Training and Employment Plan includes the following measures that are intended to enhance the positive effects of the Project related to level of education:

- Identifies employment opportunities (types, numbers, timing/schedule and employment hiring requirements) during construction and operations, informed by information from the GNWT about the project schedule and well in advance of the beginning of construction
- Identifies availability of and gaps in skilled labour for construction employment opportunities in each of the communities including the creation of skill inventories and seeks to address these to support optimizing training and employment opportunities
- Identifies barriers to increasing uptake in education and training courses (e.g., restricted licences in Tulita) and develops potential solutions to implement
- Identifies education, skills and training programs and courses required to address lack of available skilled labour for construction and operations in each of the communities, including sharing information about Labour Market Programs that can support communities, employers and organizations
- Identifies education and training programs and courses currently available, where (local CLC or campus) and how they are offered (in-person, remote, or blended), and new programs and courses required to meet local need (as well as whether or not additional staffing and space requirements are necessary)
- Identifies potential funding to support education and training prior to construction, during construction and operations

- Explores feasibility of building workshops in each community to support hands-on learning opportunities
- Ensure all communities are supported to prepare the workforce for employment opportunities through coverage of existing ECE programs and positions (e.g., Career Development Officers)
- Communities will be encouraged to develop Community Labour Market Plans to evaluate their needs in relation to the Project

9.6.3.3 Project Residual Effect

9.6.3.3.1 Construction, Operations and Maintenance

The Project is anticipated to have a positive effect on access to education, and the communities in the LAA have more direct access to Yellowknife. This positive effect is expected to be greatest during the operations and maintenance phase. Because the effects are positive, no determination of significance is required.

9.6.4 Change in Capacity to Meet Demand for Education, Certification and Training Programs

9.6.4.1 Effects Pathway

The potential effect of the Project on change in capacity to meet demand for education, certification and training programs has two effects pathways that are discussed in this section:

- Change in capacity to meet demand for education, certification and training programs during the construction phase in anticipation of project-related employment opportunities.
- Change in capacity to meet demand for education, certification and training programs during operations and maintenance due to project-related employment opportunities.

9.6.4.1.1 Construction

Change in capacity to meet demand for education, certification and training programs during the construction phase in anticipation of project-related employment opportunities

It is anticipated that the Project may have an effect on the capacity of education, training and skills development programs locally and more broadly in Yellowknife in the long term.

Employment opportunities associated with construction of the Project may require qualifications and training in the areas of equipment operators, surveyors, environmental monitors, cooks, camp managers, custodians, engineering and technical staff, and construction administrators.

Limited data on demand for specific courses or programs at CLCs is available, but engagement with CLC staff indicated that the existing capacity of CLCs to deliver the anticipated training programs is limited and several new programs may need to be implemented that are tailored specifically to the needs of the Project. Additional instructors and classroom space may also be needed to support the delivery of new training programs in the local communities.

9.6.4.1.2 Operations and Maintenance

Change in capacity to meet demand for education, certification and training programs during operations and maintenance due to project-related employment opportunities

There may be a neutral effect with no measurable change on capacity to meet demand for education, certification, and training programs within the LAA following project completion. Alternatively, residents from Norman Wells and Tulita thought that once the Project was built, it would potentially be easier to attract educators (elementary, secondary and post-secondary) to the LAA communities because they could drive in and out when they wanted. Additionally, the Project may result in journey-persons relocating to the Sahtu Region which would provide much needed supports to individuals enrolled in apprenticeship programs.

During engagement, staff at the Norman Wells CLC suggested mitigation measures that would provide funding and support to develop and offer more training locally, including the exploration of a satellite campus in Norman Wells. Another mitigation that was noted was to look at building additional accommodations in Norman Wells that could be used for students and support them coming to Norman Wells for education and training.

9.6.4.2 Mitigation

The GNWT currently offers programs and services designed to support students in obtaining education and training and facilitate their participation, which extends to students that may not have access to a local educational institution or local training facilities. While the GNWT is not committing to an establishment of a satellite Aurora College campus at this time, mitigation measures have been identified to enhance the positive effects of the Project on education and training through the leveraging of existing programs and supports (see Section 9A.3 for details on existing programs and policies) and respond to educational and training needs that are identified and linked to the Project. The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy the GNWT will develop the Contractor Training and Employment Plan.

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The Contractor Training and Employment Plan includes the following measures that are intended to mitigate the adverse effects associated with increased demand for educational services:

- Identifies employment opportunities (types, numbers, timing/schedule and employment hiring requirements) during construction and operations, informed by information from the GNWT about the project schedule and well in advance of the beginning of construction
- Identifies availability of and gaps in skilled labour for construction employment opportunities in each of the communities including the creation of skill inventories and seeks to address these to support optimizing training and employment opportunities
- Identifies barriers to increasing uptake in education and training courses (e.g., restricted licences in Tulita) and develops potential solutions to implement
- Identifies education, skills and training programs and courses required to address lack of available skilled labour for construction and operations in each of the communities, including sharing information about Labour Market Programs that can support communities, employers and organizations
- Identifies education and training programs and courses currently available, where (local CLC or campus) and how they are offered (in-person, remote, or blended), and new programs and courses required to meet local need (as well as whether or not additional staffing and space requirements are necessary)
- Identifies potential funding to support education and training prior to construction, during construction and operations
- Explores feasibility of building workshops in each community to support hands-on learning opportunities
- Ensure all communities are supported to prepare the workforce for employment opportunities through coverage of existing ECE programs and positions (e.g., Career Development Officers)
- Communities will be encouraged to develop community labour market plans to evaluate their needs in relation to the Project

The Community Services section of the Well-Being Adaptive Management Plan includes the following two measures that are anticipated to address the adverse effects related to increased demand for educational services that may arise as a result of the Project:

- Reviews existing uses and demands on services including childcare, schools and recreational facilities and identifies needs associated with any increased demands that may be associated with the Project (e.g., expansion of services)

9.6.4.3 Project Residual Effect

9.6.4.3.1 Construction

Mitigation measures described in Section 9.6.4.2 may help to address the capacity issue. However, even with additional resources, it may be difficult for the CLCs to meet all training needs. This local training deficiency may result in either community members seeking training outside of the three communities in the LAA (in order to obtain training for construction-related employment) or the GNWT relying on contractors from outside the communities to carry-out work on the Project (if not enough community members are trained to obtain employment for construction).

Following the implementation of the proposed mitigation measures described in the Contractor Training and Employment Plan, residual effects for change in capacity to meet demand for education, certification and training programs during the construction phase are characterized as follows:

- Direction is adverse: capacity to meet demand for training will be reduced during the construction phase.
- Likelihood is certain: the capacity to meet demand for training will be reduced during construction.
- Magnitude is moderate: effects will represent a moderate change relative to existing conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.
- Timing is no sensitivity: effect will occur in line with the timelines associated with the construction phase.
- Duration is medium-term: the residual effect occurs during the entire construction phase.
- Frequency is irregular: occurs at irregular intervals as interest in training ebbs and flows.
- Change is reversible: the residual effect is likely to be reversed after completion of the construction phase.

9.6.4.3.2 Operations and Maintenance

Following the construction phase, there may need to be a continued reliance on contractors from outside of the communities during the operations and maintenance phase. However, the increased ease and decreased cost of accessing the communities, may help attract new educators to the Sahtu Region and may help to retain existing teachers and adult educators.

Following the implementation of the proposed mitigation measures described in Section 9.6.4.2, residual effects for change in capacity to meet demand for education, certification and training programs during the operations and maintenance phase are characterized as follows:

- Direction is neutral: capacity to meet demand for training will be neither reduced nor increased.
- Likelihood is unlikely: capacity to meet demand for training and education is unlikely to change during operations.
- Magnitude is no measurable change: effects will represent no discernable change relative to existing conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.
- Timing is no sensitivity: effect will occur in line with the timelines associated with the operations and maintenance phase.
- Duration is long-term: the residual effect occurs during the entire operations and maintenance phase.
- Frequency is irregular: occurs at irregular intervals as interest in training ebbs and flows.
- Change is reversible: the residual effect is likely to be reversed over time due to the application of mitigation and adaptive management measures.

9.6.4.4 Determination of Significance for Change in Capacity to Meet Demand for Education, Certification and Training Programs

The Project may have a moderately adverse effect on the capacity of CLCs to meet demand for programming during the construction phase. As a by-product of unmet demand, it is possible that the potential increase in educational levels will only be partially realized. This may also mean that required trained personnel are not available from the communities. The effect of the Project on change in capacity to meet demand for education and training programs are neutral, negligible, and irregular during the operations and maintenance phase, and so are considered not significant.

9.6.5 Summary of Positive Effects of the Project on Education, Training and Skills VC

The assessment of effects of the Project on the various effects pathways of this VC has identified three potentially positive effects; they are briefly summarized in this section.

Increase in education levels due to interest in employment opportunities associated with the Project

It is anticipated that the Project will generate increased interest in education and training as community members in the LAA pursue employment opportunities associated with the Project, notably during the construction phase. This increase in interest is expected to result in increased levels of educational attainment and skills acquisition amongst community members in the LAA.

During the operations and maintenance phase, the Project may have a positive effect on education levels, though likely to a much lesser extent.

Increased access to educational programming and training due to operations and maintenance of the Project

It is expected that the Project will result in an-increase in access to education and training, as communities in the LAA will now have greater, all-season access to the Project, thus making travel in-between the communities more feasible.

This positive effect will only be completely realized when all three segments of the Project are complete.

Increased ability to recruit and retain teachers and community adult educators due to operations and maintenance of the Project

The Project may attract and retain educators as a result of the increased ease and decreased travel costs associated with accessing the communities.

9.6.6 Overall Determination of Significance for Education, Training and Skills

Given that most effects on education, training and skills are positive, and adverse effects are low in magnitude or limited in scope, the effects on education, training and skills are not significant.

9.7 Assessment of Potential Effects on Employment and Economy

Based on project interactions with the socio-economic environment identified in Appendix 9B, Table 9B.3, the Project may affect employment and economy.

Potential effects, effect pathways and mitigation measures proposed to enhance, reduce or eliminate the effects on employment and economy are identified in Table 9.14. More details on the potential effects anticipated in both the construction and operations and maintenance phases of the Project and mitigation measures follow the table, along with a description of any residual effects that remain once mitigation measures have been applied, and in cases where the residual effects are adverse, a determination of significance of the residual adverse effects is included.

Many of the potential Project effects on employment and economy are anticipated to be positive. It is anticipated that there will be increased employment and business opportunities for local residents and businesses. The employment effect is expected to be more pronounced in the construction phase compared to the operations and maintenance phase. These increased opportunities are expected to result in additional income and tax revenue that will increase the GDP. All-season access provided by the Project is anticipated to provide greater economic activity as a result of increased access and visits to the community. It is also anticipated that all-season access will provide transportation of food and goods into LAA communities and will result in lower costs to obtain supplies and materials. Positive effects will be enhanced through the development

and implementation of a Contractor Training and Employment Plan to ensure that local employment benefits are realized.

It is anticipated that the increased employment opportunities for local residents may have an adverse effect on the ability of residents to participate in the traditional economy. It is also anticipated that increased visitors or tourists to LAA communities as a result of all-season access provided by the Project may mean that some local businesses and residents require time to prepare in order to take advantage of the opportunities. The Contractor Training and Employment Plan is intended to mitigate any adverse effects of the Project, which includes measures to support communities in developing tourism plans and measures requiring contractors to incorporate cultural awareness and anti-racism training that will support hiring of local residents in a way that can support continued participation in the traditional economy.

It should be noted that many of the potential effects of the Project are interconnected and as such, the measurable parameters that have been identified for certain effect pathways may in some cases have some connection to other effects pathways. However, for the purposes of the effects assessment, measurable parameters are limited to inclusion with one effect pathway. As appropriate, interconnections and linkages between effects of the Project and between socio-economic VCs are highlighted in the text, with appropriate references to particular sections of Chapter 9.

Table 9.14 Potential Effects and Mitigation Measures for Employment and Economy

Effect Name	Effect Pathway	Mitigation Measures
Change in employment and income	<ul style="list-style-type: none"> • Increase in employment and employment opportunities associated with construction of the Project • Increase in employment and employment opportunities due to operations of the Project and as a result of all-season and lower cost access to communities 	<ul style="list-style-type: none"> • The effects of the Project on change in employment and income are positive and so no mitigations are required. However, the GNWT will develop and implement a Contractor Training and Employment Plan that will include measures intended to enhance the positive effects of the Project on employment and income levels. These measures will include work to support community planning in relation to employment and training needs, workforce development and identification of gaps in skilled labour, sharing information on existing labour market programming and services.
Change in GDP and government revenues	<ul style="list-style-type: none"> • Contribution to GDP in NWT and government revenues due to construction of the Project • Contribution to GDP in NWT and government revenues due to operations of the Project 	<ul style="list-style-type: none"> • The effects of the Project on change in GDP and government revenues are positive and so no mitigations are required. However, the GNWT will develop and implement a Contractor Training and Employment Plan that will include measures intended to enhance the positive effects of the Project on local employment and income levels. The plan includes measures related to enhancing local employment which would increase the positive effects of the Project on government revenues.

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Effect Name	Effect Pathway	Mitigation Measures
<p>Change in economic development opportunities and capacity of local businesses</p>	<ul style="list-style-type: none"> • Increases in contracts for businesses due to construction of the Project • Increases in contracts for businesses due to operations of the Project • Changes to the nature or viability of some existing local businesses (including capacity) due to operations of the Project • Enhance opportunities for economic development (e.g., enhanced tourism, arts and crafts, and existing and new businesses) all-season in communities due to operations of the Project 	<ul style="list-style-type: none"> • The GNWT will develop and implement a Contractor Training and Employment Plan that will include measures intended to enhance the positive effects of the Project on local businesses. These measures will include work to support community planning in relation to workforce development and identification of gaps in skilled labour and sharing information on existing labour market programming and services. • In order to address the adverse effects of the Project on the capacity of local businesses and employment, the GNWT has also committed to include conditions in construction contracts that require the contractor to prepare a Contractor Training and Employment Plan that: <ul style="list-style-type: none"> – Outlines how they will increase on-the-job training for LAA and RAA residents – Demonstrates through reporting that LAA and RAA residents and Indigenous people are being trained – Demonstrates how local and Indigenous labour and businesses will be sourced – Commits to cultural awareness and anti-racism training to mitigate potential adverse effects associated with presence of non-NWT/non-LAA/RAA workers – Details how contractors will communicate and collaborate with LAA and RAA community governments and Indigenous organizations regarding their involvement in construction and operation
<p>Change in cost of living / consumer prices</p>	<ul style="list-style-type: none"> • Change in cost of living due to operations of the Project related to reduced transportation costs to bring consumer and commercial goods, services, and materials into communities 	<ul style="list-style-type: none"> • Effects are positive or neutral, no mitigation required

Effect Name	Effect Pathway	Mitigation Measures
Change in traditional economy	<ul style="list-style-type: none"> Change in time available to participate in traditional harvesting due to employment associated with construction of the Project Change in time available to participate in traditional harvesting due to employment associated with or as a result of operations of the Project 	<ul style="list-style-type: none"> The GNWT will develop and implement a Contractor Training and Employment Plan that includes a measure to support cultural awareness and anti-racism training to mitigate the potential adverse effects associated with the presence of non-resident workers. The GNWT has also committed to verify a community based cultural awareness and anti-racism training as part of the Contractor Training and Employment Plan for non-NWT and non-Indigenous workers. This training would support employers and contractors in setting employment conditions and terms (such as rotational shifts) that would help community members have adequate time to continue to participate in traditional activities.
Change in the GNWT operations employment	<ul style="list-style-type: none"> Increase in number of the GNWT staff due to construction of the Project Increase in number of the GNWT staff due to operations of the Project and decreased in number of GNWT staff to maintain the MVWR 	<ul style="list-style-type: none"> Effects are positive or neutral, no mitigation required

Each section of the assessment of potential effects includes mitigation sections with more detailed information on specific measures and commitments, and a full summary of the mitigation measures and commitments that are part of the Community Readiness Strategy is available in Section 9.16.1, and a full summary of additional mitigations and commitments is presented in Section 9.16.3.

9.7.1 Summary of Engagement Findings on Employment and Economy

During engagement in the LAA and RAA communities, many observations and views were expressed by representatives of Indigenous Governments, Indigenous Organizations, and other affected parties, including businesses, youth, Elders, and women on the topic of employment and economy. In summary, community members anticipate job opportunities during the Project's construction phase but are aware of the need for education and training in order for individuals to increase their chances of employment. Most also see opportunities for local businesses to be contracted for construction work and want efforts to be made to prioritize the hiring of local businesses in the LAA and RAA communities. Concerns were voiced, however, about providing enough supports to enable more businesses to be contracted across the region instead of the same few businesses that get the contracts for the MVWR.

Community members generally believe that when the Project is operating, the LAA communities will experience economic opportunities and diversification, and some economic opportunities in the RAA communities. The increased movement of people among the communities, and tourists and

other visitors to these communities is expected by most residents to stimulate economic activity. The cost of living is expected to decrease, especially in relation to personal transportation (i.e. lessening reliance on air travel due to being connected to the rest of Canada all-season by road), construction materials and supplies, and possibly oil and gas (due to less costly transportation by truck). While the hope is that costs in general will decrease due to the Project, many community residents are unsure as to whether it will actually happen. Community members tend to think that Tulita and Norman Wells will experience most of the economic benefits – especially if Norman Wells becomes a business hub for the region.

Engagement in the LAA and RAA communities indicated that the effects of the Project on the traditional economy may be both positive and negative. On the positive side, the Project may facilitate Indigenous peoples' access to traditional foods and materials, but on the negative side, the Project may disturb natural habitats and result in competition for foods and materials through non-traditional land use.

Overall, most Indigenous Governments, Indigenous Organizations, and other affected parties in the engaged LAA and RAA communities see employment and economic opportunities as being one of the main attractions of the Project. Many individuals are passionate advocates of the Project. However, even the community advocates of the Project acknowledge that the training and education of community members and support of community businesses will be required to support employment and business opportunities and that as attractive as the Project is in terms of employment and economy, communities must first build the capacity necessary to address the social pressures to which the Project will contribute.

Details of engagement are integrated into the effects pathways described in Sections 9.7.2 through 9.7.8.

9.7.2 Change in Employment and Income

9.7.2.1 Effects Pathways

The potential effect of the Project on change in employment and income has two effects pathways that are discussed in this section:

- Increase in employment and employment opportunities associated with construction of the Project
- Increase in employment and employment opportunities due to operations of the Project and as a result of all-season and lower cost access to communities

9.7.2.1.1 Construction

Increase in level of employment and employment opportunities associated with construction of the Project

The construction of the Project is expected to result in three types of employment: direct, indirect and induced. Direct employment refers to the jobs arising as a result of the actual construction of the Project. Indirect employment arises from the additional economic activity generated as the result of the purchase of materials and services required for project construction (e.g., diesel or trucking services). Induced employment refers to the jobs created when the wages and salaries paid by the workers hired through direct and indirect employment-related to the Project are spent in the community, generating additional economic activity (for example in grocery stores, retail outlets, and restaurants).

Construction planning has not advanced to the stage where firm employment requirements or schedules are available. However, a general timeline and total annual workforce requirement has been determined for the purpose of assessment. The Project is expected to require 10 years of construction activity that would take place over up to 20 years. The construction is proposed to be carried out in three segments and with two crews working from each end of the segment (i.e., four crews in total for each segment). The timing and duration of each construction segment is dependent on the GNWT securing construction funding and regulatory approvals. Conceptually, two years between construction of segments is assumed, during which permitting and procurement would be completed. The conceptual schedule assumes the Project would be fully constructed sometime between 2041 and 2046.

The number of direct jobs expected to be created by the construction of the Project is approximately 200-330 full-time employees (FTEs) for each year of construction activity. This figure is comprised of the following estimated job numbers and types of employment¹⁷:

- 160-280 construction personnel (40-70 persons plus cross-shift at two work camps)
- 8-10 supervisors (4-5 supervisory personnel per cross-shift)
- 6 environmental / wildlife monitors (three per cross-shift)
- 24-30 camp services personnel (cooks, first aid, cleaning, and others per camp plus cross-shift)
- Construction administration and management personnel

It is estimated that 50% of the 200-330 person construction workforce will come from the local Sahtu and Dehcho communities and from elsewhere in the NWT with the remainder of the workforce coming from outside the NWT (MVHEP, 2022).

¹⁷ This figure does not include up to 10 additional personnel per portion that may include the GNWT's Engineers and contractor's specialists.

These project related employment opportunities may result in increased employment rates during the construction period. Among the LAA and RAA communities, the employment rates have tended to be well below the territorial employment rate of 65% in 2021, with the exception of Norman Wells (Table 9.15).

In the LAA communities, between 2014 and 2019, the industry with the highest levels of employment in Wrigley and Tulita was consistently 'public administration'. The industry with the highest level of employment in Norman Wells was 'mining, quarrying, and oil and gas extraction' in 2014 but had been replaced by 'transportation and warehousing' in 2019. The increase in employment opportunities associated with the Project during construction may change the proportions of the type of industry employment. Details of employment rates and types are provided in Appendix 9C, Section 5.2.

Table 9.15 Employment Rates in LAA and RAA Communities, 2021

Community	Employment Rate
Wrigley	42%
Tulita	55%
Norman Wells	75%
Fort Simpson	58%
Déline	44%
Colville Lake	47%
Fort Good Hope	51%

Anticipated indirect jobs will be related to supply and resupply, waste haul, equipment and material supply, and personnel transport. The estimated number of indirect jobs is between 84 – 126 FTEs per year of construction, and estimated number of induced jobs is between 40.5 to 60 FTEs per year of construction¹⁸. For the purposes of assessing effects on employment and economy, the median number of anticipated jobs (i.e., 265 direct FTEs, 105 indirect FTEs and 50.25 induced FTEs per year of construction) was used. Project construction would generate approximately 3,550 person-years of direct and indirect employment in NWT over the course of the full construction period, translating into approximately \$42.7 million in annual labour income.

Information on the potential employment and income effects of the Project can also be found in Sections 9.5.2.1 and 9.6.2.1 of this chapter.

Community members suggested that existing businesses and contractors were well positioned to support project construction and noted that the skills/experience gained by local residents to support the Project could be applied to future non-project-related employment opportunities (e.g., mine construction).

¹⁸ Based on the ratio of direct: indirect and direct: induced jobs identified for the Inuvik - Tuktoyaktuk Highway, Environmental Impact Statement for the Construction of the Inuvik - Tuktoyaktuk Highway, May 2011, EIRB file number 02/10:05

A summary of potential expected employment and income effects arising in the NWT from construction (all years combined) is presented in Table 9.16.

The Project Description (Chapter 5) assumes that 100 individuals will be hired from the labour pool in the Sahtu and Dehcho regions that are able and willing to work rotational shift work. It is possible that additional education or skills training may be required for some positions (refer to education, training and skills [Section 9.6] for more information). Once construction is complete, some workers may be able to move into employment related to project maintenance. However, the majority of jobs will end after the construction phase.

Table 9.16 Effects of Project Construction on Employment and Income in the NWT

Effect	Direct	Indirect	Induced	Total
Employment (FTE)	2,500	1,050	503	4,053
Wages and Salaries	\$343,868,534	\$83,766,472	\$51,146,977	\$478,781,983
Benefits	\$24,070,797	\$6,031,186	\$3,682,582	\$33,784,566

Note:

Values may not add to the total due to rounding

Source: based on Hamlet of Tuktoyaktuk, Town of Inuvik, Government of Northwest Territories. (2011).

These project-related employment opportunities may increase the average family employment levels in communities, but the effect would be short term and may revert after construction when jobs are no longer available, and if workers are unable to find other employment. In general, with the exception of Norman Wells, communities within the LAA and RAA have lower average family incomes than the territorial average, which was \$149,197 in 2020. Between 2010 and 2020, Tulita's average family income ranged from 32% (2013) to 44% (2010) lower than the territorial average. In the RAA, family income averages for Fort Simpson, Fort Good Hope and Délı̄ne ranged from 8% to 45% less than the territorial average between 2010 and 2020. Norman Wells' average family income ranged from 25% (2020) to 65% (2013) higher than the territorial average. Information is not available for Wrigley or Colville Lake. Details of personal and family income levels are provided in Appendix 9C, Section 5.2.

During engagement in LAA and RAA, community members stated that they anticipate the opportunity for construction jobs, which would help to diversify the local economy and give work to general contractors who are ready for work as well as relatively unskilled or inexperienced workers. That being said, to some degree, it depends on the community: Norman Wells community members stated that few people are unemployed, and oil and government workers are well paid; while Tulita community members stated a general interest in project construction employment.

Residents of RAA communities indicated that they would be willing to "follow the work around". There are concerns, however, that "Southerners" may be hired for jobs instead of LAA and RAA community members because of lack of education and training within the working-age community population and/or hiring practices that do not prioritize the local labour pool. It is also assumed that mostly Tulita and Norman Wells will benefit from construction-related employment.

9.7.2.1.2 Operations and Maintenance

Increase in level of employment and employment opportunities due to operations of the Project and as a result of all-season and lower cost access to communities

Once the construction of the Project is completed, it will be necessary to employ workers to carry out its maintenance on an ongoing basis. Unlike the economic effects of the construction phase, which are limited to the construction period, operations and maintenance effects carry on for the life of the Project and have a long-term effect on the economy.

Only a basic estimate of direct jobs required for operations and maintenance has been developed. The GNWT estimates that there would be a total of one supervisor, three or four operators and three or four casual positions required per maintenance camp along the Project, and that there would be a total of three camps once the Project is operational. In the winter, the numbers of jobs would be reduced to one supervisor and three or four operators. This is an estimated total of 21 to 27 positions in the summer and 12 to 15 positions in the winter, for an overall total of 33 to 42 positions. These new positions may result in changes to the local employment rates in each community, but given the small number of jobs, it may not be possible to see measurable changes in employment rates due to project-related operational jobs.

For the purposes of assessment, annual employment estimates were derived based on the maintenance estimates for the Inuvik-Tuktoyaktuk highway construction and are presented in Table 9.17. Annual employment effects are estimated at 35.3 jobs and over \$2 million in salaries and wages. This may be reflected in higher family income levels in communities over a longer period, although given the small number of jobs associated with project operations, the change may not be possible to measure.

As indicated in the construction section (Section 9.7.2.1.1), additional details on employment rates, types, and family income levels are available in Appendix 9C, Section 5.2.

Table 9.17 Annual Employment Estimates for the Maintenance of Inuvik-Tuktoyaktuk Highway

Effect	Direct	Indirect	Induced	Total
Employment (FTE)	25.0	7.4	2.9	35.3
Wages and Salaries	\$1,435,527	\$412,140	\$244,614	\$2,092,280
Benefits	\$123,455	\$35,444	\$21,037	\$179,936

Note:

Values may not add to the total due to rounding; FTEs are not actual jobs but equivalent to full-time jobs (including part-time jobs)

Source: based on Hamlet of Tuktoyaktuk, Town of Inuvik, Government of Northwest Territories. (2011).

Indigenous Governments, Indigenous Organizations, and other affected parties of some engaged LAA and RAA communities identified tourism as being an expected driver of induced employment and economic activity in communities during the Project's operations and maintenance phase, as tourism means more money and more income/economic activity. Community groups stated that increased local employment due to tourism may mean less crime in the communities as, in their experience, crime reduces when the local economy is stronger (see Section 9.5.6 for a discussion of crime).

9.7.2.2 Mitigation

Several mitigation and enhancement measures were proposed during engagement with Indigenous Governments, Indigenous Organizations, and other affected parties to enhance effects of the Project on employment and income, including:

- Providing a construction schedule to the communities
- The GNWT sharing information and working with local schools/trainers to design courses to prepare communities or construction employment opportunities
- Requiring contractors to report on training employees
- Including local requirements for jobs and training
- Ensuring that companies are held to their commitments
- Offering training incentive programs for employees to improve and/or diversify their skill and knowledge set for employment

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

While the effect of the Project on employment and income is anticipated to be positive, to enhance the positive effects for LAA and to a lesser extent, RAA communities, the Contractor Training and Employment Plan component of the Community Readiness Strategy includes the following measures:

- Identifies employment opportunities (types, numbers, timing/schedule and employment hiring requirements) during construction and operations, informed by the GNWT about the project schedule and well in advance of the beginning of construction
- Identifies availability of and gaps in skilled labour for construction employment opportunities in each of the communities including the creation of skill inventories and seeks to address these to support optimizing training and employment opportunities
- Identifies barriers to increasing uptake in education and training courses (e.g., restricted licences in Tulita) and develops potential solutions to implement

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- Identifies education, skills and training programs and courses required to address lack of available skilled labour for construction and operations in each of the communities, including sharing information about Labour Market Programs that can support communities, employers and organizations
- Identifies education and training programs and courses currently available (local CLC or campus), how offered (in-person/remote/blended)) and new programs and courses may be required to meet local need (as well as whether or not additional staffing and space requirements are necessary)
- Identifies potential funding to support education and training prior to construction, during construction and operations
- Develops plans for employment and local opportunity catchment to reduce a surge in the required labour force during construction, reducing the potential for in-migration to the region
- Explores feasibility of building workshops in each community to support hands-on learning opportunities
- Identifies existing programs that support cultural awareness and anti-racism training to mitigate potential adverse effects associated with presence of non-resident workers
- Ensure all communities are supported to prepare the workforce for employment opportunities through coverage of existing ECE programs and positions (e.g., Career Development Officers)
- Communities will be encouraged to develop community labour market plans to evaluate their needs in relation to the Project.
- ITI staff are available to discuss tourism readiness with communities and has funding available in various programs that can be used by communities to develop community led initiatives such as tourism plans as communities identify a need or desire to create a specific plan related to maximizing benefits and mitigating adverse effects associated with the operation of the Project, including:
 - Identifying barriers or gaps in the current state that need to be addressed to fully realize benefits from tourism
 - Identifying future potential for tourism development and promotion, and
 - Identifies additional needs and supports needed and available to mitigate adverse effects related to tourism as a result of the Project.

9.7.2.3 Project Residual Effect

9.7.2.3.1 Construction

The residual effect on employment and income is expected to be positive and so no mitigation measures are required, but there are commitments that have been made through the Contractor Training and Employment Plan to enhance benefits to the local population. Employment opportunities associated with project construction will provide new skills and more construction-related experience, possibly resulting in increased incomes and less reliance on income assistance.

9.7.2.3.2 Operations and Maintenance

Project operations and maintenance will provide a few direct opportunities for ongoing employment, such as a few labour positions for ongoing project maintenance, which is a positive effect of the Project. The Project is also expected to have indirect and induced positive residual effects on employment as a result of increased businesses in LAA communities due to the economic expansion afforded by the all-season use of the Project.

9.7.2.4 Project Residual Effect

As the potential effects of the Project for both construction and operations are positive, no significance of determination of effects is required.

9.7.3 Change in Gross Domestic Product and Government Revenues

9.7.3.1 Effects Pathways

The potential effect of the Project on change in GDP and government revenues has two effects pathways that are discussed in this section:

- Contribution to GDP in NWT and government revenues due to construction of the Project
- Contribution to GDP in NWT and government revenues due to operations of the Project

9.7.3.1.1 Construction

Contribution to GDP in NWT and government revenues due to construction and operations of the Project

Project construction is expected to contribute positively to the NWT GDP and to government revenues from taxation. Employment income generated by direct and indirect project construction will be taxed, as will incomes earned by businesses directly supporting project construction, which will result in increased government revenues. Increased government revenues associated with the Project may offset some of the costs associated with mitigating the Project's potential adverse effects and enhancing benefits to communities. The GDP for the Northwest Territories for the years

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2007 through 2022 declined from \$5,655M in 2007 to \$4,397M in 2022 – a net reduction of \$1,258M (or 22%). The largest contributor to NWT GDP, the mining, oil and gas extraction industry, fell by 30.5% between 2019 and 2020, which was estimated by the NWT Bureau of Statistics to be due to temporary shutdowns of production. However, the construction industry grew by 27.4%, largely a result of increased engineering construction including projects such as the Tłı̄chǫ Highway. Details of GDP are provided in Appendix 9C, Section 5.2.

The GNWT's Business Case projected a cost of over \$700 million to construct the Project (GNWT, 2015b). Similar to infrastructure projects across Canada, it is anticipated that project costs will have escalated significantly since it was originally estimated.

An estimate of the GDP and government revenue effects arising from project construction (all years combined) from NWT residents employed for project construction are provided in Table 9.18. These estimates are derived from the anticipated employment levels for the Project described in Section 9.7.2 as well as the NWT Bureau of Statistics Input/Output model used in the Environmental Impact Statement for the Construction of the Inuvik – Tuktoyaktuk Highway¹⁹. The Project is estimated to have a combined direct and indirect territorial GDP effect of over \$650 million during the construction period and generate \$48 million in additional revenue for the GNWT, and \$78 million in additional federal revenue (dollar estimates based on 2021 Statistics Canada data).

Table 9.18 Effects of Project Construction on GDP and Government Revenue in the NWT

Effect	Direct	Indirect	Induced	Total
GDP	\$512,364,116	142,403,002	\$92,064,559	\$746,831,677
Total Government Revenue	\$104,536,034	\$22,281,882	\$22,913,846	\$149,731,762
Federal	\$66,022,759	\$12,397,438	\$9,820,220	\$88,240,416
Net Indirect Income	\$8,940,582	\$1,759,096	\$2,301,614	\$13,001,292
Personal Income Taxes	\$57,082,177	\$10,638,342	\$7,518,606	\$75,239,124
NWT	\$38,513,276	\$9,884,444	\$13,093,626	\$61,491,346
Net Indirect Income	\$10,316,056	\$5,444,821	\$9,615,632	\$25,376,508
Personal Income Taxes	\$28,197,220	\$4,439,623	\$3,477,994	\$36,114,837

Note:

Values may not add to the total due to rounding

Source: based on Hamlet of Tuktoyaktuk, Town of Inuvik, Government of Northwest Territories (2011).

¹⁹ May 2011, EIRB file number 02/10:05

9.7.3.1.2 Operations and Maintenance

Contribution to GDP in NWT and government revenues due to operations of the Project.

Once the project construction is completed, there will be ongoing effects on GDP and government revenues arising from expenditures on project operations and maintenance. An estimate of the annual GDP and government revenue effects arising from project operations and maintenance from NWT residents employed for Project construction are provided in Table 9.19. The Project is estimated to have a combined direct and indirect annual effect on territorial GDP effect of over \$2.6 million annually and generate \$285,000 in additional revenue for the GNWT, and \$291,000 in additional federal revenue each year.

Table 9.19 Annual Effects of Project Operations and Maintenance on GDP and Government Revenue in the NWT

Effect	Direct	Indirect	Induced	Total
GDP	2,009,737	659,424	440,305	3,109,466
Total Government Revenue	\$364,624	\$104,683	\$107,875	\$577,182
Federal	\$190,925	\$54,815	\$45,987	\$291,727
Net Indirect Income	\$22,968	\$6,594	\$10,274	\$39,836
Personal Income Taxes	\$167,957	\$48,220	\$35,714	\$251,891
NWT	\$173,699	\$49,869	\$61,887	\$285,455
Net Indirect Income	\$107,665	\$30,910	\$45,498	\$184,073
Personal Income Taxes	\$66,034	\$18,958	\$16,389	\$101,382

Note:

Values may not add to the total due to rounding

Source: Hamlet of Tuktoyaktuk, Town of Inuvik, Government of Northwest Territories. (2011).

These positive effects are somewhat offset by the loss of economic activity associated with the construction and maintenance of the MVWR (estimated annual costs of \$886,767 and annual GDP of \$616,375) replaced by the Project (NWT Bureau of Statistics, 2023). This will result in annual savings to the GNWT, but it also means that the associated annual purchases of goods and services and hiring of labour will be eliminated; thereby, reducing economic activity in the NWT somewhat, but the overall effects are anticipated to be net positive.

The economic effects related to the loss of winter road construction and maintenance are not estimated at this point pending information on their current costs. Overall, the effect is expected to be relatively small, leaving the net effect of operations and maintenance on GDP and government revenues as positive.

9.7.3.2 Mitigation

Engagement did not provide specific comments related to economic benefits at the territorial level, and instead were focused more on community-level or regional levels of employment and economic activities. This includes discussion of mitigation effects, which identified measures that could enhance local economic activities and employment.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16).

As the net effects of project construction and operations and maintenance on GDP and government revenues are expected to be positive, no mitigation measures are proposed. However, measures focused on local employment are outlined in the Contractor Training and Employment Plan component are intended to enhance positive effects of the Project:

- Identifies availability of and gaps in skilled labour for construction employment opportunities in each of the communities including the creation of skill inventories and seeks to address these to support optimizing training and employment opportunities
- Identifies barriers to increasing uptake in education and training courses (e.g., restricted licences in Tulita) and develops potential solutions to implement
- Identifies education, skills and training programs and courses required to address lack of available skilled labour for construction and operations in each of the communities, including sharing information about Labour Market Programs that can support communities, employers and organizations
- Identifies education and training programs and courses currently available (local CLC or campus), how offered (in-person/remote/blended) and new programs and courses required to meet local need (as well as whether or not additional staffing and space requirements are necessary)
- Identifies potential funding to support education and training prior to construction, during construction and operations
- Develops plans for employment and local opportunity catchment to reduce a surge in the required labour force during construction, reducing the potential for in-migration to the region
- Explores feasibility of building workshops in each community to support hands-on learning opportunities
- Identifies existing programs that support cultural awareness and anti-racism training to mitigate potential adverse effects associated with presence of non-resident workers
- Ensure all communities are supported to prepare the workforce for employment opportunities through coverage of existing ECE programs and positions (e.g., Career Development Officers)
- Communities will be encouraged to develop community labour market plans to evaluate their needs in relation to the Project

- ITI staff are available to discuss tourism readiness with communities and has funding available in various programs that can be used by communities to develop community led initiatives such as tourism plans as communities identify a need or desire to create a specific plan related to maximizing benefits and mitigating adverse effects associated with the operation of the Project, including:
 - Identifying barriers or gaps in the current state that need to be addressed to fully realize benefits from tourism
 - Identifying future potential for tourism development and promotion, and
 - Identifies additional needs and supports needed and available to mitigate adverse effects related to tourism as a result of the Project

9.7.3.3 Project Residual Effect

9.7.3.3.1 Construction

Residual effects for change in GDP and government revenues during project construction are characterized as positive. GDP and government revenues will increase due to additional spending on labour, goods and services and the tax revenue generated through that spending.

9.7.3.3.2 Operations and Maintenance

Residual effects for change in GDP and government revenues during project operations and maintenance are positive. GDP and government revenues will increase due to additional spending on project maintenance and the tax revenue generated through that spending. As the potential effects of the Project for both construction and operations and maintenance are positive, no significance of determination of effects is required.

9.7.4 Change in Economic Opportunities and Capacity of Local Businesses

9.7.4.1 Effects Pathways

The potential effect of the Project on change in economic opportunities and capacity of local businesses has four effects pathways that are discussed in this section:

- Increases in contracts for businesses due to construction of the Project
- Increases in contracts for businesses due to operations of the Project
- Changes to the nature or viability of some existing local businesses (including capacity) due to operations of the Project.
- Enhanced opportunities for economic development (e.g., enhanced tourism, arts and crafts, and existing and new businesses) all-season in communities due to operations of the Project

9.7.4.1.1 Construction

Increases in contracts for businesses due to construction of the Project

Construction of the Project will require considerable capital expenditures during each year of construction activity, much of which is expected to be spent on local sources of goods, services and labour. These expenditures will provide opportunities for businesses to obtain contracts to support project construction.

Community members emphasized the need for the Project to focus on hiring local and Indigenous labour and businesses and noted that the construction skills/experience gained by local residents to support the Project could be applied to future non-project related employment opportunities (e.g., mine construction). There is a desire among some communities for local contractors to build the Project themselves, so that revenues will stay in the North and that communities will be more likely to realize economic benefits in their communities. There is a belief that they have the capacity to do so. In Tulita community members made reference to local workers who did major road and drainage work, built a baseball diamond and, green houses, and identified existing rentals, heavy equipment, and line crews who would be able to work on project construction.

It is recognized that procurement processes are sometimes a barrier for small businesses seeking to become involved as subcontractors on large construction projects, and the contracting processes will need to be designed to enhance opportunities for local business participation.

Members of RAA communities noted that it will likely be the businesses in the LAA communities that will be contracted for project construction work as a result of obligations outlined in the land claim agreement.

Overall, it is expected that the construction of the Project will have positive effects on economic development by generating an increased number of contracts and business opportunities for local businesses.

9.7.4.1.2 Operations and Maintenance

Increases in contracts for businesses due to operations of the Project

Changes to the nature or viability of some existing local businesses (including capacity) due to operations of the Project

Project operations and maintenance could change the nature or viability of some existing local businesses. Community members suggested that easier and less costly all-season access to communities along the Project could improve conditions for existing businesses by:

- Providing contracting or employment opportunities to provide services and materials for ongoing project maintenance
- Decreasing the need to stockpile supplies in the “shoulder seasons” (periods between winter road and barge operations)

- Attracting more potential staff to communities, as it would be easier to retain “outside” employees if communities are more accessible
- Attracting more visitors
- Making it easier to access regional markets
- Increasing demand for supplies and services due to the lower cost of obtaining them
- Increasing the ability to stock items with a more limited shelf life

Project operations would likely also change the demand for air services currently flying in and out of communities due to all-season road access as a result of the Project. Establishing better infrastructure for trucking could allow for increased transportation of food and supplies by road instead of by air. With the more economical option of road travel in place all-season for community residents as a result of the Project, many may choose to avoid air travel when visiting family in other communities, or when commuting for shopping, employment or other reasons.

Enhanced opportunities for economic development (e.g., enhanced tourism, arts and crafts, and existing and new businesses) all-season in communities due to operations of the Project

Project operations and maintenance could also change the viability for new local businesses or for business expansion. The expected effect most frequently identified by community members during engagement was enhanced opportunities for tourism because increased accessibility of communities could result in both a greater number of visitors and an increase in the length of time they spend in the area. Community members suggested that there is potential for growth in almost every sector of the economy, including: adventure tourism, eco-tourism, hunting/fishing outfitting, hospitality, traditional arts and crafts, conservation economy (i.e., Biosphere Reserve), oil and gas development, waste management, remediation services, and traditional foods processing. These opportunities, along with increased access to relatively inexpensive land, were cited as potential avenues to increased economic diversification in communities that would be affected by operation of the Project. The specific growth opportunities will vary according to the specific circumstances and opportunities of each community.

Community members also noted that there are existing businesses well positioned to support ongoing project maintenance and operations. However, concerns were voiced that due to lack of local competition, *“it is the same people that get the jobs; there is one company getting richer and richer.”*

Members of RAA communities identified the potential for Norman Wells to be a business hub once the Project is completed²⁰, which could allow resources to be stockpiled or stored in Norman Wells. This could reduce the costs associated with getting materials and supplies to RAA communities all-season, compared to having to source and transport materials and supplies from locations farther away for most of the year. Fort Good Hope and Colville Lake, in particular, could benefit from having a business hub within a few hours’ drive (via the existing MVWR). For additional information on potential changes in cost of living and consumer prices, please refer to Section 9.7.5.

²⁰ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

Members of some communities, such as Fort Good Hope, stated that the development of granular resources due to project construction, could stimulate construction in the community, as the lack of these resources is a major constraint.

Even local businesses that may be expected to be adversely affected by the Project, such as airlines, may not actually be affected as much as expected. For example, LAA community members stated that passenger airlines have medical travel as a core component of their business and given the driving distances to large centres with extensive medical services, air travel is still expected to be used for medical travel, especially urgent care or emergency medical needs. However, airlines that specialize in shipping are more likely to be adversely affected by project operations.

9.7.4.2 Mitigation

Possible mitigation measures for assisting community businesses in securing construction-related contracts were identified during engagement in Norman Wells and Tulita, and include:

- Including local contracting requirements for project construction
- Providing a staged approach to ensure that communities are prepared for construction business opportunities
- Providing funding for local business improvement programs
- Asking existing businesses what they need to successfully bid
- Providing training and support to local/regional businesses to bid on contracts
- Ensuring that northern companies are affiliated with communities
- Establishing partnerships among communities to benefit the region as a whole
- Creating an agreement to use local businesses, provide local training and local opportunities

Tulita members advocated a hiring policy for the Project which includes contracting businesses in the RAA communities as well as the LAA communities before contracting southern companies. With respect to business opportunities during the Project's operations and maintenance phase, Indigenous Governments, Indigenous Organizations, and other affected parties that were engaged identified a need to plan for the effects of visitors and tourists.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy, the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The Contractor Training and Employment Plan includes measures that are intended to enhance the positive effects of the Project related to new business and employment opportunities. There are also a series of measures included to address the potential adverse effects related to the economic effects of visitors and tourists once the Project is operational. The plan:

- Identifies employment opportunities (types, numbers, timing/schedule and employment hiring requirements) during construction and operations, informed by the GNWT about the project schedule and well in advance of the beginning of construction
- Identifies availability of and gaps in skilled labour for construction employment opportunities in each of the communities including the creation of skill inventories and seeks to address these to support optimizing training and employment opportunities
- Identifies barriers to increasing uptake in education and training courses (e.g., restricted licences in Tulita) and develops potential solutions to implement
- Identifies education, skills and training programs and courses required to address lack of available skilled labour for construction and operations in each of the communities, including sharing information about Labour Market Programs that can support communities, employers and organizations
- Identifies education and training programs and courses currently available (and where (local CLC or campus)/how offered (in-person/remote/blended)) and new programs and courses required to meet local need (as well as whether or not additional staffing and space requirements are necessary)
- Identifies potential funding to support education and training prior to construction, during construction and operations
- Develops plans for employment and local opportunity catchment to reduce a surge in the required labour force during construction, reducing the potential for in-migration to the region
- Explores feasibility of building workshops in each community to support hands-on learning opportunities
- Identifies existing programs that support cultural awareness and anti-racism training to mitigate potential adverse effects associated with presence of non-resident workers
- Ensure all communities are supported to prepare the workforce for employment opportunities through coverage of existing ECE programs and positions (e.g., Career Development Officers)
- Communities will be encouraged to develop community labour market plans to evaluate their needs in relation to the Project.
- ITI staff are available to discuss tourism readiness with communities and has funding available in various programs that can be used by communities to develop community led initiatives such as tourism plans as communities identify a need or desire to create a specific plan related to maximizing benefits and mitigating adverse effects associated with the operation of the Project, including:
 - Identifying barriers or gaps in the current state that need to be addressed to fully realize benefits from tourism

- Identifying future potential for tourism development and promotion, and
- Identifies additional needs and supports needed and available to mitigate adverse effects related to tourism as a result of the Project

The GNWT has also committed to include conditions in construction contracts that require the contractor to prepare a Contractor Training and Employment Plan that:

- Outlines how they will increase on-the-job training for LAA and RAA residents
- Demonstrates through reporting that LAA and RAA residents and Indigenous people are being trained
- Demonstrates how local and Indigenous labour and businesses will be sourced
- Commits to cultural awareness and anti-racism training to mitigate potential adverse effects associated with presence of non-NWT/non-LAA/RAA workers
- Details how contractors will communicate and collaborate with LAA and RAA community governments and Indigenous organizations regarding their involvement in construction and operation

9.7.4.3 Project Residual Effect

9.7.4.3.1 Construction

Some out-of-territory contracting is still expected to occur during construction, even after mitigation is applied. However, the Contractor Training and Employment Plan will enhance economic opportunities by providing opportunities for an increased amount of work to local and Indigenous businesses in the LAA and RAA that have the capacity to meet demand.

Overall, the Project is expected to have a positive effect on economic development opportunities and local business capacity. Business opportunities will increase during construction to supply goods and services to the Project; however, effects may not be noticeable because the number of affected businesses is small.

9.7.4.3.2 Operations and Maintenance

Residual effects for change in economic opportunities and the capacity of local businesses during project operations and maintenance are characterized as positive. Business opportunities will increase as a result of lower-cost access to transported goods and services and increased visitor traffic.

As the potential effects of the Project for both construction and operations and maintenance are positive, no significance of determination of effects is required.

9.7.5 Change in Cost of Living and Consumer Prices

9.7.5.1 Effects Pathways

The potential effect of the Project on change in cost of living and consumer prices has one effects pathway that is discussed in this section:

- Change in cost of living due to operations and maintenance of the Project related to reduced transportation costs. to bring consumer and commercial goods, services, and materials into communities

9.7.5.1.1 Construction

The construction phase of the Project is not anticipated to affect the cost of shipping goods to communities in the LAA or the RAA. However, with the construction of the Project in phases (from south-to-north), there would be a staggered removal of the Nutrition North subsidy. For example, when the phase to Tulita is completed, Tulita residents will no longer be eligible for the Nutrition North subsidy, while Norman Wells residents will still use the Nutrition North subsidy.

9.7.5.1.2 Operations and Maintenance

Change in cost of living due to operations of the Project related to reduced transportation costs to bring consumer and commercial goods, services, and materials into communities

Once operational, the Project may contribute to a reduction in the cost of shipping some goods and supplies to communities that are connected to the all-season road (e.g., those communities in the LAA). Lower prices will result in residents being able to buy more goods with the same amount of income, thereby increasing their standard of living.

Operation of the Project is anticipated to reduce prices for many goods and services, increase the variety of goods and services available to community residents, and make those goods and services available all-season in the communities of Tulita and Norman Wells. Community members were unsure whether overall prices will actually reduce – or reduce noticeably – once the Project is operational. This is particularly true for the RAA communities of Fort Good Hope, Colville Lake and Délıne who will not be connected to the all-season road. In addition, in Tulita and Norman Wells, the presence of an all-season road will likely eliminate the Nutrition North subsidy which may limit the possible cost savings on store-bought food in these two communities²¹. For additional information on the potential effect of the Project on food prices and food security, refer to Section 9.5.5 as well as existing conditions related to food costs in Appendix 9C, Section 5.2.

²¹ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

Members of the communities of Tulita and Norman Wells expect that the cost of personal travel will decrease as community residents will have access to all-season road transportation and may forego more expensive air travel when visiting other parts of the territory and beyond. Oil and fuel were believed to be potentially less expensive in the region due to the cost savings of transporting petroleum via truck instead of barge. Cheaper fuel will have a spin-off saving in electricity costs, because electrical generation in most of the RAA and LAA communities is via diesel generator (Norman Wells is the exception, because natural gas is used for electrical generation, which is not expected to change in cost due to the Project). The costs of shipping in general were identified during engagement as being a possible cost saving in most communities.

Members of the RAA communities expressed a view that the costs of building materials and supplies may decrease due to the Project, as they can be trucked into Tulita and Norman Wells and then either trucked to RAA communities on the MVWR or flown in over a much shorter distance. Also, members of several communities believed that the Project would enable Norman Wells to be a staging area for supplies and goods in the region, which could result in costs savings for communities in the LAA as well as potentially some communities in the RAA. For example, in the RAA communities of Fort Good Hope and Colville Lake, located to the north of Norman Wells, community members noted during engagement that Norman Wells being connected to an all-season road would allow the community to act as a hub or storage location for goods and materials. This was identified as a potential cost savings to get goods into their communities as it would be less expensive to transport materials to their communities from Norman Wells compared to other locations to the south.

9.7.5.2 Mitigation

As the effect of the Project on the cost of living and consumer prices is expected to be positive, no mitigation activities are proposed.

9.7.5.3 Project Residual Effect

9.7.5.3.1 Construction, Operations and Maintenance

Residual effects for change in cost of living and consumer prices during project construction, operations and maintenance are characterized as positive. Increased access to lower-cost transportation is expected to reduce the cost goods and some services; however, effects may not be noticeable as consumer prices reflect a large number of costs.

As the potential effects of the Project for both construction and operations and maintenance are positive, no significance of determination of effects is required.

9.7.6 Change in Traditional Economy

9.7.6.1 Effects Pathways

The potential effect of the Project on change in traditional economy has two effects pathways that are discussed in this section:

- Change in time available to participate in traditional harvesting due to employment associated with construction of the Project.
- Change in time available to participate in traditional harvesting due to employment associated with or as a result of operations of the Project.

9.7.6.1.1 Construction

Change in time available to participate in traditional harvesting due to employment associated with construction of the Project

The traditional economy plays an important role in the economic well-being of residents of LAA and RAA communities, acting to offset the high cost of living by providing traditional foods as an alternative to store-bought groceries. In general, residents of all LAA and RAA communities participate in hunting and fishing at a higher rate than the territorial average of 36% of the population. The community with the lowest participation rate was Norman Wells, at 37%; and the community with the highest participation rate was Wrigley, at over 65%. The other communities ranged between 42% and 60%. Details of participating in traditional harvesting levels are provided in Appendix 9C, Section 5.2. Project construction could change the amount of time available for participation in the traditional economy. Participation in construction employment may require local workers to be away from their home community for extended periods, potentially affecting their time available to participate in traditional hunting, fishing and trapping activities, as shared by members of the LAA and RAA communities during engagement.

Construction employment may result in less traditional foods being available in communities and could affect the transfer of TK as well as hinder the development of skills required to hunt in the future. This in turn could increase reliance on store-bought foods and could affect food security for those more reliant on traditional foods such as Elders.

Construction activities may disturb the land, which may result in areas temporarily or permanently being unavailable as a source of traditional foods and harvesting, leading to a reduction in the ability to harvest traditional foods (e.g., fish, caribou and moose, vegetation, birds). More details on this assessment is referred to in the Food Security section which is based on the effects assessments for cultural use (Chapter 11) and wildlife and wildlife habitat (Chapter 19).

9.7.6.1.2 Operations and Maintenance

Change in time available to participate in traditional harvesting due to employment associated with or as a result of operations of the Project

Employment during the operations and maintenance phase of the Project is expected to be limited to considerably fewer positions than during the construction phase, and individuals employed in maintenance positions would not work on a rotational basis and would continue to live in their home communities, and would be compensated for their travel time to and from Project sites. Project operations and maintenance is not expected to result in a change in the time available for workers to participate in traditional harvesting or fishing activities, relative to any other form of waged employment.

Once operational, the Project may increase access to harvesting and trapping areas that were previously more difficult to access outside of the winter road season. Increased competition for wildlife could in turn reduce the availability of traditional foods for community consumption and increase reliance on store-bought foods to supplement diets. Additionally, as described in the effects assessments for cultural use (Chapter 11) and wildlife and wildlife habitat (Chapter 19), operation of the Project is anticipated to result in disturbance to the land that will adversely affect the access to traditional areas and traditional foods, resulting in an adverse residual effect. For additional information on the potential effect of the Project on food prices and access to traditional foods, refer to Food Security (Section 9.5.5).

9.7.6.2 Mitigation

Use of a rotational schedule during project construction may help community members have adequate time between construction shifts to continue to participate in traditional activities, such as hunting, fishing, trapping, and preparing traditional food. This was suggested by community members during engagement.

Indigenous Governments, Indigenous Organizations, and other affected parties who were engaged stated that project operations may adversely affect wildlife and habitat, especially moose and caribou and recommended that the Project's physical effects be mitigated through:

- Putting controls in place so that people are following harvesting laws
- Involving communities in route discussions to look at wildlife and land effects, especially caribou and moose
- Implementing environmental monitoring and wildlife monitoring

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy, the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The Contractor Training and Employment Plan includes a measure to support cultural awareness and anti-racism training to mitigate the potential adverse effects associated with the presence of non-resident workers. The GNWT has also committed to verify a community based cultural awareness and anti-racism training as part of the Contractor Training and Employment Plan for non-NWT and non-Indigenous workers. This training would support employers and contractors in setting employment conditions and terms (such as rotational shifts) that would help community members have adequate time to continue to participate in traditional activities.

For construction and operations and maintenance phase effects related to harvesting areas and access to traditional foods, the mitigations that are included in the Food Security section (see Section 9.5.5) related to the WMMP are responsive to these potential effects. For those adverse effects of the Project on wildlife or vegetation that in turn reduce access to or availability of traditional foods, there are several mitigation measures that have been identified in the WMMP:

- Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities, in accordance with the WMMP.
- The GNWT will work with the SRRB and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization.
- Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project.
- Personnel will not feed, harass, or hunt wildlife while working on the Project.

9.7.6.3 Project Residual Effect

The overall effects of project construction, operations and maintenance on the traditional economy are expected to be focused in the LAA. Some additional pressure on harvesting and trapping areas may still arise as a result of increased access to areas previously more difficult to reach; however, the increased access also provides the ability for more residents of the LAA and, to a lesser extent, the RAA to access these areas and be able to consume more traditional foods and participate in more traditional activities. The assessments in Chapter 11 (cultural use) and Chapter 19 (wildlife and wildlife habitat anticipate there to be a low magnitude, irreversible effect on access to traditional areas and traditional foods during as a result of disturbance to the land during the operations and maintenance phase of the Project; however, the increased access to harvesting and trapping areas as a result of the Project is anticipated to lead to a net positive effect in change in traditional economy during operations and maintenance.

9.7.6.3.1 Construction

Project construction could change the time available for participation in the traditional economy. Participation in construction employment may require local workers to be away from their home community for extended periods, potentially affecting their time available to participate in traditional activities. Reduced time available for project construction workers to participate in traditional activities could result in less traditional foods available in communities and could affect the transfer of TK and hinder the development of skills required to hunt in the future. Once operational, project employment opportunities will be more limited than those during construction and will not be rotational, so it is not anticipated for there to be adverse effects in this area once construction is completed.

After application of the mitigation measures noted in Section 9.7.6.2, residual effects on change in traditional economy during Project construction are characterized as follows:

- Direction is adverse: time to participate in traditional activities may be limited due to project employment.
- Likelihood is possible: limited time to participate in traditional activities may occur for some individuals due to project employment.
- Magnitude is low: effects may not be noticeable.
- Geographic extent is the RAA: some employment opportunities will extend to individuals located outside the LAA.
- Timing is moderate sensitivity: the effect will occur during project construction phases.
- Duration is medium-term: the residual effect occurs during the years of project construction.
- Frequency is regular: occurring during project construction.
- Change is reversible: conditions will return to their original state once construction is complete.

9.7.6.3.2 Operations and Maintenance

Residual effects for change in traditional economy during project operations and maintenance are characterized as positive. Improved access to areas where traditional activities may be carried out may enhance the traditional economy, or individuals may prefer to substitute traditional economy by accessing goods available to them in other communities that may not have been previously accessible.

9.7.6.4 Determination of Significance for Change in Traditional Economy

There may be a low magnitude residual adverse effect as a result of less time spent participating in traditional activities, and increased access by both residents and non-residents to traditional harvesting and cultural sites, but overall, this is not significant.

9.7.7 Change in the GNWT Operations Employment

9.7.7.1 Effects Pathways

The potential effect of the Project on change in GNWT operations employment has two effects pathways that are discussed in this section:

- Increase in number of the GNWT staff due to construction of the Project.
- Increase in number of the GNWT staff due to operations and maintenance of the Project and decrease in number of GNWT staff to maintain the MVWR.

9.7.7.1.1 Construction

Increase in number of the GNWT staff due to construction of the Project

It is expected that there will be a need for the GNWT staff to provide project oversight. This may be a positive effect on overall employment figures associated with construction of the Project.

9.7.7.1.2 Operations and Maintenance

Increase in number of the GNWT staff due to operations and maintenance of the Project and decrease in number of GNWT staff to maintain the MVWR

It is expected that project operations will result in two effects on the GNWT operations: 1) an increase in employment or contracting required to maintain project operations; and 2) a decrease in employment or contracting required to maintain the winter road. Only a basic estimate of direct jobs required for operations and maintenance of the Project has been developed. The GNWT estimates that there would be a total of one supervisor, three or four operators and three or four casual positions required per maintenance camp along the Project, and that there would be a total of three camps once the Project is operational. In the winter, the numbers of jobs would be reduced to one supervisor and three or four operators. This is an estimated total of 21 to 27 positions in the summer and 12 to 15 positions in the winter, for an overall total of 33 to 42 positions. No details about expected budget associated with these positions is available.

The MVWR is estimated to have eight full-time employees working for four months per year on construction and maintenance of the MVWR (NWT Bureau of Statistics, 2023). The loss of these positions will be more than compensated by the number of positions for the maintenance of the Project.

9.7.7.2 Mitigation

Engagement with Indigenous Governments, Indigenous Organizations, and other affected parties did not provide specific comments related to economic benefits at the territorial level, and instead were more focused on community-level or regional levels of employment and economic activities. This includes discussion of mitigation, which were focused on measures that could enhance local economic activities and employment as opposed to positions with the GNWT.

As the effects of the Project on GNWT operations employment is expected to be positive during both the construction and the operations and maintenance phases, no mitigation measures are proposed.

9.7.7.3 Project Residual Effect

9.7.7.3.1 Construction, Operations and Maintenance

The residual effects of the Project on the GNWT operations employment are characterized as positive. Employment will increase during operations and maintenance to carry out project maintenance activities; however, effects may not be noticeable as a relatively small number of positions will be available.

As the potential effects of the Project for both construction and operations are positive, no significance of determination of effects is required.

9.7.8 Summary of Positive Project Effects for Employment and Economy VC

This section summarizes the positive effects of the Project on various effect pathways for the employment and economy VC.

Increase in employment and income due to project construction

Construction will generate employment in a variety of sectors (e.g., construction trades, camp services, transportation) for local and NWT residents. Increased employment will in turn increase individual and family incomes.

Increase in government revenues and GDP due to project construction

Spending during the construction of the Project will result in additional income and corporate tax revenue for the governments of NWT and Canada. In addition, the increase in economic activity arising from employment and the purchase of goods and services will generate an increase in GDP.

Increase in business opportunities due to the construction and operations and maintenance of the Project

Local and NWT businesses will have increased opportunities to provide goods and services under contract during the construction phase of the Project. During project operations and maintenance, businesses will also have increased opportunities arising from increased demand due to greater numbers of people visiting the communities along the Project and from the lower cost of obtaining supplies and materials.

Reduced cost of living and consumer prices due to the operations and maintenance of the Project

Operation of the Project will enable lower-cost transportation goods into the communities obtaining all-season road access. This is anticipated to lower the cost of living and consumer prices.

Increase in the GNWT operations employment due to the operations and maintenance of the Project

The Project will provide some additional jobs for the GNWT during the operations and maintenance phase.

9.7.9 Overall Determination of Significance for Employment and Economy VC

Given that most effects on employment and economy are positive, and any adverse effects are low in magnitude or limited in scope, the effects on employment and economy are not significant.

9.8 Assessment of Potential Effects on Infrastructure, Services and Institutional Capacity

Based on project interactions with the socio-economic environment identified in Appendix 9A, Table 9B.4, the Project may affect infrastructure, services and institutional capacity.

Potential effects, effect pathways and mitigation measures proposed to reduce or eliminate the effects on infrastructure, services and institutional capacity are identified in Table 9.20. More details on the potential effects anticipated in both the construction and operations and maintenance phases of the Project and mitigation measures follow the table, along with a description of any residual effects that remain once mitigation measures have been applied, and in cases where the residual effects are adverse, a determination of significance of the residual adverse effects is included. It should be noted that many of the potential effects of the Project are interconnected and as such, the measurable parameters that have been identified for certain effect pathways may in some cases have some connection to other effects pathways. However, for the purposes of the effects assessment, measurable parameters are limited to inclusion with one effect pathway. As appropriate, interconnections and linkages between effects of the Project and between socio-economic VCs are highlighted in the text, with appropriate references to particular sections of Chapter 9.

Table 9.20 Potential Effects and Mitigation Measures for Infrastructure, Services and Institutional Capacity

Effect Name	Effect Pathway	Mitigation Measures
Change in housing and accommodation (amount and type)	<ul style="list-style-type: none"> • Increased demand for temporary accommodations due to the presence of non-resident construction workers • Change in short-term accommodation due to the operation of the Project (e.g., travelers) • Change in demand for housing due to change in resident population associated with operation of the Project 	<ul style="list-style-type: none"> • There are not anticipated to be any effects of the Project on housing and accommodation during the construction phase and so no mitigations are required. • The GNWT will develop and implement a Contractor Training and Employment Plan includes measures related to supporting communities to plan specifically for the effects of increased visitors and tourists that are likely to occur as a result of the Project being operational, including working with communities to develop tourism plans. • The GNWT will develop and implement a Well-Being Adaptive Management Plan with measures specifically focused on responding to adverse effects of the Project on the capacity of and demand on community services and develop programming and services to mitigate such effects.
Change in social infrastructure and services (emergency and protective services, health services, and community services)	<ul style="list-style-type: none"> • Increased demand for social infrastructure and services by non-resident construction workers due to the construction of the Project • Increased demand for social infrastructure and services by residents of formerly 'isolated' communities due to the operations of the Project • Increased demand for emergency and protective services (e.g increased workforce population and/or accidents during construction) due to the construction of the Project • Increased access (easier and lower cost) to social infrastructure and services due to the operation of the Project 	<ul style="list-style-type: none"> • The GNWT will develop and implement a Road Safety Plan with measures that are intended to increase safety on the Project once operational and mitigate the adverse effect of the Project on social infrastructure. • The GNWT will develop and implement a Well-Being Adaptive Management Plan with measures specifically focused on responding to adverse effects of the Project on the capacity of and demand on community services related to increased health needs of residents associated with the Project, and develop programming and services to mitigate such effects.

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Effect Name	Effect Pathway	Mitigation Measures
<p>Change in public infrastructure and services (roadways, water, sewage, waste disposal, telecom, and electricity)</p>	<ul style="list-style-type: none"> • Change in demand for public infrastructure and services due to change in resident population and presence of non-resident construction workers required for the Project • Change in demand for public infrastructure and services due to construction of the Project • Change in demand for public infrastructure and services due to operations of the Project • Temporary disruption to public infrastructure and services due to construction of the Project 	<ul style="list-style-type: none"> • The GNWT will obtain approval and agreement from the Town of Norman Wells, the Hamlet of Tulita and Wrigley to use their community water supplies, their sewage lagoon and solid waste disposal facilities. • The GNWT will develop and implement a Draft Waste Management Plan (WMP).
<p>Change in institutional facilities and services (educational and cultural facilities and services)</p>	<ul style="list-style-type: none"> • Change in demand for institutional facilities and services due to change in resident population and non-resident construction workers due to the construction of the Project • Change in demand for institutional facilities and services due to change in resident population due to the operation of the Project • Increased access (easier and lower cost) to institutional facilities and services by residents due to the operation of the Project 	<ul style="list-style-type: none"> • The GNWT will develop and implement a Contractor Training and Employment Plan includes measures related to increased demand for education and training as a result of the Project that results in capacity pressures for local education facilities. • The GNWT will develop and implement a Well-Being Adaptive Management Plan with measures specifically focused on responding to adverse effects of the Project on the capacity of and demand on community services and develop programming and services to mitigate such effects.

Each section of the assessment of potential effects includes mitigation sections with more detailed information on specific measures and commitments, and a full summary of the mitigation measures and commitments that are part of the Community Readiness Strategy is available in Section 9.16.1, and a full summary of additional mitigations and commitments are contained in Section 9.16.3.

9.8.1 Summary of Engagement Findings on Infrastructure, Services and Institutional Capacity

During engagement in the LAA communities, information and feedback was gathered from representatives of Indigenous Governments, Indigenous Organizations, and other affected parties, including RCMP, emergency service providers, health service providers, and education and childcare service providers on the topic of infrastructure, services and institutional capacity. More limited comments were provided by engaged Indigenous Governments, Indigenous Organizations, and other affected parties of RAA communities due to the relatively minor anticipated effects of the Project on their community infrastructure.

Indigenous Governments, Indigenous Organizations, and other affected parties identified adult educational facilities as the main infrastructure components that will be affected by the Project (due to the expected increased demand for employment-related education and training by working-age members of communities in the region) and, to a lesser degree, housing and health services (which do not presently have sufficient capacity). A linkage between adult education and housing was made during engagement – if Norman Wells was to become a new satellite campus of Aurora College (a mitigation measure suggested by community members and service providers), accommodation would need to be constructed for the students. Some community members also noted that if more vehicles are going to be electric powered in coming decades, there may be a need to construct (and supply with power) charging stations along the route. While some effects of the Project on infrastructure were identified by the engaged Indigenous Governments, Indigenous Organizations, and other affected parties, it was not a “hot topic” for most engaged parties, and it was more of a concern in LAA communities than RAA communities.

Overall, most groups and individuals in the LAA felt that the Project’s operations and maintenance phase will potentially put increased pressure on health facilities (due to increase in substance use and abuse in communities that did not previously have easy all-season access to alcohol and drugs) as well as protection services (due to both factors described above). Many interviewees also stated that the current gaps in health and emergency and highway rescue services need to be addressed before increased pressure associated with adverse effects of the Project is added, including the geographic extension of community-level fire services to respond to accidents on the Project.

To a lesser degree, community members identified the need for additional temporary accommodation (for the expected increased number of tourists), as well as vehicle parking and boat launching facilities in LAA communities, and either satellite phones be made available to residents or infrastructure is built to support the use of cell phones along the project corridor.

Details of engagement are integrated into the effects pathways described in Sections 9.8.2 to 9.8.6.

9.8.2 Change in Housing and Accommodation

9.8.2.1 Effects Pathways

The potential effects of the Project on change in housing and accommodation has three effects pathways that are discussed in this section:

- Increased demand for temporary accommodations due to the presence of non-resident construction workers
- Change in demand for short-term accommodation due to the operation of the Project (e.g., travelers)
- Change in demand for housing due to change in resident population associated with operation of the Project

9.8.2.1.1 Construction

Increased demand for temporary accommodations due to the presence of non-resident construction workers

As outlined in the Project Description (Chapter 5), it is estimated that a construction workforce of 40 to 70 persons per crew will be required, with two crews per project segment, working on a rotational basis, over the construction period of approximately 10 years, for an estimated total of 200-330 people. As outlined in Chapter 5, it is assumed that a total of 100 individuals will be hired from the Sahtu and Dehcho communities (which may include both the LAA and RAA communities). Construction camps will be established for each construction segment and will consist of mobile trailers and supports (e.g., power, heat, kitchen, laundry, washrooms). Workers from Norman Wells, Tulita and Wrigley will have the option to reside in their home community during their rotation, and shuttles will transport them to the worksite when ground transportation is available, and their travel time to get to and from sites will be compensated. These workers will stay in the construction camp at other times. It is anticipated that non-resident construction workers will be housed in the construction camps and camps will be established that have sufficient accommodations for all non-resident workers.

During engagement, some concern was raised in LAA communities about possible housing pressures during the Project's construction phase, depending on the number of non-local workers who are employed. A housing shortage is already an issue, according to Tulita residents, as it already has some homeless community members.

Given that the construction camps are intended to house all non-resident workers, it is not anticipated that non-resident workers would be contributing to local population levels or seeking temporary or short-term accommodations in LAA communities. Refer to Population Composition and Migration (Section 9.5.2) for additional information on the potential effects of the Project on local population level during construction. No increase in local population as a result of construction is anticipated to occur in RAA communities and so there will also be no increase in demand for temporary accommodations in RAA communities.

9.8.2.1.2 Operations and Maintenance

Change in demand for short-term accommodation due to the operations of the Project (e.g., travelers)

Once the Project is in operation, a potential increase of tourists, vacationers, and visitors to the LAA communities is anticipated. Those who plan on staying in LAA communities for more than a day may seek temporary accommodations. This may put pressure on the existing temporary housing stock in the communities and create challenges for local residents who seek or require temporary accommodation. This may lead to people living inside, or even outside, the community turning privately-owned housing stock into “air bed and breakfast” units to cater to the visiting population, thereby reducing availability of privately-owned housing stock for purchase or rental and/or driving up the prices. Engagement with Indigenous Governments, Indigenous Organizations, and other affected parties in Tulita and Norman Wells highlighted the shortage of housing in communities. Travellers and tourists may also be willing to pay more for temporary accommodation than the local population can afford thereby pricing the local population out of the market.

The connection of LAA communities to an all-season road may decrease the costs associated with shipping of building materials, which may in turn facilitate the building of new accommodations (e.g., a motel) in the LAA communities. This may meet the needs for the increased pressure on accommodations in these communities that could result from increased tourism/visitors as well as support the need for more housing to respond to current needs and shortages.

There is currently limited availability of short-term accommodations in RAA communities. No effect on short-term accommodation in RAA communities is anticipated for the Project’s operations and maintenance phase because the Project will not change their access to all-season road infrastructure.

Change in demand for housing due to change in resident population associated with operations and maintenance of the Project

As discussed in the Population Composition and Migration section (Section 9.5.2), all-season road access due to the existence of the Project may slow out-migration in LAA communities if residents choose to remain in communities as a result of project employment opportunities or increased employment and business opportunities associated with new industries (e.g., tourism). The degree to which the potential increase in demand for housing stock or changes in demand for rented or owned homes is driven by any potential increase in community population in LAA communities in general is not, at this point, possible to determine. NWT Housing staff have noted that Norman Wells is currently short on housing and the Project may exacerbate that. In general, significant proportions of the housing stock in LAA and RAA communities are rented, with over half of houses in Tulita, Norman Wells, Délı̄ne and Fort Good Hope being rented. Wrigley, and Colville Lake have much smaller proportions of rented homes in 2021 (25% and 17% respectively) and Fort Simpson has just under half of homes being rented. However, as discussed in Section 9.5.2, Population Composition and Migration, it is anticipated that the effects of the Project on population are likely to be negligible.

Engagement with Indigenous Governments, Indigenous Organizations, and other affected parties revealed that highways in remote northern communities tend not to affect housing pressures to any large degree. As a point of comparison, staff of the Hamlet of Tuktoyaktuk have stated that their community has not experienced any noticeable change in housing demand since the opening of the Inuvik–Tuktoyaktuk Highway in 2017.

In terms of possible increased pressure on housing stock in the communities that are newly connected via the Project, community members of Tulita were of the view that this will likely not be an issue, as *“the cost of living is high here, so people may not want to come”*.

No effect on the demand for accommodation in RAA communities is anticipated for the Project's operations and maintenance phase because the Project will not change these communities' access to all-season road infrastructure.

9.8.2.2 Mitigation

While some concerns about pressure on housing and accommodations as a result of the Project were expressed during engagement in Tulita, no specific mitigation measures were either identified or discussed. However, engagement in both LAA and RAA communities resulted in general suggestions for the need to implement measures that would support community preparedness and planning so that communities were ready generally for an increase in visitors or non-residents accessing communities.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The Contractor Training and Employment Plan includes a measure related to helping communities prepare for increased visitors as a result of the Project:

- ITI staff are available to discuss tourism readiness with communities and has funding available in various programs that can be used by communities to develop community led initiatives such as tourism plans as communities identify a need or desire to create a specific plan related to maximizing benefits and mitigating adverse effects associated with the operation of the Project, including:
 - Identifying barriers or gaps in the current state that need to be addressed to fully realize benefits from tourism
 - Identifying future potential for tourism development and promotion
 - Identifies additional needs and supports needed and available to mitigate adverse effects related to tourism as a result of the Project

The Well-Being Adaptive Management Plan also includes commitments in the area of Community Services that are intended to address and adaptively manage adverse effects of the Project that may arise associated with increased visitors or non-residents accessing communities:

Once construction is complete, the GNWT will investigate the potential repurposing of construction camps for use as housing in LAA communities.

9.8.2.3 Project Residual Effect

9.8.2.3.1 Construction

With the implementation of the proposed mitigation measures, no residual effects are anticipated regarding the demand for temporary housing in LAA communities.

9.8.2.3.2 Operations and Maintenance

With the implementation of the proposed mitigation measures, the residual effects during the operations and maintenance phase are characterized as follows:

- Direction is adverse: there may be an adverse effect associated with an increase in demand for temporary accommodations as a result of more visitors to communities via the Project.
- Likelihood is possible: the Project could result in adverse effects related to increased demand for temporary accommodations for visitors/tourists.
- Magnitude is low: The mitigations contained in the Well-Being Adaptive Management Plan are anticipated to mitigate the potential effects to a large degree.
- Geographic extent is the LAA
- Timing is no sensitivity: there is not a particular time associated with the potential adverse effect.
- Duration is long-term: The effects of the Project associated with increased demand for temporary accommodation will be present continuously during operations.
- Frequency is continuous: the adverse effects will be present continuously during operations.
- Change is irreversible: as the Project has an indefinite end point, the change is considered irreversible, but as adaptive management and mitigations are applied, the change may become less noticeable over time.

9.8.2.4 Determination of Significance for Change in Housing and Accommodation

It is expected that the Project's operations and maintenance phase will have a low magnitude adverse effect in LAA communities related to increased demand for accommodations for visitors/tourists, and no residual effect on RAA communities. As the effects are anticipated to lessen over time as adaptive management is applied, the determination is that the effect is not significant.

9.8.3 Change in Social Infrastructure and Services

9.8.3.1 Effects Pathways

The potential effect of the Project on change in social infrastructure and services (emergency, protective and health) has four effects pathways that are discussed in this section:

- Increased demand for social infrastructure and services by non-resident construction workers due to the construction of the Project
- Increased demand for social infrastructure and services by residents of formerly 'isolated' communities due to the operations of the Project
- Increased demand for emergency and protective services (e.g., increased workforce population and/or accidents during construction) due to the construction of the Project
- Increased access (easier and lower cost) to social infrastructure and services due to the operation of the Project

9.8.3.1.1 Construction

Increased demand for social infrastructure and services by non-resident construction workers due to the construction of the Project

Higher demand for medical services in local communities due to the presence of non-local construction workers is possible due to the potential for injuries from construction accidents and adverse social behaviours. However, as per Chapter 5, each construction camp will include first aid facilities and there should also be medics on site at the construction camps who can address most work crew injuries and health problems. Construction workers who sustain serious or traumatic injury will be transported to an appropriate medical facility. This means that there will be limited additional pressure placed on local community health services.

The GNWT-MACA have indicated that although community governments may see opportunity in service delivery to the camps, and trained community government staff may see opportunity in working for contractors for the delivery of certain services, these opportunities may put pressure on community government service delivery to residents.

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Norman Wells is expected to have the capacity to handle increased demand for community health services during the construction phase of the Project, as the community's health facility –Sahtu Got'ine Regional Health and Social Services Centre, which opened in 2018 – is well equipped. According to community members, Tulita currently has an old health centre, with a new replacement health facility currently under construction. According to community members interviewed, the new facility, once constructed and operating, may have the capacity to handle increased demand for community health services such as non-local construction workers. It is important to note that the replacement health facility in Tulita will be providing the same services as the old facility; it is only the infrastructure that is changing.

With a larger and better equipped health facility, Norman Wells typically receives patients from nearby Tulita, primarily during winter when the MVWR is in operation. Construction of the Project should not affect health-related travel between these two communities.

Some community members of Tulita and Norman Wells stated that at present health services are at maximum capacity. They said there are existing doctor and nurse shortages and therefore any increased use of community health services will exacerbate the problem. Tulita residents stated that the community presently has no mental health, suicide prevention, addictions or social workers. Being equipped with only a health cabin, Wrigley will have a limited capacity and range of health services to offer construction workers.

Health infrastructure in the RAA communities should not be affected by project construction, due to their distance from the construction activities.

Increased demand for emergency and protective services (e.g., increased workforce population and/or accidents during construction) due to construction of the Project

Medical and Fire Emergency Services

All LAA and RAA communities – except Colville Lake – presently have a fire hall. However, none of the communities have an official ambulance vehicle.

With the setting up of temporary structures for workers, the presence of heavy equipment on the ROW, and potential increased population within the LAA (due to outside workers), an increased demand for emergency services can be expected, but the level of increase is not expected to be considerable. However, for construction workers who are injured or fall ill on the ROW far from a community, there is a concern, because there is neither equipment nor a mandate for the LAA community fire services to come to their aid.

Also, various kinds of flammable materials and building materials may be used, or produced, during project construction (including the construction workers camps and associated infrastructure). If any fires occur in the LAA that involve these materials, it will be necessary for fire responders to be aware of what they are dealing with and trained to deal with these materials ahead of time. Affected parties have also mentioned that another first responder training course would be needed in Tulita prior to project construction.

Protective Services

All LAA and RAA communities – except Wrigley and Colville Lake – presently have an RCMP detachment (protective services). The presence of non-resident construction workers can be expected to increase demand for the protective services provided by the RCMP detachments due to an increased number of people living in the community, possible influx of alcohol and drugs, as well as the potential for adverse social behaviours among construction workers and/or between construction workers and local residents (see Section 9.5.6 for further details on drugs, alcohol, crime, and other social pressures). This may be a concern for the community of Wrigley which does not have its own detachment but is served by Fort Simpson. According to community members, in periods where community employment levels are high (as can be expected during the project construction phase), the demand for protective services is relatively low; this reduction in resident demand will mitigate a potential increase in protective services demand due to the presence of non-local workers. This can also be a concern for the RCMP detachments in the other LAA communities, as their existing police resources are at capacity, as per feedback provided through engagement with community protective services and community government.

No project construction-influenced changes to emergency and protective services in the RAA communities are expected, due to the absence of construction workers in these communities.

9.8.3.1.2 Operations and Maintenance

Increased access (easier and lower cost) to social infrastructure and services due to the operation of the Project / increased demand for social infrastructure and services by residents of formerly 'isolated'²² communities due to the operation of the Project

During the Project's operations and maintenance phase, the opportunities for all-season travel of persons and goods between the former 'isolated' communities and other communities will create changes in patterns of access to social infrastructure (e.g., health), as well as change in demand for various forms of social infrastructure (health, emergency services and protection services) as described in this section.

Health Infrastructure

In terms of health infrastructure, Tulita and Norman Wells have health facilities (Harriet Gladue Health Centre, and Sahtú Got'iné Regional Health and Social Services Centre, respectively). Fort Simpson, Délı̄nę and Fort Good Hope also have health centres. Wrigley and Colville Lake have health cabins (i.e., doctors and nurses visit, but do not live in the community).

²² The term 'isolated' is being defined as "a geographical area that has scheduled flights and good telephone service, but is without year-round access by land and/or water normally used in all weather condition" as per the Public Health Working Group on Remote and Isolated Communities December 15, 2020 – Draft, retrieved from https://www.nccih.ca/634/Recommended_definition_for_remote_and_isolated_communities.nccih?id=731

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As has been predicted for similar highway projects in the NWT, access to health care services among LAA communities is expected to improve with the operation of the Project. The Project will provide easier and less expensive access to Norman Wells' health centre as well as medical transfers between Norman Wells and the other LAA communities of Tulita and Wrigley²³. However, it is not anticipated that the Project will place considerable additional pressures on Norman Wells' Sahtú Got'iné Regional Health and Social Services Centre. As a new facility, it is well staffed, equipped and has space to accommodate additional patients.

Additionally, all-season road access will allow residents to travel outside of the LAA to larger centres to access non-emergent health services; thereby, decreasing potential pressure on LAA community health services (specifically Norman Wells). An added benefit is that health staff in Norman Wells and Tulita may feel less isolated as a result of being able to build and maintain relationships with each other and with other communities as a result of being able to regularly interact with each other throughout the year via the Project. Also, while the Project may facilitate increased use of health infrastructure in the LAA, it may attract qualified health staff to relocate to these communities to meet the increased demand. These changes are therefore mostly positive.

As per the assessment of social pressures (see Section 9.5.6), the Project may provide increased access to drugs and alcohol both as a result of LAA residents being able to leave their communities more easily and affordably by land, and as a result of non-residents being able to readily visit the community. These effects may be most pronounced in Tulita which currently has bylaws enacted that place restrictions on the amount of alcohol that residents can bring into the community. This increase in consumption may have several effects, including:

- Increased demand for counselling and facility-based addictions treatment for those community members who are using these substances on a more regular basis (which may exceed capacity)
- Increased demand for emergency services associated with impaired driving
- Increased demand for protective services due to alcohol-related crimes or violent incidents

Community members from Tulita stated that being able to get to the Norman Wells health centre by road will be beneficial to them. However, individuals from Norman Wells commented that during the project operations and maintenance phase, Tulita will experience a greater increase in health issues associated with drugs and alcohol, in comparison to Norman Wells, because at present Tulita's access to these substances is limited.

It is important to note that issues of alcohol and drug use, and limited community capacity to deal with the issues associated with alcohol and drug use, are long-standing problems; the Project will therefore exacerbate ongoing issues rather than create new ones.

²³ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

Medical and Fire Emergency Services

One consequence of the Project's operations and maintenance phase may be an increase in the number, as well as the severity, of vehicle-related accidents which will require emergency services (mostly ambulatory). Traffic accidents along the Project may be more severe and cause more traumatic injuries due to the faster driving speed (80 km/h). For additional information on the risk of transportation related accidents, refer to Chapter 25 (accidents and malfunctions).

While community-level data about current accident rates on the MVWR is unavailable, community members from Norman Wells and Tulita expressed concern about the ability of current services to accommodate additional demand, particularly those related to emergency services. Tulita community members were of the view that their fire department workers will need more training to deal with emergencies along the Project. Engagement in both LAA and RAA communities indicated that there was a need for existing service gaps and deficits to be addressed before project operations.

An increase in vehicle related accidents requiring emergency services may not be able to be addressed by current services levels within communities. Any decision to expand a LAA community's emergency services response protocols are at the discretion of communities and are typically based on assessed capacity and risk levels with expanding and/or extending services.

During engagement, Norman Wells community members stated that while its fire department is very capable, it is not permitted to service any emergency needs outside the town boundary; this will need to be addressed during the project operations and maintenance phase.

In cases where an accident occurs between communities (e.g., half-way between Wrigley and Tulita), the time it takes to provide emergency services to the accident will need to be sufficient to keep the number of "crisis" situations (due to late response) to a minimum. It may be challenging for first responders to respond adequately to project incidents that are an hour or two away, while still ensuring adequate services within the community. Emergency service response protocols are at the discretion of communities and are typically based on assessed capacity and risk levels with expanding and/or extending services. Should the communities decide to extend their emergency services beyond municipal boundaries, planning and coordination by both the GNWT and the communities will be important at that time.

The ability of communities to respond to an increased demand for emergency services that arise as a result of the Project also has an adverse effect on public safety. If communities do not have the resources or capacity to develop or extend protocols to respond to the increased demand, residents may report feeling less safe, and there may be disproportionate adverse effects on vulnerable populations. For more detailed information, refer to Public Safety, Section 9.5.9.

The provision of emergency services can be challenging in small communities, where all firefighters are volunteers. Municipal workers in Tulita stated that this situation is particularly true in Wrigley due to its small population. The challenge will be heightened with the increased responsibilities and response area created by the Project.

At the same time, the completed Project was perceived by some Tulita community members, via engagement, as being potentially safer than the winter road, as described in Section 9.5.9.

Protection Services

The RCMP will need to attend to accidents on the Project outside the LAA and RAA communities. For the communities of Norman Wells and Tulita this may pose a capacity issue, as both have only three officers and it is required that officers always travel in pairs. Consequently, when attending an accident on the Project, the one remaining officer will not be able to leave the detachment if there is a situation in the community that requires their attention. Community members of both Tulita and Norman Wells confirmed this issue through engagement.

Tulita community members recommended that to reduce the risk of traffic accidents, good signage needs to be put in place along the project route. They also identified a need to have satellite phones/radios and communication measures to support RCMP and emergency response. In Fort Good Hope, community members commented that some residents should be trained in security to augment the limited RCMP resources. A drug dog was also identified as a valuable support.

In addition, it is anticipated that the RCMP in the LAA community of Tulita and RAA communities of Fort Good Hope, Colville Lake and Délı̄nę may need to respond to increased reports of crimes during the operations and maintenance phase on account of increased access to, and consumption of alcohol and drugs in the Sahtu Region.

9.8.3.2 Mitigation

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The GNWT will develop a Road Safety Plan which contains measures that are anticipated to mitigate the adverse effects of the Project that would result in increased demand on social infrastructure and services. These measures include:

- Improving communication along the highway (e.g., signage, communications)
- Raising public awareness about highway safety
 - Conducting highway safety information campaigns on topics such as: drinking/drugs and driving, hitchhiking risks, wildlife risks, winter driving risks, speed, seat belts
- Identifying segments of the population that are most at risk on the road (e.g., youth, women, new drivers) to consider their unique circumstances and appropriately target education and awareness efforts and materials
- Enforcing highway safety via implementation of standard practice patrols and check stops along the Project once operational

The management and delivery of ground ambulance and highway rescue services in the Northwest Territories (NWT) is challenged by the social and geographic conditions that exist for communities and highways in the territory. A large geographic area, low population base, extensive distances between communities, the small size and remoteness of many communities, a limited communications network, harsh climatic conditions and lack of an all-season territorial-wide transportation network are factors that impact the effectiveness and efficiency of the provision of these services. The GNWT will continue to build safe roads and focus highway safety education and enforcement where community emergency service capacity is either limited or not available.

The Well-Being Adaptive Management Plan also includes commitments in the area of Community Services that are intended to address and adaptively manage adverse effects of the Project that may arise associated with increased visitors or non-residents accessing communities:

- Reviews existing uses and demands on health and social services and identify service needs and gaps associated with health and wellness that are being exacerbated as a result of adverse effects of the Project (e.g., increased drug and alcohol use may require additional health promotion efforts regarding HSS supports for individuals seeking treatment as well as options for On-the-Land healing in the community or region)

Chapter 25 (accidents and malfunctions), includes several commitments related to construction and operations and maintenance of the Project that are intended to reduce the potential for transportation accidents. These in turn would mitigate the effects of accidents on social infrastructure and services. These measures include:

- Implementation of best management and industry practices, as appropriate, to prevent or reduce the occurrence of vehicle accidents and driver error which may lead to transportation accidents due to collisions, roll over, or loss of control, such as:
 - Project vehicles will be driven by trained and competent drivers
 - The project site during construction and operations will rely on traffic control speed limits, weight restrictions, and signage for safe driving conditions
 - Project vehicles and equipment will undergo inspection prior to use by an operator
 - Project vehicles will be required to have beacon lights and flagging
 - Radio communication controls between project vehicle and equipment operators
 - Zero access policy for members of the public during construction
 - Regular updates on road changes during construction and operations and maintenance
- All on-site contractors will have industry-compliant and satisfactory Health, Safety and Environmental policies, programs, and manuals that will be successfully implemented throughout the Project.
- The GNWT and its contractors will follow all management plans and the ERP, which addresses potential transportation accidents and malfunctions for the Project.
- Regular public updates on road conditions and closures via the GNWT INF website. Road closure signage will be posted at the physical site where appropriate.

- On-going maintenance of the road to repair degraded areas will provide safer driving conditions
- Operational use of the road will include highway enforcement of speed limits and safe driving laws
- Signage will be posted to identify known animal crossings or key habitat areas to prevent animal collisions with vehicles

Additionally, the GNWT will require that contractors provide medical transportation services to its own workers, and this will be reflected in the Emergency Response Plan.

9.8.3.3 Project Residual Effect

9.8.3.3.1 Construction

As construction worker injuries and illness cannot be completely mitigated, the construction phase will result in an increased demand for health services in LAA communities.

Following the implementation of the proposed mitigation measures described in Section 9.8.3.2, residual effects for change in social infrastructure and services during construction are characterized as follows:

- Direction is adverse: construction worker injuries and illness will place an increased demand on local community health facilities and staff.
- Likelihood is possible: construction worker injuries and illness will occur that may result in increased demand on local facilities.
- Magnitude is low: represent a small change relative to existing conditions.
- Geographic extent is the LAA: residual effects will be restricted to the three LAA communities.
- Timing is no sensitivity: residual effect is not sensitive to the timing of a project phase and/or specific project activity.
- Duration is medium-term: the residual effect lasts through construction.
- Frequency is irregular: construction worker accidents/illnesses occur at irregular intervals.
- Change is reversible: the residual effect is likely to be reversed once the construction phase is completed.

9.8.3.3.2 Operations and Maintenance

Even with mitigation, the number of traffic accidents, and their severity, may increase in LAA communities. This may increase pressure on emergency services, protection services, and health services in these communities.

Even with mitigation, some LAA communities may continue to face ongoing challenges in recruiting a sufficient number of volunteers to respond to emergencies within the community as well as along the Project.

The increase in LAA communities' access to alcohol and drugs will result in increased demand on protection services to deal with crimes and incidents associated with the consumption of drugs and alcohol and increased demand in health counselling and facility-based treatment services.

Following the implementation of the proposed mitigation measures described in Section 9.8.3.2, residual effects for change in access to social infrastructure and services during operations and maintenance are characterized as follows:

- Direction is adverse: the Project will place increase pressures on local community emergency services, protection services, and health services.
- Likelihood is possible: the adverse effects associated with increased traffic accidents and crime that may increase demand on local services are likely to occur.
- Magnitude is low: residual effects represent a small change relative to existing conditions.
- Geographic extent is the LAA: residual effects will be restricted to the three LAA communities that will be connected to an all-season road.
- Timing is no sensitivity: residual effect is not sensitive to the timing of a project phase and/or specific project activity.
- Duration is long-term: the residual effect extends throughout operations.
- Frequency is irregular: construction worker accidents/illnesses occur at irregular intervals.
- Change is reversible: as adaptive management takes place, and services and facilities are changed to adapt to the effects of the Project, the adverse effects should lessen or decrease in frequency over time.

9.8.3.4 Determination of Significance for Change in Social Infrastructure and Services

During the construction phase, it is expected that there will be an increased demand for health services in LAA communities due to construction worker injuries and illness that cannot be treated by worker camp medics. This adverse effect is of low magnitude, irregular frequency and reversible, and is therefore not significant.

During the operations and maintenance phase, the increase in number and severity of traffic accidents along the Project will result in increased demand on emergency, health, and protection services. It is also expected that in LAA community access to alcohol and drugs will result in increased demand on protection services to deal with crimes and incidents associated with the consumption of drugs and alcohol. These adverse effects are of low magnitude, irregular frequency and reversible, and are anticipated to lessen over time as adaptive management is carried out and are therefore not significant.

9.8.4 Change in Public Infrastructure and Services

9.8.4.1 Effects Pathways

The potential effect of the Project on change in public infrastructure and services (water, sewage, waste disposal, telecom, and electricity) has four effects pathways that are discussed in this section:

- Change in demand for public infrastructure and services due to change in resident population and presence of non-resident construction workers required for the Project
- Change in demand for public infrastructure and services due to construction of the Project
- Change in demand for public infrastructure and services due to operations and maintenance of the Project
- Temporary disruption to public infrastructure and services due to construction of the Project

9.8.4.1.1 Construction

Change in demand for public infrastructure and services due to change in resident population and presence of non-resident construction workers required for the Project

The Project Description (Chapter 5) assumes that two dedicated project construction camps will be established for each construction segment at locations such as the existing camp facilities within Norman Wells and dedicated camp locations within municipal boundaries of Tulita and/or Wrigley. These construction camps will make use of municipal services such as drinking water and disposal of sewage and wastes.

Water

Drinking water for construction camps will be sourced from municipal systems in Wrigley, Tulita and/or Norman Wells. The estimated volume needed, per community water system where used, is approximately 10 m³ per day / 3,000 m³ per year. Non-potable water for camp operations will be withdrawn from municipal distribution or authorized water sources: the estimated volume is 20 m³ per day / 6,000 m³ per year.

The communities of Norman Wells and Fort Simpson have Class II water plants and have certified operators. Both communities use water from the Mackenzie River. The communities of Wrigley, Tulita and Fort Good Hope have Class I water plants: Wrigley and Fort Good Hope use water from the Mackenzie River, while Tulita uses water from the Great Bear River. The communities of Délı̄nę and Colville Lake have 'small system' classified water plants: Deline uses water from Great Bear Lake and Colville Lake uses water from the Colville Lake. Details of community water treatment are provided in Appendix 9C, Section 5.3.

Waste

All seven LAA and RAA community governments provide sanitation services via truck and both solid and sewage waste disposal services. Tulita's landfill current has between 2-5 years remaining until the end of its lifespan. Norman Wells' landfill has approximately 15 years of life left. Colville Lake has a new landfill. Details of community waste treatment are provided in Appendix 9C, Section 5.3.

Various waste materials will be generated during project construction, including camp greywater, camp sewage, camp solid waste, and recyclables. In addition, various hazardous materials will be used and hazardous wastes will be generated during construction. The wastewater generation associated with the maximum number of people (up to 80 people per camp) in two camps, per segment to be constructed, will be approximately 20 m³ per day per camp during peak occupancy. Greywater and sewage will be stored at the construction camps. Sewage will be periodically transported and disposed at those sewage lagoon facilities in Wrigley, Tulita or Norman Wells that agree to accept project sewage. If approved, greywater will either be transported to sewage lagoon facilities or deposited to a greywater sump. If municipal facilities are unable to accept solid waste, containerized waste will be transported by road to an alternate accredited facility approved to accept the specified project wastes.

Solid waste from the camps and construction activities may be either incinerated or hauled for disposal to municipal solid waste disposal facilities at Norman Wells and/or other municipal facilities that agree to accept project waste. Solid waste generated per camp during maximum occupancy (80 people) will be approximately 1 m³ per day. The GNWT will obtain confirmation from the municipalities that they will accept the waste.

Recyclables and Hazardous Waste

There are currently no facilities in the Sahtu or Dehcho regions licenced to accept and manage recyclables or hazardous wastes from commercial operations and recycling operations generally are limited. The Town of Norman Wells's recycling program at present is able only to recycle cans. The Tulita Dene Band provides a drop-in recycling program twice a year. The community of Tulita has a composting program which converts 500 pounds of food waste and 200 pounds of paper waste per week into compost. Plans are in place to expand Tulita's composting program to include more paper goods in 2023. Details of community recycling are provided in Appendix 9C, Section 5.3. Recyclable and hazardous wastes will be backhauled for disposal and/or recycling at accredited facilities capable of accepting such wastes in other locations within or outside of NWT, as outlined in the draft WMP.

Power

The Project Description assumes that the camps will supply their own heating and power for lighting and auxiliary equipment using diesel fueled generators and heaters; therefore, these utilities will not be provided by the local municipalities. The same is also true regarding telecommunications.

These changes will pertain only to the three LAA communities, as the construction camps will not be placed in RAA communities. According to engagement with community infrastructure providers, the extent of changes in public infrastructure use will vary by community:

- In Norman Wells (the largest LAA community), there is confidence that their existing public infrastructure is sufficient to manage increased demand due to the construction camp population.
- Tulita (medium-sized community) is not concerned about water use but may have concerns about increased wastes.
- Information on the community capacity to handle increased demands on in Wrigley (the smallest LAA community) is yet to be determined.

Construction workers who are residents in these communities will be given the options of living either in the camp or in their home communities during their rotation shift; their choice will not affect the resident workers' consumption of water or generation of waste.

Change in demand for public infrastructure and services due to construction of the Project

As per Chapter 5, non-potable water for road compaction and camp operations will be drawn in winter and summer from potential authorized sources, which have been quantified and are described in Section 9.8.4.1.1. Construction activities will also involve the creation of various kinds of waste, which have also been quantified and are described above. While the drawing of non-potable water will not affect LAA community infrastructure, the generation of waste by construction activities will involve the use of municipal waste disposal facilities, as described above. RAA communities will not be affected due to their distance from the construction activities.

Temporary disruption to public infrastructure and services due to construction of the Project

As per Chapter 5, the Project's estimated 10-year construction period will occur over a timeframe of up to 20 years, divided into three segments: Wrigley to the Dehcho/Sahtu border; Tulita south to the Dehcho/Sahtu border; and Tulita north to the PCAR. It is assumed that there will be a two-year gap between the construction of each project segment. Mobilization of equipment and material will occur in summer (April to November) via barge and in winter (December to March) by winter road; construction will generally occur year-round.

Temporary public infrastructure disruptions may include cuts to water or power or rescheduling or rerouting of waste services.

The location and duration of public infrastructure disruptions, and the types of infrastructure services being disrupted, will be determined only after a construction schedule and agreements with the communities regarding these disruptions (e.g., disposal of various wastes) are finalized. However, it can be assumed that any disruptions to the provision of public utilities to communities during the construction phase will be temporary and will be confined to the LAA communities. RAA communities will not be affected due to their distance from the construction activities.

9.8.4.1.2 Operations and Maintenance

Change in demand for public infrastructure and services due to the operations and maintenance of the Project

As per Chapter 5, two to three permanent maintenance camps (facilities) will be located at permanent borrow/quarry sources near the project alignment to facilitate ongoing maintenance of the Project during the operations and maintenance phase; the locations of these camps have not yet been determined. During the Project's operations and maintenance phase, water will be drawn from authorized sources during the summer for dust control; this will not affect either the LAA or RAA communities' public infrastructure or services.

Some additional public infrastructure was suggested by community members from Tulita in connection with project operations in the LAA including parking lots and boat launches to access Keele River.

Other kinds of public infrastructure that may be in demand by visitors to the LAA communities include parks, recreational facilities and sewage disposal for recreational vehicles. All three LAA communities have a gymnasium, while Tulita and Norman Wells have additional recreation infrastructure such as swimming pools, an arena, and a community hall. Norman Wells has a Youth and Elder Centre which operates as a drop-in center. All four RAA communities have a gymnasium, while Fort Simpson, Délı̄nę and Fort Good Hope have additional recreation infrastructure such as an arena and a community hall. Fort Simpson also has a curling rink and a seasonal swimming pool. Details of community recreation facilities are provided in Appendix 9C, Section 5.3. There is no available data on existing demand for these other kinds of public infrastructure.

9.8.4.2 Mitigation

The GNWT will obtain approval and agreement from the Town of Norman Wells, the Hamlet of Tulita and Wrigley to use their community water supplies, their sewage lagoon and solid waste disposal facilities.

A WMP will be developed and implemented.

No mitigation measures are suggested, as public infrastructure in LAA and RAA communities will not be used for activities associated with project operations and maintenance. GNWT will implement its system for road closures guided by the NWT Road Safety Plan (2015).

9.8.4.3 Project Residual Effect

9.8.4.3.1 Construction

Even with mitigation, some LAA communities may experience a strain on one or more components of their public infrastructure due to their limited current capacity. Tulita and Wrigley have been identified as having potential capacity constraints for solid waste disposal. Wrigley may also have constraints on their potable water capacity. Following the implementation of the proposed mitigation measures described in Section 9.8.4.2, residual effects for change in public infrastructure and services during construction are characterized as follows:

- Direction is adverse: the capacity of some public infrastructure in some local communities may be strained by the demands made by construction labour camps.
- Likelihood is possible: the capacity of some communities may be strained by demands made by construction labour camps.
- Magnitude is low: residual effects represent a small change relative to existing conditions.
- Geographic extent is the LAA: residual effects will be restricted to the three LAA communities.
- Timing is no sensitivity: residual effect is not sensitive to the timing of a project phase and/or specific project activity.
- Duration is short-term: the residual effect occurs during one segment of the construction phase, or less than 5 years.
- Frequency is continuous: construction worker camp demands on public infrastructure occurs continuously.
- Change is reversible: the residual effect is likely to be reversed once the construction phase is completed.

9.8.4.3.2 Operations and Maintenance

No residual effects on public infrastructure are anticipated during the operations and maintenance phase of the Project.

9.8.4.4 Determination of Significance for Change in Public Infrastructure and Services

During the construction phase, it is expected that there will be an increased demand for public infrastructure (potable water, disposal of wastewater and solid wastes) in LAA communities due to construction camps and this may have an adverse effect on infrastructural capacity for communities in the LAA. However, this adverse effect is of low magnitude and is reversible and is therefore not significant.

9.8.5 Change in Institutional Facilities and Services

9.8.5.1 Effects Pathways

The potential effect of the Project on change in institutional facilities and services (educational and cultural facilities and services) has three effects pathways that are discussed in this section:

- Change in demand for institutional facilities and services due to change in resident population and non-resident construction workers due to the construction of the Project
- Change in demand for institutional facilities and services due to change in resident population due to the operation of the Project
- Increased access (easier and lower cost) to institutional facilities and services by residents due to the operation of the Project

9.8.5.1.1 Construction

Change in demand for institutional facilities and services due to change in resident population and non-resident construction workers due to the construction of the Project

Education programs, along with various other programs and training throughout the year, are based on community need and funding secured by the municipal governments. Among the LAA communities, Tulita and Norman Wells have an Aurora College CLCs. Among the RAA communities, Fort Simpson Délı̄ne, and Fort Good Hope have an Aurora College CLC. Education programs along with various other programs and training throughout the year are based on community need and funding secured by the municipal governments. There is presently no training facility or CLC (Aurora College campus) in either Wrigley or Colville Lake. Details of educational facilities are provided in Appendix 9C, Section 5.4.

Educational Facilities/Community Learning Centres

Prior to, and during, the Project's construction phase, some residents of the LAA and RAA communities who seek employment for project construction may either require or desire educational and training programs (e.g., adult literacy, trades training) prior to applying for employment. This will mean an increased demand for adult educators and, if the education is provided in-person, CLCs. Education programs, along with various other programs and training throughout the year, are based on community need and funding secured by the municipal governments. Among the LAA communities, Tulita and Norman Wells have an Aurora College CLC. Among the RAA communities, Fort Simpson Délı̄ne, and Fort Good Hope have an Aurora College CLC. There is presently no training facility or CLC in either Wrigley or Colville Lake, which would require residents to either undertake distance learning or travel to other locations in order to access training at a CLC. Details of educational facilities are provided in Appendix 9C, Section 5.4.

Once construction work starts, the demand for education and skills training – and the corresponding demand on training facilities in the communities – by community members would be expected to be less than the period prior to the construction-related hiring. Nevertheless, the demand during the construction period would still be greater than the period prior to the announcement regarding project construction employment. In communities with limited institutional space and education and training staff, the demand for facilities and staff may be more than presently exists. This increased demand on capacity will likely be greater in LAA communities (where residents can work without the inconvenience of travel for rotational employment) than in RAA communities.

Norman Wells community members stated that the community should have a small Aurora College satellite campus so that people in the community and region do not need to travel so far (to Inuvik, Fort Smith or Yellowknife) for the training required to qualify for project construction employment. They also stated that if such a satellite campus is established in Norman Wells, it will be necessary for the community to build additional housing to accommodate students who come in from neighbouring communities as Norman Wells does not presently have the capacity to accommodate them. Additional housing could remove a barrier to being able to offer training to members of other communities in the region.

Preschool Facilities

In the LAA communities, as a result of an increase in the number of employed residents due to construction-related employment from the Project, there may be increased demand for childcare and preschool programming. In communities where childcare/preschool programs are either absent or in short supply, this could result in either lost project employment opportunities or the arrangement of informal childcare to accommodate the need. Among the LAA communities, Tulita is the only community that has licenced Early Childhood and Learning programs operating and can accommodate up to 20 preschoolers. Neither Wrigley nor Norman Wells currently have a licensed early learning and childcare program for children from birth to three years of age. In the RRA communities, Délı̄ne and Fort Good Hope have licenced Early Childhood and Learning programs, and Fort Simpson has three preschool facilities. Colville Lake currently does not have any licensed Early Learning or childcare programs. Due to likely higher rates of project employment in the LAA communities compared to the RAA communities, the increased demand on childcare and preschool capacity will likely be greater in LAA communities than RAA communities.

Tulita community members commented that they have sufficient daycare capacity to accommodate up to 20 more spots, though a maximum of 12 additional spots could be accommodated on any particular day.

Cultural/Recreation Facilities

Depending on whether non-local construction workers can live in the community (as opposed to the workers camp) and/or whether workers who live in the workers camp access community recreational facilities, there is the potential for increased use of recreational facilities in the LAA communities during the construction phase. There is currently no baseline data available on existing use of recreational facilities. This effect is not anticipated to occur in RAA communities.

9.8.5.1.2 Operations and Maintenance

Change in demand for institutional facilities and services due to change in resident population due to the operations and maintenance of the Project

All Institutional Facilities

As mentioned, project operations may stimulate the economies of Wrigley, Tulita and Norman Wells, thereby creating potential in-migration to these LAA communities. Increased resident population may result in increased use of institutional facilities (schools, adult educational facilities, daycare, recreation facilities). Any change in resident population will likely be gradual and small, so that facilities and services will have time to adjust to the changes and will have time to plan for and secure government funding for the expansion.

Increased access (easier and lower cost) to institutional facilities and services due to the operation of the Project

Culture/Recreation Facilities

Due to the intermittent and seasonal nature of travel (i.e., by the MVWR in winter) among the LAA communities, and the high cost of travel by air, many of the cultural and recreational events in the communities of Tulita and Norman Wells occur in isolation rather than as part of the region. With the opportunity of being able to travel by highway all-season, the feasibility of having out-of-town participants attend community events in Tulita and Norman Wells will be increased. In addition, the feasibility of having regional events hosted in one of the LAA communities may increase. With the prohibitive cost of air travel eliminated, intramural sports among youth, as well as traditional/cultural gatherings involving all age groups in the LAA communities all-season becomes possible. This change in inter-community accessibility may have some, but limited effect on the RAA communities.

Adult Education and Training Facilities

The ease of all-season travel for communities within the LAA which previously had only winter access by road (i.e., Norman Wells and Tulita) will enable members of these communities to travel by road for the purpose of accessing adult education and training in CLCs anywhere along Hwy 1 as well as communities connected by all-season highway to the Hwy 1, such as Yellowknife (i.e., Aurora College North Slave Campus). However, within the LAA communities, there may be a neutral effect with no measurable change on the physical capacity of CLCs to meet demand for education, certification, and training programs following project completion.

During engagement, staff at the Norman Wells CLC suggested mitigation that would provide funding and support to develop and offer more training locally, including the exploration of a satellite campus in Norman Wells. Another mitigation that was noted was to look at building additional accommodations in Norman Wells that could be used for students and support them coming to Norman Wells for education and training.

9.8.5.2 Mitigation

Additional comments and mitigation suggestions related to education institutional capacity are contained in education, training and skills.

No specific mitigation comments or measures were provided during engagement discussions on potential adverse effects on other institutional facilities.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The GNWT currently offers programs and services designed to support students in obtaining education and training and facilitate their participation, which extends to students that may not have access to a local educational institution or local training facilities. While the GNWT is not committing to an establishment of a satellite Aurora College campus at this time, mitigation measures have been identified to enhance the positive effects of the Project on education and training through the leveraging of existing programs and supports (see Section 9A.3 for details on existing programs and policies) and respond to educational and training needs that are identified and linked to the Project. The Contractor Training and Employment Plan includes measures that are intended to address barriers associated with increases in demand for educational and training services as a result of the Project:

- Identifies barriers to increasing uptake in education and training courses (e.g., restricted licences in Tulita) and develops potential solutions to implement
- Identifies education, skills and training programs and courses required to address lack of available skilled labour for construction and operations in each of the communities, including sharing information about Labour Market Programs that can support communities, employers and organizations
- Identifies education and training programs and courses currently available (local CLC or campus), how offered (in-person, remote, blended) and new programs and courses required to meet local need (as well as whether or not additional staffing and space requirements are necessary)
- Identifies potential funding to support education and training prior to construction, during construction and operations

The Community Services section of the Well-Being Adaptive Management Plan includes the following measure that is anticipated to address the adverse effects related to increased demand for educational services that may arise as a result of the Project:

- Reviews existing uses and demands on services including childcare, schools and recreational facilities and identifies needs associated with any increased demands that may be associated with the Project (e.g., expansion of services)

No mitigation is required for increased demand for institutional facilities due to change in resident population, or for effects related to all-season access to institutional facilities and services by residents of communities newly connected to all-season road infrastructure (i.e., Norman Wells and Tulita), as these are both positive effects.

9.8.5.3 Project Residual Effect

9.8.5.3.1 Construction

While the identified mitigation measures are expected to address the capacity of CLCs to some degree, it may be that they do so only partially. The CLCs may lack the facility capacity to meet all demands for educational programming and training, notably in the trades where access to specialized equipment and certified trainers is needed. Given this, it is expected that it may not be possible for CLCs to have the necessary facility space to meet all training needs at the community level, and this may limit the expected increases to educational and skills levels at least to some degree unless additional supports for potential students and trainees to obtain training as outlined in the Contractor Training and Employment Plan are implemented. This also means that there may need to be a greater reliance on contractors from outside of the communities both in terms of the construction and operations and maintenance phases.

With proper planning and funding for increased demand for childcare/preschool, residual effects will be negligible (though this may vary from community to community).

Following the implementation of the proposed mitigation measures described in Section 9.8.5.2, residual effects for change in institutional facilities and services during construction are characterized as follows:

- Direction is adverse: CLCs may lack the facility capacity to meet all demands for educational programming and training by community members seeking project employment.
- Likelihood is possible: there may be adverse effects on the capacity of educational institutions as a result of mitigation measures not being sufficient to address all demands.
- Magnitude is moderate: residual effects are likely to be noticeable and/or measurable and represent a moderate change relative to existing conditions.
- Geographic extent is the LAA: residual effects will be restricted to the three LAA communities.

- Timing is high sensitivity: effect occurs during a critical time – i.e., the narrow window of opportunity for the local population to obtain qualifications required for the project employment that they seek.
- Duration is medium-term: the residual effect lasts through construction (up to 20 years).
- Frequency is irregular: demands for educational programming and training occur at irregular intervals.
- Change is reversible: the residual effect is likely to be reversed once the construction phase is completed.

9.8.5.3.2 Operations and Maintenance

Residual effects for change in institutional facilities and services during operations and maintenance are characterized as positive.

9.8.5.4 Determination of Significance for Change in Institutional Facilities and Services

The Project may have a moderately adverse effect on the capacity of CLCs to meet local demand for technical training in preparation for construction-related employment. Despite being of moderate magnitude and medium duration, this effect is considered to be not significant due to its irregular frequency and reversibility.

9.8.6 Summary of Positive Project Effects for Infrastructure, Services and Institutional Capacity

This section summarizes the positive effects of the Project on various effect pathways for the infrastructure, services, and institutional capacity VC.

Change in Demand for Institutional Facilities and Services Due to Change in Resident Population during Operations and Maintenance of the Project

Project operations and maintenance may create potential in-migration to the LAA communities, which will result in increased use of institutional facilities (schools, adult educational facilities, daycare, recreation facilities). Any change in resident population will likely be gradual, so that facilities and services will have time to adjust to the changes and will have time to plan for and secure government funding for the expansion. Expanded facilities often provide a greater range of services than the original-sized facilities.

Increased Access (Easier and Lower Cost) to Institutional Facilities and Services by Residents of Former 'Isolated' Communities Due to the Operations and Maintenance of the Project

The opportunity of being able to travel to and from LAA communities via the Project all-season will enable out-of-town participants to attend community events in Tulita and Norman Wells throughout the year. The feasibility of having regional events hosted in one of the LAA communities may increase. Intramural sports among youth in the LAA communities all-season will become possible. This change in inter-community accessibility may have an effect on the RAA communities but not to the same extent as seen in the LAA communities.

9.8.7 Overall Determination of Significance for Infrastructure, Services and Institutional Capacity

Given that a majority of effects on infrastructure, services and institutional capacity are considered positive, and any adverse effects are low in magnitude or limited in scope, the effects on infrastructure, services and institutional capacity are not significant.

9.9 Assessment of Potential Effects on Non-Traditional Land and Resource Use

Based on project interactions with the socio-economic environment identified in Table 9.B5, the Project may affect non-traditional land and resource use.

Potential effects, effect pathways and mitigation measures proposed to reduce or eliminate the effects on non-traditional land and resource use are identified in Table 9.21. More details on the potential effects anticipated in both the construction and operations and maintenance phases of the Project and mitigation measures follow the table, along with a description of any residual effects that remain once mitigation measures have been applied, and in cases where the residual effects are adverse, a determination of significance of the residual adverse effects is included.

It should be noted that many of the potential effects of the Project are interconnected and as such, the measurable parameters that have been identified for certain effect pathways may in some cases have some connection to other effects pathways. However, for the purposes of the effects assessment, measurable parameters are limited to inclusion with one effects pathway. As appropriate, interconnections and linkages between effects of the Project and between socio-economic VCs are highlighted in the text, with appropriate references to particular sections of Chapter 9.

Table 9.21 Potential Effects and Mitigation Measures for Non-Traditional Land and Resource Use

Effect Name	Effect Pathway	Mitigation Measures
Change in non-traditional land use	<ul style="list-style-type: none"> • Change in non-traditional land use designation prior to construction due to the Project • Change in non-traditional land use due to the construction of the Project • Change in non-traditional land use due to the operation of the Project 	<ul style="list-style-type: none"> • The GNWT will develop and implement a Contractor Training and Employment Plan includes measures related to supporting communities to plan specifically for the effects of increased visitors and tourists that are likely to occur as a result of the Project being operational, including working with communities to develop tourism plans.
Change in access to non-traditional land use	<ul style="list-style-type: none"> • Increase in capacity to transport goods, services, and resources due to the operation of the Project • Change in access to land and surrounding lakes/rivers, environmental and culturally sensitive areas, and between communities along the Project • Disruption of transportation/movement and temporary or permanent restrictions to access due to construction of the Project 	<ul style="list-style-type: none"> • The GNWT will develop and implement a Contractor Training and Employment Plan includes measures related to supporting communities to plan specifically for the effects of increased visitors and tourists that are likely to occur as a result of the Project being operational, including working with communities to develop tourism plans. • The GNWT will develop and implement a WMMP. The WMMP will contain detailed monitoring and mitigation measures to be implemented for the duration of the construction and operations of the Project. • In addition to these mitigation measures, the following specific mitigation for the construction phase have been identified: <ul style="list-style-type: none"> – Construction personnel will be prohibited from using recreational all-terrain vehicles and snowmachines while working on the Project. – Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project. – Travel of vehicles will be confined to existing infrastructure roads and trails as much as possible to avoid disturbing vegetated areas – Removal of vegetation will be limited to the width of the ROW. – Transportation of construction materials and equipment via barge will be used to reduce the number of trucks for construction resupply along the Mackenzie Highway (Highway No. 1).

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Effect Name	Effect Pathway	Mitigation Measures
Change in aesthetics	<ul style="list-style-type: none"> • Decreased aesthetics due to construction (e.g., presence of workspaces and camps) of the Project • Decreased aesthetics due to operation of the Project 	<p>For air quality:</p> <ul style="list-style-type: none"> • Cold starts of equipment will be limited to the extent possible. • Incinerators will be operated in accordance with manufacturer’s specifications and emissions will meet Canadian Council of Ministers of the Environment Canada Wide Standards for Dioxins & Furans and Mercury. • Road surfaces will be repaired and maintained to reduce rolling resistance of vehicles. • The contractor will be encouraged to use modern construction equipment that has lower GHG emissions. • The contractor will be encouraged to use passenger vehicles (e.g., passenger van or bus) to move crews. • Vehicles and equipment will be maintained regularly. <p>For noise levels:</p> <ul style="list-style-type: none"> • The GNWT will engage with communities to inform them of the activities and the noise sources that will occur prior to construction. • Blasting activities will be limited to daytime hours to the extent practical. • Communities will be informed of time periods and characteristics of noise that may exceed the recommended noise threshold. • Methods to reduce the powder factor will be considered (e.g., through a combination of increased hole spacing, decreased column height of explosives, increased depth of stemming material in the blasthole, variable diameter blastholes) to reduce noise. • Project vehicles will avoid the use of residential roads, where possible. • The use of modified blasting techniques will be considered to reduce noise, including: use of electronic detonation instead of explosive detonation cord; use of air decking which involves the use of an inverted cone in the blasthole to constrain energy within the rock mass; timing sequence to develop an echelon effect; and, coordinating blast patterns towards a partially open face.

Effect Name	Effect Pathway	Mitigation Measures
Change in aesthetics (cont'd)		<ul style="list-style-type: none"> • Transportation of construction materials and equipment via barge will be used to reduce the number of trucks for construction resupply along the Mackenzie Highway (Highway No. 1). • Use of residential roads by construction equipment will be limited, where possible. • Vehicles and equipment will be equipped with manufacturer recommended noise muffling equipment.
Change in non-traditional resource use (including aggregate and granular resources (e.g., sand and gravel), mineral resources, forest resources, oil and gas)	<ul style="list-style-type: none"> • Increased access to resources and resource exploration due to the operation of the Project • Increase in use of available resources for the construction of the Project • Decreased access to wildlife resources due to construction of the Project • Decreased access to wildlife resources due to operation of the Project 	<ul style="list-style-type: none"> • The GNWT will develop and implement a WMMP that will include measures related to monitoring wildlife that may be affected by the construction or operation of the Project. The plan will also include measures to prevent or limit some recreational activities (e.g., hunting, use of vehicles) by workers on the Project.

Each section of the assessment of potential effects includes mitigation sections with more detailed information on specific measures and commitments, and a full summary of the mitigation measures and commitments that are part of the Community Readiness Strategy is available in Section 9.16.1, and a full summary of additional mitigations and commitments are contained in Section 9.16.3.

9.9.1 Summary of Engagement Findings on Non-Traditional Land and Resource Use

During engagement in the LAA communities, input was gathered from representatives of Indigenous Governments, Indigenous Organizations, and other affected parties, including renewable resources councils, land corporations, Elders, and a representative of the GNWT-ECC on the topic of non-traditional land and resource use. More limited comments were provided by engaged Indigenous Governments, Indigenous Organizations, and other affected parties of RAA communities due to the distance of the Project to these communities.

Indigenous Governments, Indigenous Organizations, and other affected parties who were engaged focused their attention on potential effects of the Project on non-traditional land and resource use during the operations and maintenance phase.

Overall, community members in the LAA commented that while the Project's operations and maintenance phase will increase non-traditional use of lands and resources, these effects will, for the most part, be adverse. Tulita residents mentioned that the Project will scar the land, that the

dust produced by traffic on the Project will negatively affect local vegetation and wildlife, and that there will be an increase in noise due to road traffic. At the same time, members of the LAA communities stated that these aesthetic effects are acceptable given the benefits of the Project on other aspects of peoples' lives.

Members of LAA communities expect that the Project will bring more tourists into the communities and that recreational use of lands and waters (for example, hiking and fishing) in the vicinity, by non-resident non-Indigenous peoples, will therefore increase. In addition, individuals from Tulita believe the Project will make vacationing by local residents to other communities in the region, to other parts of the Territory, and across Canada, more affordable and popular.

Details of engagement are integrated into the effects pathways described in Sections 9.9.2 to 9.9.6.

9.9.2 Change in Non-Traditional Land Use

9.9.2.1 Effects Pathways

The potential effect of the Project on change in non-traditional land use has three effects pathways that are discussed in this section:

- Change in non-traditional land use designation prior to construction due to the Project
- Change in non-traditional land use due to the construction of the Project
- Change in non-traditional land use due to the operation of the Project

9.9.2.1.1 Construction

Change in non-traditional land use designation prior to construction due to the Project

The Project is situated on several different categories of land; it also straddles two regions: the Sahtu Region and the Dehcho Region. Within the Sahtu Region, communities are primarily situated on Commissioner's Land, but can also consist of a combination of municipal land, private land, tenured Commissioner's Land, tenured territorial land and federal land.

Sahtu Region

The SLUP provides overarching direction on how land in the Sahtu Region is to be used, developed, and conserved (SLUPB, 2023). The SLUP applies throughout the Sahtu Region, with the exception of "lands in a settlement area that comprise a park to which the *Canada Nation Parks Act* applies, that have been acquired pursuant to the *Historic Sites and Monuments Act* or that are situated within the boundaries of a local government" (SLUPB, 2023). The community boundaries for the Hamlet of Tulita and the communities of Norman Wells, Fort Good Hope and Colville Lake are not subject to the requirements of the SLUP. However, for Norman Wells, Délı̄në and Tulita, where their Block Land Transfer Area lands extend outside of their community boundaries, these lands are subject to the provisions of the SLUP (SLUPB, 2023). There are no Established Protected Areas within the Project's LAA or RAA. Sahtu Settlement Lands include both private and public lands.

Additional information about the SLUP with respect to the Project is provided in Chapter 6.

Dehcho Region

The Draft Dehcho Land Use Plan (DLUP) is currently under development and is therefore not in effect. A Draft Interim Land Use Plan was completed by the Dehcho Land Use Planning Committee in 2016 (GNWT, 2021c). The communities of Wrigley (in the LAA) and Fort Simpson (within the RAA) lie within the Dehcho Region.

Highways are the responsibility of the GNWT-INF. The GNWT and the community and/or Indigenous Governments of Wrigley, Tulita and Norman Wells will exchange land so that the segment of the planned transportation corridor to be built on lands currently owned by the community/Indigenous Governments will rest upon territorial land following the Project's construction.

Where permanent infrastructure will be located on Sahtu Settlement Lands (e.g., quarries, borrow sources, access roads, and new segments of the highway ROW), the GNWT will require an agreement with the applicable district land corporation that provides for compensation and/or land exchange or, if such an agreement cannot be negotiated, arbitration or, if both the GNWT and the applicable district land corps consent, the GNWT statutory procedure to expropriate in accordance with chapter 24 of the Sahtu Dene and Metis Comprehensive Land Claim Agreement.

The land exchange will be finalized through existing channels and mechanisms, after the Project is constructed, as legal surveys of the finished Project are required for Transfer documents that can be registered at the Northwest Territories' Land Titles Office. The relevant community/Indigenous Governments and the GNWT will enter into agreements that provide for any required access, use of the project lands, and the contemplated land exchange.

To prevent future dispositions on those portions of the proposed highway that are on public land, the GNWT-INF will apply for a reservation by notation (reserve) from the GNWT-ECC. A reserve approach is used by the GNWT to preserve and set aside land for a public purpose, as provided for in Section 19(b) of the *Northwest Territories Lands Act* and Section 4 of the *Commissioner's Land Act*. A reserve is not a sale or disposition of land. Once the Project is constructed and formally designated as a public highway under the *Public Highways Act*, the GNWT-INF will apply to have the reserve relinquished.

The project alignment will also traverse some private land which will require conformity with existing land use designations/plans and with existing/planned land uses (including seasonal and permanent camp areas, parks/recreation areas, transportation corridors, industrial zones, protected areas, ecologically important areas, navigable waters) along the ROW. It is not possible at this stage of design to determine the degree to which the Project will need to be in conformity.

The PDA will likely intersect or coincide with the special land use areas identified in Table 9.22.

It will be necessary for the regulator (or owner responsible for the disposition) or the SLUPB to accept the conformity of construction activities with the conformity requirements in these designated zones (see Chapter 6).

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Table 9.22 Special Land Use Areas Within the Project Development Area

Land Zone / Category	Feature Name	Location	Jurisdiction
Special Management Zone (SMZ)	Mackenzie River (Deh Cho)	Entire Sahtu portion of the Mackenzie River (Deh Cho)	Sahtu (SLUPB)
Special Management Zone	Willow Lake Wetlands	Inland from the Mackenzie River Special Management Zone to the north of Tulita	Sahtu (SLUPB)
Conservation Zone (CZ)	Bear Rock (Petinīzah)	Northwest of Tulita	Sahtu (SLUPB)

Several special land use areas are within the LAA and are listed in Table 9.23.

Table 9.23 Special Land Use Areas Within the Local Assessment Area

Land Zone / Category	Feature Name	Location	Jurisdiction
Special Management Zone	K'ąąłq Tué (Willow Lake Wetlands) SMZ (62) Deh Cho (Mackenzie River) SMZ (63) Norman Range SMZ (50)	North of Tulita; PDA passes through portions of each	Sahtu (SLUPB)
Conservation Zone	Petinīzah CZ (Bear Rock) (32) Mio Lake CZ (36)	North of Tulita; PDA passes through a portion	Sahtu (SLUPB)
Territorial Park	Mackinnon Territorial Park	On the northeast shore of the Mackenzie River on the outskirts of Norman Wells	GNWT (Parks)

The Petinīzah (Bear Rock) Conservation Zone is adjacent to the Mackenzie River Special Management Zone. The Project intersects with only the very southernmost portion of the Norman Range Conservation Zone which includes the entire Level IV Norman Range Ecoregion including Sam McRae Lake, Turton Lake, Chick Lake, Oscar Lake, Kelly Lake, Lennie Lake and Yamoga Rock. The Project intersects a small portion of the Willow Lake Wetlands Special Management Zone, which is bounded to its south by the Great Bear River Special Management Zone. The Deh Cho (Mackenzie River) Special Management Zone is defined by a 5 km buffer that applies to the length of the Mackenzie River as it runs through the Sahtu Region.

There are 14 conformity requirements (CR) applicable to these zones. The Project conforms to the CRs (see Chapter 6).

The change in land ownership will only pertain to the PDA.

Change in non-traditional land use due to the construction of the Project

As per the Project Description (Chapter 5), construction will occur approximately 300 days per year. During the construction phase, a variety of activities will occur in the PDA, including:

- Mobilization of equipment, materials, fuel and other supplies
- The use of staging areas
- Resupplying annually or semi-annually bulk items such as fuel, geotextile, bridge components and culverts
- Construction of two dedicated project construction camps for each construction segment
- Clearance of trees and standing deadfall along the ROW, quarry and borrow sources, associated access roads, new staging areas, and maintenance camps
- Creation of 15 material sources (granular borrow sources and rock quarries) for construction of the Project and access roads to quarry and borrow sources
- Embankment construction
- Using portions of the existing MVWR as a travel lane for movement of equipment working to construct new embankment within the shared ROW of the MVWR and new alignment
- Demobilization of construction equipment, camps, scrap materials and waste
- Closure and reclamation of camps, temporary quarries, maintenance camps and MVWR once each segment of the Project is constructed

These activities will create disturbances to the physical environment (land and water) within the LAA; in particular, heavy machinery used for construction may disturb land and various species habitats. However, the Project is linear in nature and is expected to primarily adhere to the existing corridor used by the MVWR. Due to this fact, there may be limited changes to non-traditional land use due to project construction, such as recreation. During engagement in Tulita, community members spoke about cabins located along the MVWR and concerns that these cabins may not remain accessible during both construction and operation of the Project. Due to the distances involved, the RAA communities will not be affected by construction activities' disturbances to the local physical environment.

Tourism in the LAA and RAA communities may not be noticeably affected by project construction activities because tourism activities in the Sahtu and Dehcho regions are not focused on these communities, but rather on natural features located at distances away from these communities.

9.9.2.1.2 Operations and Maintenance

Change in non-traditional land use due to the operations and maintenance of the Project

Changes in non-traditional land uses within the LAA which may occur during the Project's operations and maintenance phase are:

- The possible reduction in snowmobile use in LAA communities
- The possible construction and use of cabins near the Project and potential changes in areas where non-traditional hunting and fishing are practiced due to operations and maintenance of the Project and use of cabins
- Proposed land use projects in Norman Wells may have a better chance of being approved and funded, including a downtown beautification project and a proposed downtown campground
- Increased traffic (including drivers from other NWT communities and tourists from elsewhere) may necessitate the creation of public parking spaces and community signage in LAA communities. As noted by Norman Wells staff, the experience of Tuktoyaktuk – where the number of visitors tripled once the Inuvik to Tuktoyaktuk Highway opened, and the community was not prepared – may be duplicated in LAA communities if they are not ready

Changes in patterns of non-traditional hunting activities (recreation) may also be affected by operations and maintenance of the Project. As it is, LAA and RAA community residents already primarily hunt along the winter road (MVWR and winter roads that connect the MVWR to Colville Lake, Délıne and Fort Good Hope) corridors; the Project will now enable all-season access for hunting along the ROW. Community members from Tulita commented that the Project will provide an opportunity to develop additional recreation areas, such as a walking trail to Four Mile Creek, and to take part in recreational activities such as hiking and fishing in more areas (i.e., increased choice of where they can go).

The Project may facilitate an increase in tourism opportunities/businesses in all three LAA communities (Wrigley, Tulita and Norman Wells). As the Project will not directly affect all-season access to the RAA communities, no changes in tourism opportunities/businesses in the RAA communities are anticipated. Tulita residents believe that the Project will lead to increased tourism which will require an understanding of *“what was possible within the municipal boundaries”* to accommodate this growth. They made reference to Tuktoyaktuk and the challenges they experienced accommodating the increasing tourism industry as a result of the all-season road. Meeting minutes from the Tłıchq All Season Road Corridor Working Group (December 12, 2019) describe information shared by a resident of Tuktoyaktuk regarding the road opening. The GNWT is integrating lessons learned from this Working Group into the Project.

9.9.2.2 Mitigation

Although residents of Tulita indicated some concern about the effects of the Project during construction on local hunting camps, no specific mitigation measures were raised during engagement.

As indicated, engagement in Tulita indicated that residents are concerned about potential challenges in accommodating any increase in tourism once the Project is operational. In the case of Tuktoyaktuk, it was noted that the community was not ready for the road opening and provided advice on what to do to be prepared. This advice included having a plan in place for tourists when they show up. It also included the need to create an infrastructure system to deal with trucks that breakdown or need tire repair, which is related to increased numbers of tourists but would also be applicable to increased traffic generally as a result of all-season access.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The effects of the Project related to increased visitors are to be addressed by the following measures in the Contractor Training and Employment Plan:

- ITI staff are available to discuss tourism readiness with communities and has funding available in various programs that can be used by communities to develop community led initiatives such as tourism plans as communities identify a need or desire to create a specific plan related to maximizing benefits and mitigating adverse effects associated with the operation of the Project, including:
 - Identifying barriers or gaps in the current state that need to be addressed to fully realize benefits from tourism
 - Identifying future potential for tourism development and promotion
 - Identifies additional needs and supports needed and available to mitigate adverse effects related to tourism as a result of the Project

In addition to these mitigation measures, an additional mitigation measure identified during operations and maintenance is related to the need to plan for traffic increases:

- Meeting with LAA community governments to plan for traffic increases prior to opening of the Project, including signage and designated parking spaces within the LAA communities

9.9.2.3 Project Residual Effect

9.9.2.3.1 Construction

The project alignment routing has been designed to avoid or reduce effects on particularly sensitive habitats (as per Chapter 5, the project alignment reflects community input and TK obtained during project engagement). Regardless, the disruptive nature of construction may decrease tourism and outdoor recreation activities during the construction phase such as hunting and fishing even if wildlife and fish are not directly affected by construction.

Residual effects on non-traditional land use during construction are characterized as follows:

- Direction is adverse: construction activities may adversely affect some portions of the PDA to an extent where non-traditional land uses ordinarily conducted in these areas may be disrupted.
- Likelihood is possible: construction activities may adversely affect non-traditional land use for some.
- Magnitude is low: represents a small change relative to existing conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.
- Timing is no sensitivity: does not occur during a time-sensitive land use activity.
- Duration is short-term: the residual effect only pertains to the construction season.
- Frequency is irregular: occurs based on the construction activities in specific locations and will occur only during one construction season.
- Change is reversible: the residual effect is likely to diminish following completion of construction.

9.9.2.3.2 Operations and Maintenance

Minor residual effects on vehicular traffic-related land uses in LAA communities are anticipated following the mitigation identified for operations and maintenance. Residual effects on non-traditional land use during operations and maintenance are characterized as follows:

- Direction is adverse: unregulated parking and increases in tourists and visitors in communities will adversely affect life of residents.
- Likelihood is possible: it is possible that unregulated parking and tourists/visitors will adversely affect life at some times for some residents.
- Magnitude is low: represents a small change relative to existing conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.
- Timing is no sensitivity: does not occur during a time-sensitive land use activity.
- Duration is long-term: the residual effect extends through project operations and maintenance.

- Frequency is regular: occurs at regular intervals (e.g., peak during summer tourism season).
- Change is irreversible: the residual effect is likely to persist as the Project will remain in existence for an indeterminate amount of time.

9.9.2.4 Determination of Significance for Change in Non-Traditional Land Use

With the implementation of the mitigation measures, the Project is anticipated to meet the SLUP conformity requirement related to land use designations/plans during construction and operations and maintenance.

During the construction phase, a decrease in tourism and non-traditional outdoor activities (e.g., recreational hunting and fishing) is expected due to the disruptive nature of construction; this residual effect is considered to be adverse. However, with a low magnitude, short-term duration, and irregular frequency, this residual effect is considered not significant.

During the operations and maintenance phase, an adverse residual effect of increased tourism and traffic and associated parking issues in LAA communities all-season is expected. However, with a low magnitude and regular frequency, this long-term residual effect is considered not significant.

9.9.3 Change in Access to Non-Traditional Land Use

9.9.3.1 Effects Pathways

The potential effect of the Project of a change in access to non-traditional land use has three effects pathways that are discussed in this section:

- Disruption of transportation/movement and temporary or permanent restrictions to access due to construction of the Project
- Increase in capacity to transport goods, services, and resources due to operations and maintenance of the Project
- Change in access to land and surrounding lakes/rivers, environmentally and culturally sensitive areas, and between communities along the Project

9.9.3.1.1 Construction

Disruption of transportation/movement and temporary or permanent restrictions to access due to construction of the Project

At present, five of the seven LAA and RAA communities are accessible by land only in the winter via the MVWR and via air year-round; the three LAA communities (Wrigley, Tulita and Norman Wells) are accessible via barge during the summer shipping season; and two communities (Fort Simpson and Wrigley) are accessible by land year-round via Hwy 1.

During the construction period, the three LAA communities may experience disruptions or restrictions in use of the MVWR – and therefore access to non-traditional land use activities outside their communities in the winter – as construction activities will be using the MVWR for transportation of materials. In addition, the existing stretch of Hwy 1 will be used to transport equipment and materials to the end of the Project near Wrigley; as per Chapter 5, approximately 500 trucks may be required to complete each annual mobilization for construction over a 10 – 20-year period. It is possible that using Hwy 1 for construction-related transportation may restrict traffic along Hwy 1 at Wrigley and Fort Simpson (the only community in the RAA that may be affected; the other three RAA communities will not experience transportation disruptions due to construction-related trucking for this Project).

During the construction phase, construction workers may have a desire to access lands adjacent to the project ROW via all-terrain vehicles and snowmachines for recreational purposes (including hunting and fishing) during their leisure time. Such activities may disturb sensitive lands and various species habitats in the PDA and the LAA, but due to distance, not RAA communities.

9.9.3.1.2 Operations and Maintenance

Increase in capacity to transport goods, services, and resources due to operations and maintenance of the Project

Once the Project is in operation, it is likely that the total annual number of cars, light trucks, heavy trucks coming to the LAA communities of Tulita and Norman Wells²⁴ will increase, as they are presently accessible by land only during the winter months via the MVWR. Other types of vehicles, such as recreational vehicles, may visit these two communities.

As a result of the Project, the capacity for Tulita and Norman Wells to receive goods transported by road will potentially increase, which is likely to have positive effects on communities. The number and range of services available in these communities may also increase, as all-season accessibility by road may induce new businesses to establish in Tulita and Norman Wells.

Individuals from Tulita believe the Project will make it less costly for community members to leave the community to visit family and go on vacations and will be less expensive and easier for outsiders (tourists) to visit the community and region (see Section 9.5.4 for more information on effects of the Project related to changes in Community/Family and Social Ties). They did note, however, that the price of gas needs to be considered when weighing the benefit given the increasing cost of fuel.

Industrial activity may become part of the increased transportation capacity created by the Project. For example, petroleum-related reclamation work in and around Norman Wells will be initiated in coming years; transporting the equipment necessary for the reclamation via the Project would be more economical to petroleum producers than via current options.

²⁴ For Norman Wells, all-season access by road is also dependent upon completion of the Great Bear River Bridge project, which may or may not be constructed prior to the Project.

The capacity to transport goods, services, and resources due to operations and maintenance of the Project will not be changed in the RAA communities because they either will not have direct access to the Project (as is the case for Fort Good Hope, Colville Lake and Délı̄ne) or are already on Hwy 1 (as is the case for Fort Simpson).

Change in access to land and surrounding lakes/ivers, environmentally and culturally sensitive areas, and between communities along the Project

Recreational use of land and water may also be potentially affected by the all-season access to places along the Project, opening up areas that are not currently accessible and potentially changing the land uses in these areas. Recreational use of lands surrounding communities in the LAA may increase due to easier access to these lands, considering that residents will be able to drive to areas previously only accessed by foot or snowmachine. Currently, the majority of residents and visitors in the LAA communities go to the high-use recreational areas of interest, but fewer people may use them in preference for off-roading activities: such activities may occur in areas which are environmentally or culturally sensitive. RAA communities will not experience any changes in access to their lands and waters due to the distance from the PDA.

Residents from Tulita commented on improved access to Trout Lake (15 km on the other side of Bear Rock [Petı̄ı̄zah]), a site that community members use for fishing derbies. Community members noted that because of climate change, they are delayed getting their boats in the water; the Project will make it easier for people to move their boats (and skidoos) allowing them to access the lakes/ivers sooner.

Individuals also spoke about the Nááts'ı̄hch'oh National Park Reserve (located near the Yukon-NWT border), commenting on the likely growth in visitors as a result of increased access due to the Project. Currently, very few people visit the Park Reserve due to the high cost and limited number of licenced tourism operators (three – two from Toronto and one from Whitehorse). The increase in visitors would require Tulita to build more hosting facilities, provide more services, increase the number of licensed tourism operators, increase capacity to plan and implement events, offer more products, and interact more frequently with Parks Canada. Concerns related to increased visitors are described in more detail in the Non-Traditional Resource Use section (see section describing effects of the Project, mitigation and residual effects).

Tulita residents also expressed concerns about increased access to traditional lands and water as a result of the Project, commenting on the potential for overharvesting (fish and wildlife) by tourists and non-local workers who are not aware of harvesting laws/quotas. One community member said, *“they will take all our traditional food. They don't use traditional practices. They will take much of the wild game; there could be wastage.”*

Community members from Colville Lake also expressed concerns about effects on wildlife due to increased access, commenting that “things are good right now because our community is isolated”. Fort Good Hope community members spoke about possible effects on existing hunting practices; noting that community members have rights to hunt along the winter road. More information on potential effects of the Project on cultural use is presented in Chapter 11.

9.9.3.2 Mitigation

Many community members in Tulita spoke about the need for ongoing monitoring to address “wildlife security in the future” and for funding to carrying out monitoring activities. Some discussed using Indigenous Guardians to monitor for overharvesting (e.g., overfishing in Trout Lake due to the fishing derbies) and to educate people on the effects of overharvesting and climate change. Others said there was a need for increased patrol/enforcement from the GNWT-ECC officers. It was also noted that youth are now training with Indigenous Guardians and becoming more aware of traditional practices (e.g., harvesting, tracking of soil and water).

The following specific construction mitigation measures have been identified for the construction phase:

- Construction personnel will be prohibited from using recreational all-terrain vehicles and snowmachines while working on the Project.
- Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project.
- Travel of vehicles will be confined to existing infrastructure roads and trails as much as possible to avoid disturbing vegetated areas.
- Removal of vegetation will be limited to the width of the ROW and workspaces.
- Transportation of construction materials and equipment via barge will be used to reduce the number of trucks for construction resupply along Hwy 1.

The ability for goods to be transported all-season via the Project is a positive effect and so no mitigations are required during the operations and maintenance phase.

The GNWT will establish a MVHCWG that will develop and oversee a Community Readiness Strategy (as referenced in Section 9.5.2.2 and described fully in Section 9.16). As part of that strategy the GNWT will develop a Well-Being Adaptive Management Plan that identifies additional activities and measures to be put in place as indicated by monitoring results. All plans will be developed in collaboration with communities and will build on existing programs and services that the GNWT currently offers across the NWT.

The adverse effects of the Project related to increased visitors are anticipated to be addressed by the following measures in the Contractor Training and Employment Plan:

- ITI staff are available to discuss tourism readiness with communities and has funding available in various programs that can be used by communities to develop community led initiatives such as tourism plans as communities identify a need or desire to create a specific plan related to maximizing benefits and mitigating adverse effects associated with the operation of the Project, including:
 - Identifying barriers or gaps in the current state that need to be addressed to fully realize benefits from tourism

- Identifying future potential for tourism development and promotion, and
- Identifies additional needs and supports needed and available to mitigate adverse effects related to tourism as a result of the Project

9.9.3.3 Project Residual Effect

9.9.3.3.1 Construction

Even with mitigation measures implemented successfully, it is not possible to have construction vehicles avoid the MVWR. Following the implementation of the proposed mitigation measures described in Section 9.9.3.2, residual effects for change in access to non-traditional lands during construction are characterized as follows:

- Direction is adverse: local traffic on the MVWR may be inconvenienced or blocked by construction equipment.
- Likelihood is possible: local traffic may be impeded.
- Magnitude is moderate: effects will impede the local MVWR traffic but represents a moderate change relative to baseline conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.
- Timing is no sensitivity: effect does not occur during a time-sensitive activity.
- Duration is short-term: the residual effect occurs during one segment of the construction phase.
- Frequency is irregular: occurs at no set schedule.
- Change is reversible: the residual effect is likely to be reversed after activity completion.

9.9.3.3.2 Operations and Maintenance

Changes in volume and patterns of outdoor recreation activities in LAA communities cannot be fully anticipated; certain previously high-use areas may dwindle in popularity while other, previously inaccessible locations may become used for recreation purposes. Communities may experience adverse effects as a result of the Project changing the number of visitors and tourists that access communities and sites of interest.

Following the implementation of the proposed mitigation measures described in Section 9.9.3.2, residual effects for change in access to non-traditional lands during operations and maintenance are characterized as follows:

- Direction is adverse: increased levels of visitors and tourist may have an adverse effect on non-traditional land use by residents or communities.
- Likelihood is possible: there may be some increase in visitors that have adverse effects.
- Magnitude is low: represent a small change relative to existing conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.

- Timing is no sensitivity: effect does not occur during a time-sensitive activity.
- Duration is long-term: the residual effect extends through project operations and maintenance.
- Frequency is regular: occurs at regular intervals (i.e., seasonal)
- Change is irreversible: the residual effect is likely to persist as the Project will remain in existence for an indeterminate amount of time.

9.9.3.4 Determination of Significance for Change in Access to Non-Traditional Land Use

During the construction phase, an adverse residual effect of reduced access to non-traditional land use activities outside LAA communities during the MVWR season is expected due to construction vehicular traffic. However, with a moderate magnitude, short-term duration, and irregular frequency, this residual effect is considered not significant as it will not create a change or disruption that means the land use activities cannot continue at or near current levels.

During the operations and maintenance phase, a residual effect of changes in recreational land use patterns (activities, locations) is expected due to access to formerly inaccessible locations. As this change is in the form of geographic distribution rather than a change in level of use, this residual effect is considered to be neutral. This low magnitude residual effect is considered not significant, as it is not anticipated to create a change or disruption that will prevent non-traditional land use activities from continuing at near or current levels.

9.9.4 Change in Aesthetics

9.9.4.1 Effects Pathways

The potential effect of the Project on change in aesthetics has two effects pathways that are discussed in this section:

- Decreased aesthetics due to construction (e.g., presence of workspaces and camps) of the Project
- Decreased aesthetics due to operations and maintenance of the Project

9.9.4.1.1 Construction

Decreased aesthetics due to construction (e.g., presence of workspaces and camps) of the Project

Currently the main linear non-natural features in the LAA are the MVWR and the Norman Wells Pipeline (which approximately follows the east bank of the Mackenzie River and is buried under the ground with pipeline markers along the 20-metre cleared ROW) (Enbridge, 2021). Therefore, from an aesthetic perspective, the environment connecting the three LAA communities of Wrigley, Tulita and Norman Wells has already been disturbed.

However, the construction of the Project – even if it follows the MVWR – will have an aesthetic effect. Besides the physical alterations to the environment along the PDA, there will be workers camps, maintenance camps, staging areas, newly constructed quarries and borrow sources and access roads to these quarries/pits – five of which will have access roads in excess of 2.5 km in length (Chapter 5).

As the project alignment has not yet been finalized, neither the location, number and type of non-traditional land uses altered by construction of the Project, nor the total area with changed viewshed can be established at present. However, a land use authority noted that the project route south of Tulita should deviate from the MVWR route due to the landscape.

One land feature of aesthetic value is Bear Rock (Petinīzah), which lies outside Tulita, besides being an important cultural site, this rock is used recreationally, and it has a path to the summit which is a popular “lookout”. According to a local stakeholder the MVWR route is located near the base of Bear Rock (Petinīzah). If the Project follows the MVWR at this point, there may be aesthetic concerns, as the ROW for the MVWR is 20 metres; for the Project, it is 60 metres. As per Chapter 5, an alignment routing option situated 2 km north of the MVWR at Bear Rock has been identified in order to reduce disturbance near Bear Rock.

In addition, construction of the Project will result in environmental disturbances such as decreased air quality and increased noise, which will affect aesthetics in the LAA; this information has been obtained from various biophysical chapters as described in this section.

Air Quality (Chapter 12)

A description of the GHG and CAC emission effects that are likely to occur during construction of the Project can be found in Chapter 12 (air quality effects assessment). Emissions which exceed National Pollutant Release Inventory (NPRI) Reporting Thresholds during the Project's construction phase include:

- CO: road construction activities
- NO_x: road construction phase
- Particulate Matter (PM₁₀): construction phase mobilization and demobilization, road construction
- Particulate Matter (PM_{2.5}): construction phase mobilization and demobilization, road construction

As these air pollutants have been determined to have residual effects which are adverse, of moderate magnitude, of regular or continuous frequency, LAA community residents may experience poorer quality air during the project construction phase than what they have typically experienced. Due to the distance from project construction activities, air quality in the RAA communities will not be affected.

Noise (Chapter 13)

A description of the noise effects that are likely to occur during construction of the Project can be found in Chapter 13 (noise effects assessment). Noise levels which meet or exceed thresholds include:

- Short-term community annoyance: construction phase
- Low-frequency noise: construction phase
- Speech comprehension: construction phase

As these noise levels have been determined to have residual effects which are adverse, of high magnitude for approximately 11 days then down to moderate magnitude afterward, of regular frequency, LAA community residents may experience reduced aesthetics due to noise than what they have typically experienced during the 12-hour daylight daily period used for construction. Due to the distance from project construction activities, the noise levels in the RAA communities will not be affected.

9.9.4.1.2 Operations and Maintenance

Decreased aesthetics due to operations and maintenance of the Project

As the Project highway alignment (route) design is not yet final (see Section 5.2.1), neither the location, number and type of non-traditional land uses altered by the presence of the Project, nor the total area with changed viewshed can be established at present.

The presence of the Project will have an aesthetic effect because it will be wider and more visible than the MVWR that it is replacing. In addition, with all-season vehicular and passenger traffic along the project route, some litter and other waste materials may accumulate along the Project, which has small-scale aesthetic effects. Community members from Tulita agreed that the Project will change the aesthetics. That being said, they also acknowledged that the Project is needed:

“...it will impact and scar the land, but we need it. We need to do the best we can.

Yes, it will change; look at Whatì. Some areas will need to be balanced. We will need more protection of the land because if it changes and loses its intrinsic value then it's not there anymore.”

Fort Good Hope community members also spoke about concerns regarding garbage on the Project.

In addition, operations and maintenance of the Project will result in environmental disturbances such as decreased air quality and increased noise, which will affect aesthetics in the LAA. This information has been obtained from various biophysical chapters as described in this section.

Air Quality (Chapter 12)

CACs are produced through the following equipment/activities:

- Quarry/borrow source activities (operations: 9 pits) (crushers, sorting and stockpiling, blasting activities)
- Highway traffic – operations (50 vehicles per day, assuming 15% of vehicles are heavy trucks)

Emissions which exceed NPRI Reporting Thresholds during the Project's operations and maintenance phase include:

- Particulate Matter (PM₁₀): operations and maintenance phase
- Particulate Matter (PM_{2.5}): operations and maintenance phase

The dominant source of PM₁₀ and PM_{2.5} (i.e., dust) is from vehicles. It is important to note, however, that expected traffic volume is 50 vehicles per day. As such, these air pollutants have been determined to have residual effects which are adverse, of low magnitude, of irregular frequency, LAA community residents may experience poorer quality air (specifically particulate matter) during the Project's operations and maintenance phase than what they have traditionally experienced during daylight hours. Due to the distance from the Project, air quality in the RAA communities will not be affected.

Noise (Chapter 13)

Noise is produced through the following equipment/operations and maintenance activities:

- Quarry/borrow source activities (crushers, sorting and stockpiling, blasting activities)
- Highway traffic – operations (50 vehicles per day, assuming 15% of vehicles are heavy trucks)

However, noise levels are not expected to exceed thresholds during the operations and maintenance phase of the Project: therefore, noise may not be an aesthetic concern for LAA community residents after the completion of construction. Due to the distance from Project, the noise levels in the RAA communities will not be affected.

9.9.4.2 Mitigation

Tulita community members commented on the need to control dust, during both construction and operations, between Tulita and Wrigley in the spring for the beavers and moose, and more generally along the Project to protect the plants and animals. Colville Lake also spoke about dust control being needed along the creeks.

The GNWT has committed to a series of measures to mitigate the Project's adverse effects on air quality and noise levels, which would in turn have an adverse impact on aesthetic levels.

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For air quality:

- Cold starts of equipment will be limited to the extent possible.
- Incinerators will be operated in accordance with manufacturer's specifications and emissions will meet Canadian Council of Ministers of the Environment Canada Wide Standards for Dioxins & Furans and Mercury.
- Road surfaces will be repaired and maintained to reduce rolling resistance of vehicles.
- The contractor will be encouraged to use modern construction equipment that has lower GHG emissions.
- The contractor will be encouraged to use passenger vehicles (e.g., passenger van or bus) to move crews.
- Vehicles and equipment will be maintained regularly.

For noise levels:

- The GNWT will engage with communities to inform them of the activities and the noise sources that will occur prior to construction.
- Blasting activities will be limited to daytime hours to the extent practical.
- Communities will be informed of time periods and characteristics of noise that may exceed the recommended noise threshold.
- Methods to reduce the powder factor will be considered (e.g., through a combination of increased hole spacing, decreased column height of explosives, increased depth of stemming material in the blasthole, variable diameter blastholes) to reduce noise.
- Project vehicles will avoid the use of residential roads, where possible.
- The use of modified blasting techniques will be considered to reduce noise, including: use of electronic detonation instead of explosive detonation cord; use of air decking which involves the use of an inverted cone in the blasthole to constrain energy within the rock mass; timing sequence to develop an echelon effect; and, coordinating blast patterns towards a partially open face.
- Transportation of construction materials and equipment via barge will be used to reduce the number of trucks for construction resupply along Hwy 1.
- Vehicles and equipment will be equipped with manufacturer recommended noise muffling equipment.

It is anticipated that these will address changes in aesthetics by address the air and noise emission levels to the extent possible that would adversely effect aesthetics.

9.9.4.3 Project Residual Effect

9.9.4.3.1 Construction

Construction activities will inevitably create air pollution and noise, even with appropriate mitigation.

Following the implementation of the proposed mitigation measures described in the Air and Noise chapters, residual effects for change in aesthetics during construction are characterized as follows:

- Direction is adverse: aesthetics will be adversely affected during construction.
- Likelihood is certain: air or noise contamination during project construction will result in a change in aesthetics.
- Magnitude is moderate: effects will represent a moderate change relative to baseline conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.
- Timing is no sensitivity: effect does not occur during a time-sensitive land use activity.
- Duration is short-term: the residual effect occurs during one segment of the construction phase, or less than 5 years.
- Frequency is regular: occurs at regular intervals.
- Change is reversible: the residual effect is likely to be reversed after construction completion.

9.9.4.3.2 Operations and Maintenance

The effects of vehicular traffic on dust production will be largely mitigated by the application of water on the road surface: anticipated residual effects are low in magnitude.

Following the implementation of the proposed mitigation measures described in Chapters 12 and 13, residual effects for change in aesthetics during operations and maintenance are characterized as follows:

- Direction is adverse: aesthetics will be adversely affected by vehicular traffic.
- Likelihood is certain: aesthetics will be affected by air and noise contaminants.
- Magnitude is low: effects of the Project may be noticeable and/or measurable but represent a small change relative to existing conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.
- Timing is no sensitivity: effect does not occur during a time-sensitive land use activity.
- Duration is long-term: the residual effect extends through project operations and maintenance.

- Frequency is irregular: occurs at no set schedule.
- Change is reversible: the residual effect is likely to be reversed after activity completion and reclamation (e.g., removal of all structures, equipment, and materials from workspaces, reclamation of temporary borrow sources, quarries, and workspaces, promotion of natural revegetation, and closing abandoned sections of MVWR after construction of a section is complete).

9.9.4.4 Determination of Significance for Change in Aesthetics

During the construction phase, an adverse residual effect of reduced aesthetics in LAA communities due to air pollution and noise created by construction activities is anticipated. Despite its moderate magnitude and regular frequency, this adverse residual effect is considered not significant given its short-term duration.

During the operations and maintenance phase, an adverse residual effect of reduced aesthetics in LAA communities due to air pollution (dust) due to vehicular traffic is anticipated. This residual effect will be low magnitude and irregular frequency and is considered not significant despite its long-term duration.

9.9.5 Change in Non-Traditional Resource Use

9.9.5.1 Effects Pathways

The potential effect of the Project on change in non-traditional resource use has four effects pathways that are discussed in this section:

- Increased access to resources and resource exploration due to the operations and maintenance of the Project
- Increase in use of available resources for the construction of the Project
- Decreased access to wildlife resources due to construction of the Project
- Decreased access to wildlife resources due to operations and maintenance of the Project

9.9.5.1.1 Construction

Increase in use of available resources for the construction of the Project

Chapter 5 has identified the resources that are required to construct the Project. They include:

- 13.5 million cubic metres (m³) of granular and rock material for road embankment, road base, borrow/quarry source access roads, workspaces/staging areas, permanent maintenance camps and erosion protection via the development of seven granular borrow sources and eight rock quarries close to the ROW

- Water for constructing the project winter travel lane, where needed, will be sourced from the Mackenzie River and other authorized sources.
- Potable water for camps is anticipated to be obtained from the closest municipal supply; whereas, non-potable water may be obtained from municipal supply or proximal water sources, if adequate and suitable for this purpose. Water source locations are listed in Chapter 5.

In addition, the construction process will involve the production of certain products, including (as per Chapter 5):

- Trees and standing deadfall will be cleared; merchantable timber (>14 centimetres [cm] diameter at breast height) will be limbed and decked in a dry area and made available to a receiver holding an authorization, such as a timber cutting permit or licence from the GNWT.
- Certain camp wastes such as sewage, greywater and domestic wastes unsuitable for incineration will be disposed of at licenced municipal facilities subject to approval of the community government and the Inspector as required, or in accordance with applicable guidelines (GNWT, 2015a). Other wastes, such as recyclables and hazardous wastes will be transferred to an accredited waste transfer company for disposal. Wastes suitable for incineration will be incinerated on site.

The LAA community of Tulita has a chronic severe shortage of granular materials, which has curtailed its community construction activities (e.g., gravel is needed for the base of new modular houses; the less granular material available, the fewer houses can be built) and economic activities. There are various existing resource uses in the LAA communities, including granular resources or borrow sources near Wrigley and quarrying near Norman Wells. Additional details on existing resource uses are provided in Appendix 9C, Section 5.1.

Project construction will potentially provide LAA communities with access to granular materials as well as salvageable timber, which would both be considered benefits; however, the consumption of potable water and waste disposal will place a burden on municipal resources (see Section 9.8). Due to the distance from project construction activities, the RAA communities will not experience any changes in their use of available resources.

Decreased access to wildlife resources due to the construction of the Project

Various species of wildlife (fish, birds, and animals) are hunted and harvested for non-traditional purposes (sport, recreation, food for non-Indigenous peoples) throughout the NWT, including the communities in the LAA and RAA. Construction of the Project will result in environmental disturbances which will affect the distribution and populations of some species which are hunted/fished for non-traditional purposes: this information has been obtained through review of various biophysical chapters, including Chapter 19 (wildlife), Chapter 20 (birds), and Chapter 18 (vegetation). In summary, these biophysical chapters focus on changes in species habitat, species

movement, mortality risk, and species health. There are a variety of recreational hunting and fishing related uses near LAA communities, including:

- Recreational fishing near Tulita, Norman Wells
- Recreational hunting near Tulita
- Recreational boating near Tulita
- Recreational trails near Tulita
- Outfitting (tourism activity) near Norman Wells
- Canoeing (tourism activity) near Tulita and Norman Wells
- Camping near Tulita and Norman Wells

Additional details on existing recreational uses are provided in Appendix 9C, Section 5.1.

Changes created by project construction that directly affect wildlife species diversity, population, and health combined with changes to local vegetation which, in turn, can affect the location, movement and population of some species of wildlife which are hunted for sport, recreation or food for non-Indigenous peoples. All these changes have been identified as being adverse and continuous but confined to the LAA and are mostly of low magnitude (see Chapter 19). They are therefore likely to be of low magnitude in terms of effect on wildlife as a recreation resource. Due to their distance from project construction activities, wildlife species in the vicinity of RAA communities will not be affected.

9.9.5.1.2 Operations and Maintenance

Increased access to resources and resource exploration due to the operations and maintenance of the Project

As per Chapter 5, once the Project is operating, project demands on local non-traditional resources will consist primarily of nine permanent granular borrow sources/rock quarries; these will to be used for road maintenance during project operations and maintenance. Project operations and maintenance will therefore potentially continue to provide LAA communities with access to granular materials.

Operations and maintenance of the Project as a all-season form of ground transportation may cause changes in a number of non-traditional resources within the LAA and perhaps RAA, including minerals, oil and gas industries. In particular, oil and gas claims in the Norman Wells – Tulita axis as well as lands with high hydrocarbon potential throughout the Sahtu Region may be spurred to develop due to the Project. Operations and maintenance of the Project will make the development of mineral/oil and gas opportunities (via oil and gas rights and mineral rights) more affordable and therefore more likely. Norman Wells has a long history of oil extraction and production; and there is moderate/low hydrocarbon potential directly surrounding the Hamlet of Tulita. In terms of minerals, there is an undeveloped lead and zinc deposit located 10 km southwest of Wrigley. Though mineral exploration and extraction has been low in the Sahtu Region, the greater region includes four geological provinces (Arctic Platform, Bear, Cordillera and Interior Platform) with

lead, zinc, iron, copper, silver, uranium, lithium, cobalt, diamonds, tungsten and emerald potential. Tulita and Norman Wells are found within the Interior Platform geological province.

Additional details on existing resource use are provided in Appendix 9C, Section 5.1.

To date only a small fraction of the proven mineral, oil and gas reserves have been developed in the Sahtu Region, largely for economic reasons. Colville Lake community members believe the Project will allow for easier access to mineral resources, and individuals from Norman Wells feel it will be more economical for companies that have mineral rights in the Sahtu Region.

Thus far, no information has been obtained on the possible influence of an operational all-season Project in the LAA on the forestry industry.

Business and commercial land uses in LAA communities may increase, as all-season road access will attract businesses to these communities. Due to their distance from the Project, RAA communities will not experience changes in business and commercial land uses.

Decreased access to wildlife resources due to the operations and maintenance of the Project

Various species of wildlife (fish, birds, and animals) are hunted and harvested for non-traditional purposes (sport, recreation, food for non-Indigenous peoples) throughout the NWT, including the communities in the LAA and RAA. Operations and maintenance of the Project will result in environmental disturbances which will affect the distribution and populations of some species which are hunted/fished for non-traditional purposes: this information has been obtained from various biophysical chapters, including Chapter 19 (wildlife), Chapter 20 (birds), and Chapter 18 (vegetation). In summary, these biophysical chapters focus on changes in species habitat, species movement, mortality risk, and species health.

Changes created by project operations and maintenance that directly affect wildlife species diversity, population, and health combined with changes to local vegetation which, in turn, can affect the location, movement and population of some species of wildlife which are hunted for sport, recreation or food for non-Indigenous peoples. All these changes have been identified as being adverse and continuous but confined to the LAA and are mostly of low magnitude. They are therefore likely to be of low magnitude in terms of effects on wildlife as a recreation resource. Due to their distance from the Project, it is anticipated that the RAA communities will not experience any decreased access to wildlife resources.

9.9.5.2 Mitigation

No specific mitigation was suggested during engagement on issues related to change in non-traditional resource use.

Some of the mitigation measures included in the WMMP are responsive to concerns related to decreases in wildlife that have an adverse effect on non-traditional resource use. These include:

- Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities, in accordance with the WMMP.

- The GNWT will work with the SRRB and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization.
- Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project. Personnel will not feed, harass, or hunt wildlife while working on the Project.

Some of the mitigation measures included in the WMMP are responsive to concerns related to decreases in wildlife that have an adverse effect on non-traditional resource use. These include:

- Wildlife monitors will assess the presence of wildlife on or near the PDA during project activities, in accordance with the WMMP.
- The GNWT will work with the SRRB and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization.

9.9.5.3 Project Residual Effect

9.9.5.3.1 Construction

Residual effects on non-traditional resource use during construction are characterized as follows:

- Direction is adverse: construction activities may adversely affect some portions of the PDA to an extent where non-traditional resource uses in these areas may be disrupted.
- Likelihood is possible: construction of the Project may have an adverse effect in some limited areas.
- Magnitude is low: represents a small change relative to existing conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.
- Timing is no sensitivity: does not occur during a time-sensitive resource use activity.
- Duration is medium-term: the residual effect extends through project construction at the specific location.
- Frequency is irregular: occurs based on the construction activities in specific locations and will occur only during one construction season.
- Change is reversible: the residual effect is likely to diminish following completion of construction.

9.9.5.3.2 Operations

Residual effects on non-traditional resource use during operations and maintenance are characterized as follows:

- Direction is adverse: operations may adversely affect some portions of the LAA to an extent where non-traditional resource uses may be disrupted.
- Likelihood is possible: operation of the Project may have an adverse effect in some limited areas.
- Magnitude is low: represents a small change relative to existing conditions.
- Geographic extent is the LAA: residual effects will not extend into the RAA.
- Timing is no sensitivity: does not occur during a time-sensitive resource use activity.
- Duration is long-term: the residual effect extends through project operations and maintenance.
- Frequency is regular: occurs at regular intervals (e.g., peak during summer tourism season).
- Change is irreversible: the residual effect is likely to persist as the Project will remain in existence for an indeterminate amount of time.

9.9.5.4 Determination of Significance for Change in Non-Traditional Resource Use

During the construction phase, an adverse residual effect of reduction in non-traditional harvests of wildlife and fish may be experienced by LAA community residents in the vicinity of the PDA.

However, with a low magnitude, irregular frequency and medium duration, this residual effect is considered not significant.

During the operations and maintenance phase, an adverse residual effect of changes in locations for recreational/sport hunting and fishing due to all-year access along the PDA is expected. However, with low magnitude and irregular frequency, this residual effect is considered not significant even though it is of long-term duration.

9.9.6 Summary of Positive Project Effects for Non-Traditional Land Use

This section summarizes the positive effects of the Project on various effect pathways for the non-traditional land use VC.

Increase in capacity to transport goods, services, and resources due to operations and maintenance of the Project

During the operations and maintenance phase of the Project, the total annual number of cars, light trucks, heavy trucks coming to the LAA communities of Tulita and Norman Wells will likely increase. The capacity for Tulita and Norman Wells to receive goods transported by road will therefore increase. The number and range of services available in these communities may also

increase, as all-season accessibility by road may induce new businesses to establish in Tulita and Norman Wells. Industry may become part of the increased transportation capacity created by the Project, as transporting the equipment (which, for example, is necessary for the reclamation of petroleum-contaminated land) via the Project would be more economical to industry with the operation of the Project than via current options.

Increased access to resources and resource exploration due to the operations and maintenance of the Project

During its operations and maintenance phase, the Project will maintain nine permanent granular borrow sources/rock quarries, which will potentially provide LAA communities with access to often locally limited granular materials.

Operations and maintenance of the Project as an all-season form of ground transportation may cause changes in a number of non-traditional resources within the LAA and perhaps RAA, including minerals, oil and gas industries. Operations and maintenance of the Project will make the development of mineral/oil and gas claims more affordable and therefore more likely.

Also, during the Project's operations and maintenance phase, business and commercial land uses in LAA communities may increase, as all-season road access will attract businesses to these communities.

9.9.7 Overall Determination of Significance for Non-Traditional Land and Resource Use

Given that a majority of effects on non-traditional land and resource use are considered positive, and any adverse effects are considered to be low in magnitude or limited in scope and are not anticipated to result in non-compliance with land use plans or prevent non-traditional land use activities from continuing at or near current levels, the effects are not significant.

9.10 Summary of Socio-Economic Adverse Residual Effects

The residual socio-economic effects (i.e., those adverse effects which are expected to remain after the implementation of mitigation measures) are described in detail in the effects assessments of each effects pathways (Sections 9.5 through 9.9). This section presents the residual effects in summary form.

9.10.1 Human Health and Community Wellness

Table 9.24 describes the adverse and/or neutral residual effects on human health and community wellness during the construction and operations and maintenance phases of the Project.

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Table 9.24 Project Residual Effects on Human Health and Community Wellness

Residual Effect	Residual Effects Characterization*								
	Project Phase	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in population health	C	A	P	L	LAA; RAA	NS	ST	IR	R
Change in community/ family and social ties	C	A	P	L	LAA; RAA	NS	ST	IR	R
	O	A	P	L	LAA; RAA	MS	LT	R	R
Change in food security: traditional foods	C	A	P	L	LAA	MS	MT	C	I
	O	A	P	L	LAA	MS	LT	C	I
Change in social pressures	C	A	P	H	LAA	NS	ST	C	R
	O	A	P	H	LAA	NS	LT	C	R
Change in nuisance (air quality, noise)	C	A	C	M	LAA	MS	ST	IR	R
	O	A	C	L	LAA	NS	LT	C	I
Change in drinking and recreational water quality	C	N	P	NMC-L	LAA	S	ST-MT	IR	R
	O	A	P	NMC-L	LAA	NS	LT	C	I
Change in public safety	C	A	P	M/M-H	LAA	NS	ST	IR	R
	O	A	P	M/M-H	LAA-	NS	MT - LT	C	R

KEY

*See Table 9.8 for detailed definitions

Project Phase

C: Construction

O: Operations and Maintenance

Direction:

A: Adverse

N: Neutral

Likelihood

U: Unlikely

P: Possible

C: Certain

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.10.2 Education, Training and Skills

Despite the mitigation measures discussed in Sections 9.6.2.2, 9.6.3.2 and 9.6.4.2, it is anticipated that Aurora College CLCs will not have sufficient capacity to meet the increased interest in educational programming and training. It is expected that this may limit or constrain the increase in education levels of local community members to some degree and increase the degree to which contractors will be needed to support the Project. The residual effects on education, training and skills are described in Table 9.25.

Table 9.25 Project Residual Effects on Education, Training and Skills

Residual Effect	Residual Effects Characterization*								
	Project Phase	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in capacity to meet demand for education, certification and training programs	C	A	C	M	LAA	NS	MT	IR	R
	O	N	U	NMC	LAA	NS	LT	IR	R

KEY

* See Table 9.8 for detailed definitions

Project Phase

C: Construction

O: Operations and Maintenance

Direction:

A: Adverse

N: Neutral

Likelihood

U: Unlikely

P: Possible

C: Certain

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.10.3 Employment and Economy

Table 9.26 summarizes the adverse residual effects on employment and economy during the construction and operations and maintenance phases of the Project.

Table 9.26 Project Residual Effects on Employment and Economy

Residual Effect	Residual Effects Characterization*								
	Project Phase	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in traditional economy (harvesting and related community/household income)	C	A	P	L	RAA	MS	MT	R	R

KEY

*See Table 9.8 for detailed definitions

Project Phase

C: Construction

O: Operations and Maintenance

Direction:

A: Adverse

N: Neutral

Likelihood

U: Unlikely

P: Possible

C: Certain

Magnitude:

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.10.4 Infrastructure, Services and Institutional Capacity

Table 9.27 summarizes the residual effects on infrastructure, services and institutional capacity during the construction and operations and maintenance phases of the Project.

Table 9.27 Project Residual Effects on Infrastructure Services and Institutional Capacity

Residual Effect	Residual Effects Characterization*								
	Project Phase	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in housing and accommodation	O	A	P	L	LAA	NS	LT	C	I
Change in social infrastructure and services	C	A	P	L	LAA	NS	MT	IR	R
	O	A	P	L	LAA	NS	LT	IR	R
Change in public infrastructure and services	C	A	P	L	LAA	NS	ST	C	R
Change in institutional facilities and services	C	A	P	M	LAA	HS	MT	IR	R

KEY

*See Table 9.8 for detailed definitions

Project Phase

C: Construction

O: Operations and Maintenance

Direction:

A: Adverse

N: Neutral

Likelihood

U: Unlikely

P: Possible

C: Certain

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.10.5 Non-Traditional Land and Resource Use

Table 9.28 summarizes the adverse residual effects on non-traditional land and resource use during the construction and operations and maintenance phases of the Project.

Table 9.28 Project Residual Effects on Non-Traditional Land and Resource Use

Residual Effect	Residual Effects Characterization*								
	Project Phase	Type	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Non-traditional Land Use	C	A	P	M	LAA	NS	ST	IR	R
	O	A	P	L	LAA	NS	LT	R	I
Change in Access to Non-traditional Land Use	C	A	P	M	LAA	NS	ST	IR	R
	O	A	P	L	LAA	NS	LT	R	I
Aesthetics	C	A	C	M	LAA	NS	ST	R	R
	O	A	C	L	LAA	NS	LT	IR	R
Change in Non-Traditional Resource Use	C	A	P	L	LAA	NS	MT	IR	R
	O	A	P	L	LAA	NS	LT	R	I

KEY

*See Table 9.8 for detailed definitions

Project Phase

C: Construction

O: Operations and Maintenance

Direction:

A: Adverse

N: Neutral

Likelihood

U: Unlikely

P: Possible

C: Certain

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.11 Summary of Positive Project Effects

This section presents summaries of all expected positive effects of the Project on the socio-economic environment.

9.11.1 Summary of Positive Project Effects

For all of the socio-economic VCs, there were some residual effects of the Project that were identified as being positive in nature. Each effect discussed in the effects assessments (Sections 9.5 through 9.9) contains a description of any residual effects that are anticipated to be present after mitigation measures have been applied and identifies if the residual effects are positive or adverse in nature. Each socio-economic VC has a synopsis of the positive effects of the Project that are anticipated (Sections 9.5.10, 9.6.5, 9.7.8, 9.8.5, and 9.9.5) which are summarized in Table 9.29.

Table 9.29 Summary of Positive Socio-Economic Effects

Socio-Economic VC	Positive Project Effect	Description of Positive Effect
Human Health and Community Wellness	Increased ability for residents to travel to other communities throughout the year to access services	<p>During the operations and maintenance of the Project, the residents of the LAA communities and to some extent the RAA will have the ability to travel to other communities in the LAA all-season to participate in events, visit family and social connections or access some services. For Tulita and Norman Wells residents (who do not currently have all-season road access), they will have the ability to travel to larger centers (e.g., Yellowknife or Hay River) to access services that are not available in the LAA communities and visit family or social connections or participate in events in those larger centres more easily.</p> <p>This may have positive effects on community/family and social ties (e.g., through reduced isolation which is anticipated to have positive effects on mental health and wellness) and population health and may slow some out-migration driven by the need to access services or employment. All-season access may facilitate employment and business opportunities for LAA residents which may also have a positive effect on levels of out-migration affecting population composition and growth. Increased access to other locations within the LAA may also increase food security by providing more regular and easier access to harvesting locations.</p>
	Increased access to resources and goods due to all-season road access	<p>All-season road access will provide easier and lower-cost access to food and goods, which will positively effect food security. It may also facilitate the growth or development of new businesses that would lead to additional employment opportunities for residents of LAA communities, contributing positively to population composition by slowing or stopping some out-migration driven by the need to access employment elsewhere.</p>

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Socio-Economic VC	Positive Project Effect	Description of Positive Effect
Human Health and Community Wellness (cont'd)	Increased employment opportunities associated with the Project	Increased direct employment opportunities that exist during both the construction and operations and maintenance phases of the Project may lead to slowing of out-migration in LAA communities, and to a lesser extent, RAA communities, that is driven by the need to seek employment elsewhere as there will be new employment opportunities available to residents.
	Increase in education levels due to interest in employment opportunities associated with the Project	It is anticipated that the Project will generate increased interest in education and training as community members in the LAA pursue employment opportunities associated with the Project, notably during the construction phase. This increase in interest is expected to result in increased levels of educational attainment and skills acquisition amongst community members in the LAA and to a lesser extent the RAA. During the operations and maintenance phase, the Project may have a positive effect on education levels, though likely to a much lesser extent.
	Increased access to educational programming and training due to operation of the Project	It is expected that the Project will result in an increase in access to education and training, as communities in the LAA will now have greater, all-season, access to the Project, thus making travel in between the communities more feasible. This positive effect will only be completely realized when all three segments of the Project are complete.
	Increased ability to recruit and retain teachers and community adult educators due to operation of Project	It is possible that the Project may attract and retain educators as a result of the increased ease and decreased travel costs associated with accessing the communities.
Employment and Economy	Increase in employment and income due to Project construction	Construction will generate employment in a variety of sectors (e.g., construction trades, camp services, transportation) for LAA and RAA communities and NWT residents. Increased employment will in turn increase individual and family incomes.
	Increase in government revenues and GDP due to Project construction	Spending during the construction of the Project will result in additional income and corporate tax revenue for the governments of NWT and Canada. In addition, the increase in economic activity arising from employment and the purchase of goods and services will generate an increase in GDP.
	Increase in business opportunities due to the construction and operation of Project	Local and NWT businesses will have increased opportunities to provide goods and services under contract during the construction phase of the Project. During project operations and maintenance, businesses will also have increased opportunities arising from increased demand due to greater numbers of people visiting the communities along the Project and from the lower cost of obtaining supplies and materials.

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Socio-Economic VC	Positive Project Effect	Description of Positive Effect
Employment and Economy (cont'd)	Reduced cost of living and consumer prices due to operation of Project	The presence of the Project will enable all-season transportation of food and goods into the LAA communities obtaining all-season access. This will lower the cost of living and consumer prices.
	Increase in the GNWT operations employment due to operation of the Project	Operation of the Project will provide some jobs for the GNWT-INF employees during both phases of the Project.
Infrastructure, Services and Institutional Capacity	Increased demand for institutional facilities / services due to change in resident population due to operation of the Project	Project operations may create potential in-migration to the LAA communities, which will result in increased use of institutional facilities (schools, adult educational facilities, daycare, recreation facilities). Any change in resident population will likely be gradual, so that facilities and services will have time to adjust to the changes and will have time to plan for and secure government funding for the expansion. Expanded facilities often provide a greater range of services than the original-sized facilities.
	Increased access (easier and lower cost) to institutional facilities and services by residents of former 'isolated' communities due to operation of the Project	The opportunity of being able to travel to and from LAA communities via the Project will enable out-of-town participants to attend community events in Tulita and Norman Wells throughout the year. The feasibility of having regional events hosted in one of the LAA communities may increase. Intramural sports among youth in the LAA communities all-season will become possible. This change in inter-community accessibility may have some, but limited effect on the RAA communities.
Non-Traditional Land and Resource Use	Increase in capacity to transport goods, services, and resources due to operation of the Project	<p>During the operations and maintenance phase of the Project, the total annual number of cars, light trucks, heavy trucks coming to the LAA communities of Tulita and Norman Wells will likely increase. The capacity for Tulita and Norman Wells to receive goods transported by road will therefore increase. The number and range of services available in these communities may also increase, as all-season accessibility by road may induce new businesses to set up in Tulita and Norman Wells.</p> <p>Industry may become part of the increased transportation capacity created by the Project, as transporting the equipment (which, for example, is necessary for the reclamation of petroleum-contaminated land) via the Project would be more economical to industry with the operation of the Project than via current options.</p>

Socio-Economic VC	Positive Project Effect	Description of Positive Effect
Non-Traditional Land and Resource Use (cont'd)	Increased access to resources and resource exploration due to operation of the Project	<p>During its operations and maintenance phase, the Project will maintain nine permanent granular borrow sources/rock quarries, which will potentially provide LAA communities with access to often locally limited granular materials. Operation of the Project as a all-season form of ground transportation may cause changes in a number of non-traditional resources within the LAA and perhaps RAA, including minerals, oil and gas industries.</p> <p>Operation of the Project all-season will make the development of mineral/oil and gas claims more affordable and therefore more likely. Also, during the Project's operations and maintenance phase, business and commercial land uses in LAA communities may increase, as all-season road access will attract businesses to these communities.</p>

9.12 Determination of Significance

9.12.1 Significance of Project Residual Effects

Section 9.2.7 Significance Definition (in the Scope of Assessment section) defines how and what factors are considered in determining the significance of residual adverse effects overall for the socio-economic VCs. Residual effects of the Project are described as part of the effects assessments contained in Sections 9.5 through 9.9 and indicate if the residual effect is positive or adverse once mitigation measures have been applied. If the residual effect was determined to be adverse, then a determination of significance was made using the definition in Section 9.2.6 and described. An overall determination of significance was then made for each socio-economic VC and is described at the end of each effects assessment section (Sections 9.5.12, 9.6.6, 9.7.9, 9.8.7, and 9.9.7).

Table 9.30 provides an overall summary of the determination of significance for each socio-economic VC. Where an effect is noted as having N/A in the Significance Determination column, it means that the effects assessment indicated that the Project is anticipated to have only potential positive effects and there are no residual adverse effects anticipated. Please refer to Section 9.11 for a summary of the anticipated positive effects of the Project.

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Table 9.30 Summary of Residual Adverse Socio-Economic Effects

Socio-Economic VC	Effect	Significance Determination	Overall Significance Determination for VC
Human Health and Community Wellness	Population Composition and Migration	N/A ²⁵	<p>The majority of the effects on human health and community wellness have been determined to be not significant or positive. Change in social pressure has been identified as being significant due in large part to the potential exacerbation of issues associated with increased access to drugs and alcohol. As noted in the discussion of residual effects for change in social pressures, drug and alcohol use and misuse is an existing condition in LAA and RAA communities and is a serious concern for communities. Change in public safety has also been identified as significant because of the potential for disproportionately adverse effects on vulnerable populations, the seriousness of effects and connections to overall health and well-being of communities and community members. Both effects are anticipated to be of high magnitude and are anticipated to contribute to a long-term decline in physical and mental health.</p> <p>A Community Readiness Strategy, which includes a Well-Being Adaptive Management Plan and a Social Monitoring Plan will be developed and implemented to address the adverse effects of the Project. A follow-up and monitoring framework has been developed to support adaptive management activities and ensure adverse effects of the Project are limited or mitigated to the extent possible. Therefore, when all effects from the Project are considered, the effects on human health and community wellness overall are not significant.</p>
	Population Health	Not significant	
	Community/Family and Social Ties	Not significant	
	Food Security	Not significant	
	Social Pressures	Significant	
	Nuisance	Not significant	
	Drinking and Recreational Water Quality	N/A	
	Public Safety	Significant	
Social Determinants of Health	N/A		

²⁵ N/A means 'not applicable' in this table.

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Socio-Economic VC	Effect	Significance Determination	Overall Significance Determination for VC
Education, Training and Skills	Level of Education, Training and Skills Development	N/A	Given that a majority of effects on education, training and skills are considered positive, and any adverse effects are considered to be low in magnitude or limited in scope and will not result in an overall lack of capacity or decrease in quality of education and training services provided, the effects on education, training and skills are not significant.
	Access to Education, Training and Skills Development Programs	N/A	
	Capacity to Meet Demand for Education, Certification and Training Programs	Not significant	
Employment and Economy	Employment and Income	N/A	Given that a majority of effects on employment and economy are considered positive, and any adverse effects are considered to be low in magnitude or limited in scope and will not contribute to an overall decline in employment levels or economic activity, the effects on employment and economy are not significant.
	GDP and Government Revenues	N/A	
	Economic Opportunities and Capacity of Local Businesses	N/A	
	Cost of Living and Consumer Prices	N/A	
	Traditional Economy	Not significant	
Infrastructure, Services and Institutional Capacity	Housing and Accommodation	Not significant	Given that the adverse effects on infrastructure, services and institutional capacity are considered to be low in magnitude or limited in scope and will not result in a lack of capacity or a substantial decrease in the quality of a service provided on an ongoing basis, the effects on infrastructure, services and institutional capacity are not significant.
	Social Infrastructure and Services	Not significant	
	Public Infrastructure and Services	Not significant	
	Institutional Facilities and Services	Not significant	
Non-Traditional Land and Resource Use	Non-Traditional Land Use	Not significant	Given that the adverse effects on non-traditional land use are not expected to result in non-compliance with land use plans and will not create a change that prevents land use capability to the point where non-traditional land use activities cannot continue at or near current levels, the effects on non-traditional land use are not significant.
	Access to Non-Traditional Land Use	Not significant	
	Aesthetics	Not significant	
	Non-Traditional Resource Use	Not significant	

9.13 Assessment of Cumulative Effects

9.13.1 Introduction to Assessment of Cumulative Effects on Socio-Economic Valued Components

Project residual effects described in Section 9.10 are likely to interact cumulatively with residual effects from other physical activities (past, present, and reasonably foreseeable) as well as other social, cultural, and economic changes that have occurred in the region. These are identified and assessed in this section.

The effects of past and current projects contribute to baseline conditions upon which effects of the Project are assessed. Cumulative effects are defined as those resulting from residual effects of the Project combined with the effects of past, present and reasonably foreseeable projects and activities.

Future projects that are reasonably foreseeable are those that (a) have obtained the necessary authorizations to proceed or are in the process of obtaining the required authorization, or (b) have been publicly announced with the intention to seek the necessary authorizations to proceed.

Two conditions must be met to initiate an assessment of cumulative effects on a VC:

- The Project is assessed as having adverse residual effects on a VC.
- The adverse residual effects from the Project overlap spatially and temporally with residual effects of other physical activities on a VC.

If either condition is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities.

It is important to note that because of the uncertainties connected with the project construction start date (presently 2026 is the assumed start date), as well as the duration and sequencing of the timing of each construction segment of the Project over an estimated 20-year period, it is difficult to assess potential cumulative effects for socio-economic VCs with certainty. Readers are therefore advised to consider the cumulative effects assessment as being based on the information available at the time of the assessment and may require reassessment when the timing of the project construction and other reasonably foreseeable projects and activities are known in more detail.

Anticipated cumulative effects on each socio-economic VC are provided in Sections 9.13.2 through 9.13.6, followed by a description of the Project's contribution to cumulative effects for each socio-economic VC and the socio-economic environment overall (Section 9.13.7). Potential cumulative effects are considered for both LAA and RAA communities.

9.13.2 Cumulative Effects: Human Health and Community Wellness

9.13.2.1 Project Residual Effects Likely to Interact Cumulatively

The project and physical activity inclusion list (Table 9.31) identifies known past, present, and reasonably foreseeable projects and physical activities whose effects could overlap spatially and temporally with the residual effects of the Project on human health and community wellness. Chapter 4 presents the names, proponents, use or activity, descriptions, and status of these projects and activities.

For the effects that are anticipated to have both positive and adverse effects, only the adverse effects are included in the following sections. Those effects where the Project is anticipated to only have a positive residual effect are not assessed for cumulative effects.

Table 9.31 Projects and Physical Activities with the Potential to Contribute to Cumulative Effects on Human Health and Community Wellness

Other Projects and Physical Activities with Potential for Cumulative Effects	Effects					
	Change in Population Health	Change in Community/Family and Social Ties	Change in Food Security	Change in Social Pressures	Change in Nuisance	Change in Public Safety
Past and Present Physical Activities and Resource Use (Base Case)						
<i>Geotechnical</i>	-	-	-	-	-	-
<i>Oil, Gas & Seismic*</i>	-	-	-	-	-	-
<i>Infrastructure</i>						
MVWR, including bridges and bridge-sized culverts	✓	✓	-	✓	-	✓
Canyon Creek All Season Access Road	✓	✓	-	✓	-	✓
Norman Wells Pipeline	-	-	✓	-	✓	-
Mackenzie Valley Fibre Line	-	-	-	-	-	-
Prohibition Creek Access Road	✓	✓	✓	✓	✓	✓
<i>Quarries and Borrow Sources</i>	-	-	-	-	-	-
<i>Mining & Exploration</i>	-	-	-	-	-	-
<i>Municipal Operations, including water, waste, power and community development</i>	-	-	-	-	-	-
Wrigley Municipal Activities	-	-	-	-	-	-

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	Effects					
	Change in Population Health	Change in Community/Family and Social Ties	Change in Food Security	Change in Social Pressures	Change in Nuisance	Change in Public Safety
Other Projects and Physical Activities with Potential for Cumulative Effects						
Tulita Municipal Activities	-	-	-	-	-	-
Norman Wells Municipal Activities	-	-	-	-	-	-
Project-Related Physical Activities (Project Case)						
Mackenzie Valley Highway Project	✓	✓	✓	✓	✓	✓
Reasonably Foreseeable Physical Activities (Reasonably Foreseeable Case)						
Quarries						
Dhu-1 Quarry	✓	✓	✓	✓	✓	✓
Infrastructure						
Great Bear River Bridge	✓	✓	✓	✓	✓	✓
Oil and Gas						
Enbridge Maintenance Camp	✓	✓	-	✓	-	✓

Notes:

- ✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with project residual effects.
- = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
- * = includes support activities such as: production, exploration, remediation, drilling, wells, associated infrastructure, facilities, camp, and staging areas.

9.13.2.2 Change in Population Health

9.13.2.2.1 Cumulative Effects Pathways

As discussed in Section 9.5.3.4, during the project construction phase, there may be adverse effects on population health as shown by decreases in reported self-assessment of mental and physical health levels. These changes would be due to the presence of outside construction workers leading to increased social pressures (discussed in detail in Section 9.5.7) or construction of the Project itself leading to increased rates of accidents or injuries (Section 9.5.9) or effects from increased emissions or contaminants as a result of construction (Section 9.5.7). These effects would be concentrated in the LAA communities with some potential lesser effects in RAA communities.

Most past and present activities in and around LAA communities, such as oil and gas, infrastructure (including MVWR and CCASAR), and quarries and borrow sources located close to the communities, have been completed and already exist and are reflected in the baseline conditions for self-reported mental or physical health measures.

Past and present infrastructure activities in and around LAA communities, such as the MVWR and CCASAR, as well as reasonably foreseeable projects combine with the Project to create changes in access that may increase the presence of non-residents or visitors in LAA communities, and to a lesser extent, RAA communities. Transportation corridors make it easier for non-Indigenous residents and/or non-residents (visitors, vacationers and tourists) to enter the communities, thereby resulting in further changes in self-reported mental and physical health.

There are several reasonably foreseeable projects such as a planned quarry, potential maintenance camp or other road related infrastructure that will have similar effects in combination with the Project, in that they will potentially increase the presence of non-residents or visitors in communities, may be a source of accidents or injuries or lead to increase emissions that lead to nuisance effects. Assuming any of these reasonably foreseeable projects or activities overlap with the construction phase of the Project in timing, residents may identify that the presence of non-residents, potential increased rate of accidents, or nuisance disturbances as a result of the Project exacerbates similar conditions that may be a result of those activities.

9.13.2.2.2 Mitigation for Cumulative Effects

Mitigation measures associated with avoiding or reversing population health effects as a result of project-related changes in social pressures, nuisance and public safety are discussed in Sections 9.5.6 through 9.5.9. Given that the nature of the cumulative effects are similar to those identified for the Project, the mitigation proposed for the Project could also potentially address effects seen as a result of the past, present or reasonably foreseeable projects. In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

The GNWT has also put in place a number of action plans and programs related to health and wellness in communities that are intended to address the existing concerns and conditions in communities related to physical and mental wellness (GNWT, 2022a).

9.13.2.2.3 Residual Cumulative Effects

During construction of the Project and considering past, present, and reasonably foreseeable projects and activities, the Project may contribute to a small but incrementally adverse cumulative effect on population health in the LAA. This could be reflected in lower self-assessments of mental or physical health by residents in as a result of ongoing effects related to the Project. Given that these may not be new effects on population health, it is anticipated that the Project's relative contribution to the cumulative effect will be low. Cumulative effects extending into the RAA are not anticipated. See Table 9.32 for the summary of residual cumulative effects regarding change in population health.

9.13.2.3 Change in Community/Family and Social Ties

9.13.2.3.1 Cumulative Effects Pathways

As discussed in Section 9.5.4, during both the project construction phase and the operations and maintenance phase, the three LAA communities may experience adverse effects as a result of the presence of non-residents or visitors leading to residents feeling a reduction in sense of community belonging or community safety/security. This may extend to a lesser extent to the RAA communities if non-residents or visitors associated with the Project spend time in their communities.

Past and present infrastructure activities in and around LAA communities, such as the MVWR and CCASAR, as well as reasonably foreseeable projects and activities such as the Great Bear River Bridge, may combine with the Project to create changes in access that may increase the presence of non-residents or visitors in LAA communities, and to a lesser extent, RAA communities. Transportation corridors make it easier for non-Indigenous residents and/or non-residents (visitors, vacationers and tourists) to enter the communities, and for residents to leave communities and spend more time outside of their town of residence, resulting in further reductions in LAA community residents' feelings of sense of community.

Some reasonably foreseeable projects and activities in and around LAA communities (e.g., Great Bear River Bridge, Dhu-1 Quarry) may make use of outside workers whose presence in LAA communities would lead to residents feeling a reduction in their sense of community belonging or community safety levels. Assuming any of these reasonably foreseeable projects or activities overlap in timing with the construction phase of the Project, residents may identify that the presence of non-residents or visitors as a result of the Project exacerbates similar conditions that may be a result of those reasonably foreseeable project activities.

9.13.2.3.2 Mitigation for Cumulative Effects

There are no additional mitigation measures further to those identified for project residual effects as the mitigations for project residual effects are likely to also be effective at addressing cumulative effects. One of the mitigation measures for the Project is to target or focus employment opportunities on communities in the LAA and secondarily on the RAA communities to reduce the presence of non-residents or visitors. The GNWT has also committed to put in place conditions for contractors that encourage local hiring and support local businesses as a condition of any infrastructure projects that are proposed in the Sahtu or Dehcho regions, or the territory as a whole. In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

The GNWT has also put in place a number of action plans and programs related to health and wellness in communities that are intended to address the existing concerns and conditions in communities related to physical and mental wellness (GNWT, 2022a).

9.13.2.3.3 Residual Cumulative Effects

Considering past, present, and reasonably foreseeable projects and activities along with operation of the Project, it is not possible to completely remove the risk of non-residents or visitors acting unsafely or in a way that adversely affects community cohesion. Overall, it is anticipated that the contribution of the Project to the adverse cumulative effect on the change in community/family and social ties will be low in magnitude. See Table 9.32 for the summary of residual cumulative effects regarding change in community/family and social ties.

9.13.2.4 Change in Food Security

9.13.2.4.1 Cumulative Effects Pathways

As discussed in Section 9.5.5, during the project construction phase, it is possible that disturbances associated with construction activities will adversely affect whether residents can access and obtain traditional foods, which may adversely affect food security. Refer to the Culture and Traditional Land Use Including Harvesting VC (Chapter 11) for more information on the cumulative effects of past, present and reasonably foreseeable projects and activities on access to traditional foods.

There are several reasonably foreseeable projects and activities such as a planned quarry, potential maintenance camp or other road related infrastructure that may have similar effects as the Project in that they may potentially disturb the land in a way that adversely affects whether residents can access traditional foods. If the timing of any of these reasonably foreseeable projects or activities overlaps with the construction phase of the Project, there may be additive disturbances to the land than there otherwise would be.

9.13.2.4.2 Mitigation for Cumulative Effects

The GNWT will develop and implement a WMMP for the Project that will include the use of wildlife monitors to assess the adverse effects of Project construction activities on wildlife. Such monitoring would be able to determine if the cumulative effects of other Projects were having an effect on wildlife and habitat. In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.2.4.3 Residual Cumulative Effects

See Table 9.32 for the summary of residual cumulative effects regarding change in food security. Overall, it is anticipated that the contribution of the Project to the cumulative change in food security will be incrementally adverse as it will add to the effects of past, present and reasonably foreseeable projects and activities that affect wildlife levels and the ability to access or obtain traditional foods.

Refer to the Culture and Traditional Land Use Including Harvesting VC (Chapter 11) for more information on the cumulative effects of past, present and reasonably foreseeable projects and activities on access to and availability of traditional foods.

9.13.2.5 Change in Social Pressures

9.13.2.5.1 Cumulative Effects Pathways

As discussed in Section 9.5.6, during the project construction phase as well as the operations and maintenance phase, project activities may lead to the increased presence of non-resident workers or visitors that temporarily locate to LAA communities. This may lead to increased access to drugs or alcohol and increased rate of STIs, teen pregnancies, and crime. Additionally, during the operations and maintenance phase of the Project, all-season road access may also provide residents of LAA communities with greater access to other communities, leading to increased interactions with non-residents or visitors that may have the same effect.

Past and present infrastructure projects and activities in and around LAA communities, such as the MVWR and CCASAR, as well as reasonably foreseeable projects and activities may combine with the Project to create changes in access that may increase the presence of non-residents or visitors in LAA communities, and to a lesser extent, RAA communities.

Transportation corridors make it easier for non-Indigenous residents and/or non-residents (visitors, vacationers and tourists) to access LAA communities, thereby resulting in further changes in social pressures. All of the communities in the LAA and RAA have identified that alcohol and drug use and misuse is a priority health area for future action, which may be due in part to past and present infrastructure activities bringing non-residents or visitors into contact with residents or increasing access to drugs and alcohol from outside the community. The GNWT has also put in place a number of action plans and programs related to health and wellness in communities that are

intended to address the existing concerns and conditions in communities related to physical and mental wellness (GNWT, 2022a).

Operation of the Project along with other present or reasonably foreseeable projects and activities such as the CCASAR or the Great Bear River Bridge may facilitate or further increase the presence of non-residents or visitors and lead to further adverse effects on social pressures.

9.13.2.5.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives related to limiting or mitigating adverse effects of the Project are applicable to limiting cumulative effects on human health and community wellness (including other reasonably foreseeable projects and activities). Mitigation measures have been identified as part of the Safety and Security Plan for Vulnerable Community Members, and the community wellness and substance abuse sections of the Well-Being Adaptive Management Plan. These plans and the specific measures within them include commitments to work collaboratively with communities and leverage existing programs and services to address adverse effects of the Project, and will include cumulative effects. The GNWT has also put in place a number of action plans and programs related to health and wellness in communities that are intended to address the existing concerns and conditions in communities related to physical and mental wellness (GNWT, 2022a).

The 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.2.5.3 Residual Cumulative Effects

During construction and operations and maintenance of the Project and considering past, present, and reasonably foreseeable projects and activities, the LAA communities will see increased social pressures related to the presence of non-residents or visitors and the increased all-season road access to the communities. The RAA communities may see some increased social pressures, but to a lesser extent than the LAA communities. The Project's relative contribution to the adverse cumulative effect will be high in magnitude. See Table 9.32 for the summary of residual cumulative effects regarding change in social pressures.

9.13.2.6 Change in Nuisance

9.13.2.6.1 Cumulative Effects Pathways

As discussed in Section 9.5.7, during the project construction phase as well as the operations and maintenance phase, the Project may result in increased release of air and GHG emissions and noise, which may adversely affect air quality or noise levels and produce a nuisance effect. See Chapter 12 (air quality)) for details on the sources and nature of air emissions.

During the construction phase, other past and present projects and activities– such as oil and gas production, infrastructure such as the MVWR and CCASAR, as well as municipal operations (in particular, community development) may produce noise and/or air pollutants such as dust which could coincide with the noise and pollutants created by the project construction activities, thereby further worsening the nuisance effects within the LAA communities.

There are not anticipated to be effects from project-related noise during the operations and maintenance phase. See Chapter 13 (noise) for details on the sources and nature of noise emissions.

Air pollutants such as dust from other current activities such as operations and maintenance of the Norman Wells pipeline or reasonably foreseeable infrastructure or quarry activities may coincide with the noise and air pollutants created by the project construction and operations and maintenance activities, thereby further worsening the nuisance effects within the LAA communities to a low degree.

9.13.2.6.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative effects on nuisance levels within the LAA (including other reasonably foreseeable projects and activities) include, but are not limited to, measures that will be developed and implemented to limit or mitigate noise and air emissions associated with the Project that would in turn lead to nuisance effects (outlined in Section 9.5.7).

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.2.6.3 Residual Cumulative Effects

Following construction of the Project and considering past, present, and reasonably foreseeable projects and activities, the LAA may continue to experience a relatively low level of air emissions or noise disturbances leading to a change in nuisance effects that may include interference with access to or enjoyment of recreational, traditional or cultural activities on the land. It is not anticipated that cumulative effects will extend to the RAA communities. See Table 9.32 for the summary of residual cumulative effects regarding change in nuisance.

9.13.2.7 Change in Public Safety

9.13.2.7.1 Cumulative Effects Pathways

As discussed in Section 9.5.9, during the project construction phase as well as the operations and maintenance phase, project activities may lead to the increased presence of non-residents who visit LAA communities when they are not working, which may lead to increased interactions and contribute to reduced feelings of personal safety and security.

Past and present infrastructure activities in and around LAA communities, such as the MVWR and CCASAR, as well as foreseeable projects combine with the Project to create changes in access that may increase the presence of non-residents or visitors in LAA communities, and to a lesser extent, RAA communities.

Transportation corridors make it easier for non-Indigenous residents and/or non-residents (visitors, vacationers and tourists) to access LAA communities, thereby resulting in further changes in public safety as measured by perceived safety of community and which may disproportionately affect young women and girls, as discussed in the effects assessment for public safety and in the introduction to the human health and community wellness effects assessment.

During the operations and maintenance phase, in addition to the increased interactions with non-residents or visitors that may lead to changes in public safety that are seen in the construction phase, there may be the potential for negative or dangerous interactions between residents, especially young women and girls and non-residents (e.g., abduction or sexual assault of young women who may be hitchhiking along the project route). Past, present and reasonably foreseeable projects and activities that increase access to LAA communities or lead to an increased number of non-residents or visitors in or near to LAA communities, combine with the Project to potentially further increase this already significant effect.

9.13.2.7.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative effects on human health and community wellness (including other reasonably foreseeable projects and activities) include measures that are identified as part of the Safety and Security Plan for Vulnerable Members and the Well-Being Adaptive Management Plan related to effects of the Project may also limit cumulative effects on public safety. The GNWT has also put in place a number of action plans and programs related to health and wellness in communities that are intended to address the existing concerns and conditions in communities related to physical and mental wellness (GNWT, 2022a).

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.2.7.3 Residual Cumulative Effects

During construction and operation of the Project and considering past, present, and reasonably foreseeable projects and activities, the LAA communities and the region may see incrementally more adverse effects on public safety (as measured by perceived safety of community and rate of accidents) as a result of the Project. The overall relative contribution of the Project to the cumulative effect will be moderate. See Table 9.32 for the summary of residual cumulative effects regarding change in public safety.

9.13.2.8 Summary of Cumulative Effects on Human Health and Community Wellness

The Project involves constructing an all-season highway to replace the MVWR in a corridor within the Mackenzie Valley between Wrigley and Norman Wells that is subject to disturbance from past and present activities and projects, including existing linear infrastructure. When the effects of current and reasonably foreseeable projects and activities on human health and community wellness are considered, the Project's contributions to changes to population health, community/family and social ties, food security, and nuisance will be low in magnitude following mitigation. The construction and operation of the Project, combined with other past, present and reasonably foreseeable effects of the Project that increase access to and from communities and the presence of non-residents or visitors, is expected to exacerbate an already serious drug and alcohol problem that exists in LAA and RAA communities. The construction and operation of the Project, combined with other past, present and reasonably foreseeable project activities that increase access to and from communities and provide for all-season access by roads is anticipated to have an adverse cumulative effect on public safety levels, especially for vulnerable populations.

Table 9.32 summarizes cumulative effects on human health and community wellness.

Table 9.32 Summary of Cumulative Effects on Human Health and Community Wellness

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Likelihood	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Population Health	A	L	P	LAA	NS	LT	IR	R
Contribution from the Project to the residual cumulative effect	The Project may contribute to a small but incrementally adverse cumulative effect on population health in the LAA due to effects from past, present or reasonably foreseeable projects and activities that could lead to residents self-reporting that their mental or physical health are being adversely affected as a result of these kinds of activities. Given that these may not be new effects on population health, it is anticipated that the Project's contribution to the cumulative effect will be low in magnitude and will not extend into the RAA.							
Change in Community/ Family and Social Ties	A	L	P	LAA	NS	LT	IR	R
Contribution from the Project to the residual cumulative effect	Overall, it is anticipated that the contribution of the Project to the cumulative effect on the change in community/ family and social ties will be incrementally adverse and low in magnitude as it will add to the effects of past, present and reasonably foreseeable projects and activities that increase the presence of non-residents or visitors or increase the time outside of community by residents, both of which may lead to a decreased sense of belonging and community cohesion.							
Change in Food Security	A	L	P	LAA	NS	LT	IR	R
Contribution from the Project to the residual cumulative effect	Overall, it is anticipated that the contribution of the Project to the cumulative change in food security will be incrementally adverse and low magnitude as it will add to the effects of past, present and reasonably foreseeable projects and activities that affect wildlife levels and the ability to access or obtain traditional foods.							
Change in Social Pressures	A	H	C	LAA, RAA	NS	LT	IR	R
Contribution from the Project to the residual cumulative effect	The Project will result in increased social pressures related to the presence of non-residents or visitors and the increased all-season road access to the LAA communities. The RAA communities may see some increased social pressures, but to a lesser extent than the LAA communities. The Project's contribution to the adverse cumulative effect will be high in magnitude.							
Change in Nuisance	A	L	C	LAA	NS	LT	IR	R
Contribution from the Project to the residual cumulative effect	The Project will contribute a small amount of air and noise emissions which may interact with past, present, and reasonably foreseeable projects and activities. However, the LAA will continue to experience a relatively low level of air emissions or noise disturbances leading to a change in nuisance effects. It is not anticipated that cumulative effects will extend to the RAA communities.							

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Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Likelihood	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Public Safety	A	M-H	C	LAA	NS	LT	IR	R
Contribution from the Project to the residual cumulative effect	During construction and operation of the Project and considering past, present, and reasonably foreseeable projects and activities, the LAA communities and the region will see more adverse effects on public safety (as measured by perceived safety of community and rate of accidents, and the disproportionate effects on vulnerable populations) as a result of the Project. The overall relative contribution of the Project to the cumulative effect will be moderate.							

KEY

*See Table 9.8 for detailed definitions

Direction:

A: Adverse

N: Neutral

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Likelihood

U: Unlikely

P: Possible

C: Certain

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.13.2.9 Significance of Cumulative Effects on Human Health and Community Wellness

The Project will result in adverse effects on population health, community/family and social ties, food security, nuisance, but these will be low in magnitude following mitigation. Most effects will be concentrated in the LAA with some lesser effects being experienced in the RAA communities.

The Project will interact cumulatively with past, present, and reasonably foreseeable projects and activities, especially for projects that will increase or have increased access to the LAA communities, allowing for increased presence of non-residents or visitors which may have several different adverse effects. Overall, most cumulative effects that result from interactions between the project-related effects and those of past, present and reasonably foreseeable projects and activities will be low in magnitude.

The operation of the Project, combined with other past, present and reasonably foreseeable effects of the Project that increase access to and from communities and the presence of non-residents or visitors, is expected to exacerbate an already considerable drug and alcohol problem that exists in LAA and RAA communities and will contribute adversely to public safety levels, especially for vulnerable populations. It is not expected that mitigation measures will be able to eliminate the increasing adverse high-magnitude effects on social pressures and public safety, especially in the short-term and as a result the cumulative effects of the Project on social pressures and public safety will be significant.

Given that most effects are determined to be not significant and there is a commitment to develop and implement a monitoring and adaptive management plan, the cumulative effects on human health and community wellness overall are not significant.

9.13.3 Cumulative Effects: Education, Training and Skills

9.13.3.1 Project Residual Effects Likely to Interact Cumulatively

The project and physical activity inclusion list (Table 9.33) identifies known past, present, and reasonably foreseeable projects and physical activities that could overlap spatially and temporally with the residual effects of the Project on education, training and skills. Table 9.33 identifies the single pathway that results in an adverse residual effect of the Project on education, training and skills. Chapter 4 presents the names, proponents, use or activity, descriptions, and status of these projects and activities.

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Table 9.33 Projects and Physical Activities with the Potential to Contribute to Cumulative Effects on Education, Training and Skills

Other Projects and Physical Activities with Potential for Cumulative Effects	Effect
	Change in capacity to meet demand for training
Past and Present Physical Activities and Resource Use (Base Case)	
<i>Geotechnical</i>	-
<i>Oil, Gas & Seismic*</i>	-
<i>Infrastructure</i>	
MVWR, including bridges and bridge-sized culverts	-
Canyon Creek All Season Access Road	✓
Norman Wells Pipeline	-
Mackenzie Valley Fibre Link	-
Prohibition Creek Access Road	✓
<i>Quarries and Borrow Sources</i>	-
<i>Mining & Exploration</i>	-
<i>Municipal Operations, including water, waste, power and community development</i>	
Wrigley Municipal Activities	-
Tulita Municipal Activities	-
Norman Wells Municipal Activities	-
Project-Related Physical Activities (Project Case)	
Mackenzie Valley Highway Project	✓
Reasonably Foreseeable Physical Activities (Reasonably Foreseeable Case)	
<i>Quarries</i>	
Dhu-1 Quarry	✓
<i>Infrastructure</i>	
Great Bear River Bridge	✓
<i>Oil and Gas</i>	
Enbridge Maintenance Camp	-

Notes:

- ✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with project residual effects.
- = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
- * = includes support activities such as: production, exploration, remediation, drilling, wells, associated infrastructure, facilities, camp, and staging areas.

9.13.3.2 Change in Capacity to Meet Demand for Training

9.13.3.2.1 Cumulative Effects Pathways

As discussed in Section 9.6.4, during the project construction phase, it is expected that interest in educational programming and training will increase to the point where it strains the capacity of training facilities in the LAA. This is especially true for trades such as heavy equipment operators that will be instrumental in the development of the Project.

Present and reasonably foreseeable activities in and around LAA communities, notably those related to infrastructure development (e.g., CCASAR, PCAR), and quarries and borrow sources (e.g., Dhu-1 Quarry) located close to the communities, may all contribute to further strain on the capacity to meet demand for training. It is expected that these projects may result in increased demand for the same types of trades-based training as the Project, and as such, will further exacerbate the capacity of training institutions to meet demand.

Effects are expected to be limited to the construction phase and to the LAA. No effect is expected within the RAA.

9.13.3.2.2 Mitigation for Cumulative Effects

Mitigation measures applicable to limiting cumulative effects on the capacity to meet demand for training within the LAA include, but are not limited to, the following:

- Assessing the demand for training, associated with all projects, being experienced by training facilities in the LAA
- Working collaborative with communities to leverage existing programming and services to support education and training needs in the LAA
- Exploring opportunities to rely on alternative training delivery agents through virtual means as needed

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.3.2.3 Residual Cumulative Effects

Despite the mitigation measures noted above, during the construction phase of the Project, present, and reasonably foreseeable projects and activities may result in additional strain on training facilities to meet demand for training, over and above the capacity issues introduced by the Project alone.

Cumulative effects extending into the RAA are not anticipated, nor are they expected during the operations and maintenance phase. See Table 9.34 for the summary of residual cumulative effects regarding change in capacity to meet demand for training.

9.13.3.3 Summary of Cumulative Effects on Education, Training and Skills

The Project involves upgrading an existing winter road in a corridor within the Mackenzie Valley that is subject to disturbance from past and present activities and projects, including existing linear infrastructure. When current and reasonably foreseeable effects of the Project on education, training and skills are considered, the Project's contributions to adverse residual cumulative effects on changes in the capacity to meet demand for training are expected to be low in magnitude.

Table 9.34 summarizes cumulative effects on education, training and skills.

Table 9.34 Summary of Cumulative Effects on Education, Training and Skills

Residual Cumulative Effect	Residual Cumulative Effect Characterization							
	Direction	Magnitude	Likelihood	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Capacity to Meet Demand for Training	A	L	P	LAA	HS	MT	IR	R
Contribution from the Project to the residual cumulative effect	The Project may result in a low magnitude increase in demand for training within the LAA. This increase in interest for training may strain the capacity on training institutions to meet demand for training.							

KEY

*See Table 9.8 for detailed definitions

Direction:

A: Adverse

N: Neutral

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Likelihood

U: Unlikely

P: Possible

C: Certain

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.13.3.4 Significance of Cumulative Effects on Education, Training and Skills

During the construction phase, training facilities in the LAA may have decreased capacity to meet demand for training because of higher levels of interest associated with the Project and other current and reasonably foreseeable activities. In conclusion, with a low magnitude, medium term duration and irregular frequency that will not result in an overall lack of capacity or decrease in quality of education and training services provided, the residual cumulative effect on education, training and skills is considered not significant.

9.13.4 Cumulative Effects: Employment and Economy

9.13.4.1 Project Residual Effects Likely to Interact Cumulatively

The project and physical activity inclusion list (Table 9.35) identifies known past, present, and reasonably foreseeable projects and physical activities that could overlap spatially and temporally with the residual effects of the Project on employment and economy. Table 9.35 identifies the only adverse residual effect of the Project on employment and economy– change in traditional economy (harvesting and related community/household income). Chapter 4 presents the names, proponents, use or activity, descriptions, and status of these projects and activities.

Table 9.35 Projects and Physical Activities with the Potential to Contribute to Cumulative Effects on Employment and Economy

Other Projects and Physical Activities with Potential for Cumulative Effects	Effect
	Change in traditional economy (harvesting and related community/household income)
Past and Present Physical Activities and Resource Use (Base Case)	
<i>Geotechnical</i>	-
<i>Oil, Gas & Seismic*</i>	-
<i>Infrastructure</i>	
MVWR, including bridges and bridge-sized culverts	✓
Canyon Creek All Season Access Road	✓
Norman Wells Pipeline	✓
Mackenzie Valley Fibre Line	-
Prohibition Creek Access Road	✓
<i>Quarries and Borrow Sources</i>	-
<i>Mining & Exploration</i>	-
<i>Municipal Operations, including water, waste, power and community development</i>	
Wrigley Municipal Activities	-
Tulita Municipal Activities	-

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Other Projects and Physical Activities with Potential for Cumulative Effects	Effect
	Change in traditional economy (harvesting and related community/household income)
Norman Wells Municipal Activities	-
Project-Related Physical Activities (Project Case)	
Mackenzie Valley Highway Project	✓
Reasonably Foreseeable Physical Activities (Reasonably Foreseeable Case)	
Quarries	
Dhu-1 Quarry	-
Infrastructure	
Great Bear River Bridge	✓
Oil and Gas	
Enbridge Maintenance Camp	✓

Notes:

- ✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with project residual effects.
- = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
- * = includes support activities such as: production, exploration, remediation, drilling, wells, associated infrastructure, facilities, camp, and staging areas.

9.13.4.2 Change in Traditional Economy

9.13.4.2.1 Cumulative Effects Pathways

As discussed in Section 9.7.6, project construction could change the time available for participation in the traditional economy. Participation in construction employment may require local workers to be away from their home community for extended periods, potentially affecting their time available to participate in traditional hunting, fishing and trapping activities.

Current and potential future projects and activities in and around LAA communities, such as oil and gas and infrastructure (such as MVWR, Enbridge Maintenance Camp and Norman Wells Pipeline Operations and Maintenance), could contribute to the demand for labour and potentially increase the number of individuals who work away from their home communities for extended periods. The cumulative effect would be a reduction in the amount of traditional foods available in the communities, and a potential reduction in the transfer of TK and acquisition of the skills required to acquire traditional foods in the future. This in turn could increase reliance on store-bought foods and could potentially affect food security for those more reliant on traditional foods such as Elders.

9.13.4.2.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative effects on traditional economy within the LAA (including other reasonably foreseeable projects and activities) include, but are not limited to, the following:

- The use of a rotational schedule during project construction, may help community members have adequate time between construction shifts to continue to participate in traditional activities, such as hunting, fishing, trapping, and preparing traditional food.

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.4.2.3 Residual Cumulative Effects

The overall effect of project construction on the traditional economy is expected to be low magnitude and does not extend into the operations and maintenance phase. Any cumulative effect depends on the timing of other projects, and whether residents from the LAA and RAA communities participate in their workforces. See Table 9.36 for the summary of residual cumulative effects regarding change in traditional economy.

9.13.4.3 Summary of Cumulative Effects on Employment and Economy

The Project will draw upon local labour to undertake construction, which for some workers will require living in camps away from their home community during their 14-day shift and may affect the amount of traditional food available in the community. When effects of current and reasonably foreseeable projects and activities on employment and economy are considered, the Project's contributions to changes in traditional economy will be low in magnitude and continuous during the construction phase only. No residual cumulative effects are anticipated for changes in traditional economy.

Table 9.36 summarizes cumulative effects on employment and economy.

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Table 9.36 Summary of Cumulative Effects on Employment and Economy

Residual Cumulative Effect	Residual Cumulative Effect Characterization							
	Direction	Magnitude	Likelihood	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Traditional Economy	A	L	P	LAA, RAA	MS	MT	C	R
Contribution from the Project to the residual cumulative effect	The Project may challenge the capacity of LAA communities to participate in activities related to accessing or obtaining traditional foods, if the construction period overlaps with reasonably foreseeable projects. The Project's contributions to changes in traditional economy will be low in magnitude and continuous during the construction phase only.							

KEY

*See Table 9.8 for detailed definitions

Direction:

A: Adverse

N: Neutral

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Likelihood

U: Unlikely

P: Possible

C: Certain

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.13.4.4 Significance of Cumulative Effects on Employment and Economy

The Project will interact cumulatively with past, present, and reasonably foreseeable projects and activities but the use of rotational shifts will help enable workers to participate in traditional food gathering activities.

Following the application of mitigation measures, residual cumulative effects on traditional economy are not expected to affect the ability of community members to participate in activities related to accessing or obtaining traditional foods, and therefore will not contribute to an overall decline in employment levels or economic activity. In conclusion, the cumulative effects on employment and economy are not significant.

9.13.5 Cumulative Effects: Infrastructure, Services and Institutional Capacity

9.13.5.1 Project Residual Effects Likely to Interact Cumulatively

The project and physical activity inclusion list (Table 9.37) identifies known past, present, and reasonably foreseeable projects and physical activities that could overlap spatially and temporally with the residual effects of the Project on infrastructure, services and institutional capacity. Chapter 4 presents the names, proponents, use or activity, descriptions, and status of these projects and activities.

Table 9.37 Projects and Physical Activities with the Potential to Contribute to Cumulative Effects on Infrastructure, Services and Institutional Capacity

	Effects			
	Change in housing and accommodation	Change in Social Infrastructure and Services	Change in Public Infrastructure and Services	Change in Institutional Facilities and Services
Past and Present Physical Activities and Resource Use (Base Case)				
<i>Geotechnical</i>	-	-	-	-
<i>Oil, Gas & Seismic*</i>	-	-	-	-
<i>Infrastructure</i>	-	-	-	-
MVWR, including bridges and bridge-sized culverts	-	-	-	-
Canyon Creek All Season Access Road	-	-	-	✓
Norman Wells Pipeline	-	-	-	-
Mackenzie Valley Fibre Line	-	-	-	-
Prohibition Creek Access Road	-	✓	✓	✓

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	Effects			
	Change in housing and accommodation	Change in Social Infrastructure and Services	Change in Public Infrastructure and Services	Change in Institutional Facilities and Services
Quarries and Borrow Sources	-	-	-	-
Mining & Exploration	-	-	-	-
Municipal Operations, including water, waste, power and community development				
Wrigley Municipal Activities	-	-	✓	-
Tulita Municipal Activities	-	-	✓	-
Norman Wells Municipal Activities	-	-	✓	-
Project-Related Physical Activities (Project Case)				
Mackenzie Valley Highway Project	✓	✓	✓	✓
Reasonably Foreseeable Physical Activities (Reasonably Foreseeable Case)				
Quarries				
Dhu-1 Quarry		✓	✓	✓
Infrastructure				
Great Bear River Bridge	-	✓	✓	✓
Oil and Gas				
Enbridge Maintenance Camp	-	✓	-	-

Notes:

✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with project residual effects.

- = Interactions between the residual effects of other projects and residual effects of the Project are not expected.

* = includes support activities such as: production, exploration, remediation, drilling, wells, associated infrastructure, facilities, camp, and staging areas.

9.13.5.2 Change in Housing and Accommodation

As discussed in Section 9.8.2, during the project operations and maintenance phase, a potential increase of tourists, vacationers, and visitors to the LAA communities is anticipated and may result in a residual adverse effect on change in housing and accommodation, as those who plan on staying in LAA communities for more than a day may seek temporary accommodations. Neither the past and present physical activities and resource uses, nor the reasonably foreseeable physical activities, are expected to interact with the project operations and maintenance phase and produce cumulative effects on housing and accommodation discussed above. Therefore, further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities on change in housing and accommodation.

9.13.5.3 Change in Social Infrastructure and Services

9.13.5.3.1 Cumulative Effects Pathways

As discussed in Section 9.8.3, during the project construction phase, some incidents of construction worker injuries and illness are possible, which will result in an increased demand for health services in LAA communities.

In the event that construction of one or more of the reasonably foreseeable projects and physical activities such as the Dhu-1 Quarry coincide with the construction of Project, the increased demand for health services in Tulita and/or Norman Wells can be expected to intensify due to additional construction worker illnesses and accidents²⁶.

As discussed in Section 9.8.3, during the project operations and maintenance phase, the number of traffic accidents, and their severity, may increase in LAA communities, thereby increasing pressure on emergency services, protection services, and health services in these communities. In addition, increased access to alcohol and drugs in LAA communities will result in increased demand on protection services to deal with crimes and incidents associated with the consumption of drugs and alcohol and increased demand in health counselling and facility-based treatment services. In LAA communities that have three-officer RCMP detachments, capacity may on occasion be limited when two officers need to respond to an accident on Hwy 1.

Neither the past and present physical activities and resource uses, nor the reasonably foreseeable physical activities, are expected to interact with the Project's operations and maintenance phase and produce cumulative effects on the social infrastructure and services discussed above.

²⁶ It is being assumed that construction of the Great Bear River Bridge will be completed prior to the construction of the Tulita segment of the Project.

9.13.5.3.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative effects on social infrastructure and services within the LAA (including other reasonably foreseeable projects and activities) include, but are not limited to, the following:

- Identifying and estimating potential increased demand on Tulita and Norman Wells health services in the event that Dhu-1 Quarry and/or Great Bear River Bridge construction phase coincide with the Project's construction phase

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.5.3.3 Residual Cumulative Effects

Considering past, present, and reasonably foreseeable projects and activities, and construction of the Project, LAA communities may experience increased demand for health services if the construction of one or more of these projects overlaps with the construction phase of the Project (due to the presence of construction workers who may get injured or ill). Cumulative effects extending into the RAA are not anticipated. See Table 9.38 for the summary of residual cumulative effects regarding change in social infrastructure and services.

9.13.5.4 Change in Public Infrastructure and Services

9.13.5.4.1 Cumulative Effects Pathways

As discussed in Section 9.8.4, during the project construction phase, construction worker camps will make use of municipal infrastructure such as potable water, wastewater disposal and solid waste disposal. Depending on the public infrastructure capacity of each LAA community, the Project may have an adverse effect on one or more of the utilities provided by one or more LAA community: Tulita (solid waste disposal) and Wrigley (potentially all utilities) may be affected. Hence, cumulative effects on public infrastructure are possible during the Project's construction phase.

In the event that construction of one or more of the reasonably foreseeable projects and physical activities of Dhu-1 Quarry, and/or projects currently under construction such as the Great Bear River Bridge coincide with the construction of Project, and if either/all projects have construction worker camps that use the public infrastructure of Norman Wells and/or Tulita, the increased demand for public utilities can be expected to intensify due to the combined demands of multiple construction worker camps.

9.13.5.4.2 Mitigation for Cumulative Effects

As per Section 9.8.4, it is proposed that the GNWT will obtain approval and agreement from the Town of Norman Wells, the Hamlet of Tulita and Wrigley to use their community water supplies, their sewage lagoon and solid waste disposal facilities. A WMP will be developed and implemented.

Further, it is proposed that prior to scheduling construction, the GNWT meet with municipal officials in Norman Wells, Tulita and Wrigley to determine whether any other construction worker camps are anticipated within the municipal boundaries during the project construction phase and if the community government has any infrastructure capacity concerns. If the community government has concerns, it is proposed that the GNWT adjust the construction period to accommodate community infrastructure capacity constraints.

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.5.4.3 Residual Cumulative Effects

During construction of the Project and considering past, present, and reasonably foreseeable projects and activities, one or more LAA community may experience utility capacity challenges if two or more construction worker camps are within municipal boundaries, even with the implementation of mitigation measures. Cumulative effects are not expected to extend into the RAA. See Table 9.38 for the summary of residual cumulative effects regarding change in public infrastructure and services.

9.13.5.5 Change in Institutional Facilities and Services

9.13.5.5.1 Cumulative Effects Pathways

As discussed in Section 9.8.5, during the project construction phase, some residents of the LAA and RAA communities who seek employment for project construction may either require or desire educational and training programs (e.g., adult literacy, trades training) prior to applying for employment. Such education and skills training will require training facilities (i.e., CLCs) in the communities to accommodate an increased number of community members.

In the event that construction of one or more of the reasonably foreseeable projects and physical activities of Dhu-1 Quarry and/or the Great Bear River Bridge coincide with the construction of Project, the increased demand for the use of CLCs in LAA communities can be expected to intensify and the capacity of the CLCs may be challenged by this cumulative demand.

9.13.5.5.2 Mitigation for Cumulative Effects

In the event that the reasonably foreseeable physical activities of the Dhu-1 Quarry and the Great Bear River Bridge coincide with the construction of Project, the following mitigation measures are proposed:

- Aurora College / Polytechnic to work with the GNWT/contractors to estimate the type and frequency of education and training required, for each LAA community, and work collaboratively with communities to leverage existing programs and services to provide education and training for community residents prior to hiring.

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.5.5.3 Residual Cumulative Effects

During construction of the Project and considering past, present, and reasonably foreseeable projects and activities, LAA communities may be challenged in providing sufficient training facilities (CLCs) to cater to community demand for educational and training programs if two or more projects have construction phases during the same time. Cumulative effects extending into the RAA are not anticipated. See Table 9.38 for the summary of residual cumulative effects regarding change in institutional facilities and services.

9.13.5.6 Summary of Cumulative Effects on Infrastructure, Services and Institutional Capacity

Table 9.38 summarizes cumulative effects on infrastructure, services and institutional capacity.

Table 9.38 Summary of Cumulative Effects on Infrastructure, Services and Institutional Capacity

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Likelihood	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Social Infrastructure and Services	A	L	P	LAA	NS	ST	IR	R
Contribution from the Project to the residual cumulative effect	Reasonably foreseeable projects and activities may cause an increase in demand for health services in LAA communities if the construction or one or more of these projects overlaps with the construction phase of the Project. The Project will contribute a low magnitude increase in demand for LAA community health services during its construction phase: this will be in							

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Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Likelihood	Geographic Extent	Timing	Duration	Frequency	Reversibility
	addition to any such demands placed by other projects in the area that may be under construction at the same time.							
Change in Public Infrastructure and Services	A	L	P	LAA	MS	ST	R	R
Contribution from the Project to the residual cumulative effect	Reasonably foreseeable future projects and activities may cause one or more LAA communities to experience utility capacity challenges if the construction of one or more of these projects overlaps with the construction phase of the Project. The Project will contribute a low magnitude increase in demand for LAA community public infrastructure during its construction phase: this will be in addition to any such demands placed by other projects in the area that may be under construction at the same time.							
Change in Institutional Facilities and Services	A	L	P	LAA	HS	ST	IR	R
Contribution from the Project to the residual cumulative effect	Reasonably foreseeable projects and activities, if their construction period overlaps with the project construction period, may challenge the capacity of LAA communities to provide sufficient training facilities (CLCs) to cater to community demand for educational and training programs. The Project will contribute a low magnitude increase in demand for LAA community adult education/training facilities during its construction phase: this will be in addition to any such demands placed by other projects in the area that may be under construction at the same time.							

KEY

*See Table 9.8 for detailed definitions

Direction:

A: Adverse

N: Neutral

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Likelihood

U: Unlikely

P: Possible

C: Certain

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.13.5.7 Significance of Cumulative Effects on Infrastructure, Services and Institutional Capacity

The Project may interact cumulatively with reasonably foreseeable projects/activities (i.e., if the construction phase of one or more of these projects overlaps with the construction phase of the Project) in a way that may cause increased demand for health services in LAA communities. However, being of low magnitude, short duration, irregular frequency and reversible, the residual cumulative effects on social infrastructure and services will be not significant.

The Project may interact cumulatively with reasonably foreseeable projects/activities (i.e., if the construction phase of one or more of these projects overlaps with the construction phase of the Project) in a way that may create utility capacity challenges in LAA communities that have multiple construction camps using their utilities. Being of low magnitude and reversible, the residual cumulative effects on public infrastructure will not result in a lack of capacity or a substantial decrease in the quality of a service provided on an ongoing basis and will be not significant.

The Project may interact cumulatively with reasonably foreseeable projects/activities (i.e., if the construction phase of one or more of these projects overlaps with the construction phase of the Project) in a way that may challenge the capacity of training facilities (CLCs) in the LAA communities to cater to community demand for educational and training programs. Being of low magnitude, irregular frequency and reversible, the residual cumulative effects on institutional infrastructure will be not significant.

In conclusion, the overall cumulative effects on infrastructure, services and institutional capacity are not significant.

9.13.6 Cumulative Effects: Non-Traditional Land and Resource Use

9.13.6.1 Project Residual Effects Likely to Interact Cumulatively

The project and physical activity inclusion list identifies known past, present, and reasonably foreseeable projects and physical activities whose residual effects could overlap spatially and temporally with the residual effects of the Project on non-traditional and resource use. Chapter 4 presents the names, proponents, use or activity, descriptions, and status of these projects and activities and figures of the present the locations of these existing and known future physical activities.

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Table 9.39 Projects and Physical Activities with the Potential to Contribute to Cumulative Effects on Non-Traditional Land and Resource Use

Other Projects and Physical Activities with Potential for Cumulative Effects	Effects			
	Change in Non-Traditional Land Use	Change in Access to Non-Traditional Land Use	Change in Aesthetics	Change in Non-Traditional Resource Use
Past and Present Physical Activities and Resource Use (Base Case)				
<i>Geotechnical</i>	-	-	-	-
<i>Oil, Gas & Seismic*</i>	✓	-	✓	✓
<i>Infrastructure</i>				
MVWR, including bridges and bridge-sized culverts	✓	✓	✓	✓
Canyon Creek All Season Access Road	✓	✓	✓	✓
Norman Wells Pipeline	-	-	-	-
Mackenzie Valley Fibre Line	-	-	-	-
Prohibition Creek Access Road	✓	✓	-	✓
<i>Quarries and Borrow Sources</i>	✓	-	-	✓
<i>Mining & Exploration</i>	-	-	-	✓
<i>Municipal Operations, including water, waste, power and community development</i>				
Wrigley Municipal Activities	-	-	✓	-
Tulita Municipal Activities	-	-	✓	-
Norman Wells Municipal Activities	-	-	✓	-
Project-Related Physical Activities (Project Case)				
Mackenzie Valley Highway Project	✓	✓	✓	✓
Reasonably Foreseeable Physical Activities (Reasonably Foreseeable Case)				
<i>Quarries</i>				
Dhu-1 Quarry	-	-	-	-
<i>Infrastructure</i>				
Great Bear River Bridge	✓	✓	-	✓

Other Projects and Physical Activities with Potential for Cumulative Effects	Effects			
	Change in Non-Traditional Land Use	Change in Access to Non-Traditional Land Use	Change in Aesthetics	Change in Non-Traditional Resource Use
<i>Oil and Gas</i>				
Enbridge Maintenance Camp	✓	✓	✓	✓

Notes:

- ✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with project residual effects.
- = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
- * = includes support activities such as: production, exploration, remediation, drilling, wells, associated infrastructure, facilities, camp, and staging areas.

9.13.6.2 Change in Non-Traditional Land Use

9.13.6.2.1 Cumulative Effects Pathways

As discussed in Section 9.9.2, during the project construction phase, some changes in land ownership will occur in the PDA and those segments of the LAA that abut the PDA. Also, construction activities will create disturbances to the physical environment (land and water) within the LAA; in particular, heavy machinery used for construction may disturb land and various species' habitats. However, the Project is linear in nature and is expected to primarily adhere to the existing corridor used by the MVWR.

Past and present projects and activities in and around LAA communities, such as oil and gas, infrastructure (including MVWR and CCASAR), and quarries and borrow sources located close to the communities, contribute to the overall change in land use in the LAA, with increased amounts of land being used for infrastructure and industrial use. Foreseeable projects such as the Great Bear River Bridge will continue this ongoing process of converting more land in the area to infrastructure uses.

Also, as discussed in Section 9.9.2, during the project operations and maintenance phase, certain changes in non-traditional land uses within the LAA are expected; these include reduction in snowmobile use in LAA communities and increased use of cabins near the Project, and changes in municipal land uses such as increased parking and downtown beautification projects.

Similar to the construction phase, while the above-mentioned projects and activities will not directly contribute to the changes produced by the Project, the cumulative effect will be a reduction in wilderness and an increase in urban and industrial land uses in the LAA.

9.13.6.2.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative effects on non-traditional land use within the LAA (including other reasonably foreseeable projects and activities) include, but are not limited to, the following:

- Consider the changes in land use that will take place in connection with the Project when planning the construction of the Great Bear River Bridge (which is expected to be constructed prior to the MVH), to avoid the designation of certain land uses along the project route that are in conflict with the land uses associated with the bridge project
- The Project will use previously disturbed areas for project activities and project infrastructure and workspaces to the extent practical.

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.6.2.3 Residual Cumulative Effects

Following construction of the Project and considering past, present, and reasonably foreseeable projects and activities, the LAA will continue to increase the development of land in and around its communities for infrastructure, industrial, and possibly commercial and residential land uses; however, the LAA as a whole will be relatively undisturbed. Cumulative effects extending into the RAA are not anticipated. See Table 9.40 for the summary of residual cumulative effects regarding change in non-traditional land use.

9.13.6.3 Change in Access to Non-Traditional Land Use

9.13.6.3.1 Cumulative Effects Pathways

As discussed in Section 9.9.3, during the project construction period, the three LAA communities may experience disruptions or restrictions in use of the MVWR – and therefore decreased access to non-traditional land use activities outside their communities in the winter – as construction activities will be using the MVWR for transportation of materials. Also, during the construction phase, construction workers may have a desire to access lands adjacent to the project ROW via all-terrain vehicles and snowmachines for recreational purposes (including hunting and fishing) during their leisure time. Such activities may disturb sensitive lands and various species' habitats in the PDA and the LAA, but due to distance, not RAA communities.

Other infrastructure projects in and around LAA communities (e.g., MVWR, CCASAR) will have already created disturbances in the natural environment which enable hunting and fishing in previously less accessible areas.

Past and present infrastructure activities in and around LAA communities, such as the MVWR and CCASAR, as well as foreseeable projects such as the Great Bear River Bridge, may combine with the Project to create changes in patterns of access to lands in the vicinity of the LAA communities. Transportation corridors make it easier to access formerly inaccessible (or only seasonally accessible) areas by non-Indigenous residents and/or non-residents (visitors, vacationers and tourists); thereby, enabling further changes in non-traditional land uses (i.e., new recreational spots, building of cabins, and others).

9.13.6.3.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative effects on access to non-traditional land use within the LAA (including other reasonably foreseeable projects and activities) include measures outlined in the WMMP related to having wildlife monitors in place.

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.6.3.3 Residual Cumulative Effects

Following construction of the Project and considering past, present, and reasonably foreseeable projects and activities, the LAA will continue to be relatively undisturbed despite opening up access to previously undisturbed areas for hunting, fishing and recreational non-traditional land uses. Cumulative effects extending into the RAA are not anticipated. See Table 9.40 for the summary of residual cumulative effects regarding change in access to non-traditional land use.

9.13.6.4 Change in Aesthetics

9.13.6.4.1 Cumulative Effects Pathways

As discussed in Section 9.9.4, during the project construction phase, environmental disturbances such as decreased air quality and increased noise levels, will affect aesthetics in the LAA.

During the construction phase, other currently occurring activities – such as oil and gas production, infrastructure such as the MVWR and CCASAR, as well as municipal operations (in particular, community development) may produce noise and/or air pollutants such as dust which could coincide with the noise and pollutants created by the project construction activities, thereby further worsening the aesthetics within the LAA communities.

Also, as discussed in Section 9.9.4, during the project operations and maintenance phase, the Project will have an adverse effect on aesthetics, as it will be wider and more visible than the MVWR that it is replacing. The increased vehicular traffic all-season along the project route will result in increased litter and other waste materials and some environmental disturbances such as increased dust during summer months, which will affect aesthetics in the LAA.

The other past and present projects and activities in and around LAA communities, such as oil and gas, infrastructure (as discussed in Section 9.13.6.2.1) may contribute to the noise and seasonal dust which are produced by the Project during the operations and maintenance phase; however, since the aesthetic effects of the Project during the operations and maintenance phase will be less than during the construction phase, the cumulative effect will be less than during the project construction phase.

9.13.6.4.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative effects on aesthetics within the LAA (including other reasonably foreseeable projects and activities) include measures that will be developed and implemented to limit or mitigate noise and air emissions associated with the Project that would in turn lead to adverse aesthetic effects (outlined in Section 9.5.7). In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.6.4.3 Residual Cumulative Effects

Following construction of the Project and considering past, present, and reasonably foreseeable projects and activities, the LAA will continue to experience a relatively low level of aesthetic disturbances due to noise and air pollution/dust, especially following the construction phase of the Project. Cumulative effects extending into the RAA are not anticipated. See Table 9.40 for the summary of residual cumulative effects regarding change in aesthetics.

9.13.6.5 Change in Non-Traditional Resource Use

9.13.6.5.1 Cumulative Effects Pathways

As discussed in Section 9.9.5, during the project construction phase, project activities will result in changes that affect wildlife species diversity, population, and health combine with changes to local vegetation which, in turn, can affect the location, movement and population of some species of wildlife which are hunted for sport, recreation or food by non-Indigenous peoples.

Many current projects and activities in and around the LAA communities – in particular, oil and gas industry, infrastructure (MVWR, CCASAR) and quarries and borrow sources – have already altered the natural landscape and therefore the resources (wildlife, fish) that non-Indigenous peoples use in these communities. The addition of the proposed Great Bear River Bridge and construction of the Project will create further landscape alterations and disturbances to wildlife habitat and species distribution.

9.13.6.5.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative effects on non-traditional resource use within the LAA (including other reasonably foreseeable projects and activities) include, but are not limited to, the following:

- A WMMP will be developed and implemented. The WMMP will contain detailed monitoring and mitigation measures to be implemented for the duration of the construction and operations of the Project.

In addition, 'Follow-up and Monitoring' activities (Section 9.15), and the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16) will take into consideration potential cumulative effects on the socio-economic VCs.

9.13.6.5.3 Residual Cumulative Effects

Following construction of the Project and considering past, present, and reasonably foreseeable projects and activities, the LAA will continue to be relatively undisturbed and will be able to sustain wildlife which are hunted and fished by non-Indigenous community members. Cumulative effects extending into the LAA are not anticipated.

9.13.6.6 Summary of Cumulative Effects on Non-Traditional Land and Resource Use

The Project involves upgrading an existing winter road in a corridor within the Mackenzie Valley that is subject to disturbance from past and present activities and projects, including existing linear infrastructure. When effects from the Project, current and reasonably foreseeable projects on non-traditional land and resource use are considered, no residual cumulative effects are anticipated for non-traditional resource use.

Table 9.40 summarizes cumulative effects on non-traditional land and resource use.

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Table 9.40 Summary of Cumulative Effects on Non-Traditional Land and Resource Use

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Likelihood	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Non-Traditional Land Use	A	L	C	LAA	NS	LT	IR	I
Contribution from the Project to the residual cumulative effect	Past, present, and reasonably foreseeable projects and activities have increased the development of land in and around LAA communities for infrastructure, industrial, and possibly commercial and residential land uses; the Project will add to this change. The Project will contribute a low magnitude incremental increase in industrial and transportation land uses in the area.							
Change in Access to Non-Traditional Land Use	A	L	P	LAA	NS	LT	IR	R
Contribution from the Project to the residual cumulative effect	Past, present, and reasonably foreseeable linear projects are responsible for opening up new avenues of access to previously undisturbed areas for hunting, fishing and recreational non-traditional land uses; the Project will add to this change.							
Change in Aesthetics	A	L	P	LAA	NS	LT	IR	R
Contribution from the Project to the residual cumulative effect	Past, present, and reasonably foreseeable projects (e.g., oil and gas, quarries, mines) produce aesthetic disturbances such as noise and air pollution/dust; the Project will add to this change. The Project will contribute a low magnitude incremental increase in change to aesthetics due to the Project's contribution to the noise and air pollutants created by various industrial activities and linear projects in the area.							

KEY

*See Table 9.8 for detailed definitions

Direction:

A: Adverse

N: Neutral

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Likelihood

U: Unlikely

P: Possible

C: Certain

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

9.13.6.7 Significance of Cumulative Effects on Non-Traditional Land and Resource Use

The Project will interact cumulatively with past, present, and reasonably foreseeable projects and activities in a way that will continue to increase the development of land in and around the LAA communities for infrastructure, industrial, and possibly commercial and residential land uses. However, being of low magnitude and irregular frequency, the residual cumulative effects on non-traditional land use will be not significant.

Despite the presence of various linear, mine and petroleum projects within the RAA (including the Project), the LAA will continue to be relatively undisturbed, as the opening up of new avenues of access to previously undisturbed areas for hunting, fishing and recreational non-traditional land uses will likely be relatively limited. It is not anticipated that the small local non-Indigenous population will put much pressure on previously undisturbed areas and the driving distance between large centres of non-Indigenous populations and the LAA communities is a disincentive within the reasonably foreseeable future. Being of low magnitude and irregular frequency, the residual cumulative effects on access to non-traditional land use will not result in non-compliance with land use plans and will not create a change that prevents land use capability to the point where non-traditional land use activities cannot continue at or near current levels and will be not significant.

Following construction of the Project and considering past, present, and reasonably foreseeable projects and activities, the LAA will continue to experience a relatively low level of aesthetic disturbances due to noise and air pollution/dust. Being of low magnitude and irregular frequency, the residual cumulative effects on aesthetics will be not significant.

As no residual cumulative effects are anticipated for non-traditional resource use, a determination of significance is not warranted.

9.13.7 Project Contribution to Cumulative Effects

This section summarizes how the Project is expected to contribute to the cumulative effects of other existing and reasonably foreseeable projects and activities in the area.

9.13.7.1 Human Health and Community Wellness

The Project will contribute low or moderate magnitude incremental increases in adverse cumulative residual effects on population health, community/family and social ties, food security, and nuisance. The increase in adverse cumulative residual effects of the Project on changes in social pressures and public safety will be significant.

9.13.7.2 Education, Training and Skills

The Project may result in a low magnitude increase in demand for training within the LAA. This increase in interest for training may strain the capacity on training institutions to meet demand for training.

9.13.7.3 Employment and Economy

The Project will contribute a low magnitude, irregular decrease in access to traditional foods over the medium term due to the participation of community members in project employment and employment in other present, and reasonably foreseeable projects and activities.

9.13.7.4 Infrastructure, Services and Institutional Capacity

The Project will contribute a low magnitude increase in demand for LAA community health services, infrastructure and adult education/training during its construction phase. This will be in addition to any such demands placed by other projects in the area that may be under construction at the same time.

9.13.7.5 Non-Traditional Land and Resource Use

The Project will contribute a low magnitude incremental increase in industrial and transportation land uses in the area as well as a low magnitude incremental increase in access to non-traditional land use due to the all-season access to formerly inaccessible areas (combined with other linear projects). There will also be a low magnitude incremental increase in change to aesthetics due to the Project's contribution to the noise and air pollutants created by various industrial activities and linear projects in the area.

9.14 Prediction Confidence

The level of confidence in residual effect predictions in assessments depends on the degree of uncertainty associated with the basis for the determination of significance. Uncertainty will be influenced by factors such as the adequacy of available data, the level of knowledge and understanding about the environmental component being assessed, the characteristics of the proposed Project or technology, the nature of the project-environment interaction, prior experience with similar projects in similar environments, and the efficacy of proposed mitigation.

Residual effect prediction is based on available information. If there are limitations in the available information, this may make characterization of residual effects and determination of significance difficult or less certain. Where information gaps exist, the residual effect prediction may be less certain (i.e., there is a greater possibility that the outcome – the residual effect – may be different from what is predicted) (Horvath, 2013). Information from engagement is a key component to inform the assessment of effects. However, to date, the GNWT did not engage with community organizations or community members in Wrigley, so the effects assessment relies on publicly available information to complete some parts of the assessment as it related to Wrigley.

Prediction confidence also reflects the understanding of applicable mitigation measures, and reliance on assessments of other VCs of relevance to socio-economic VCs. Engagement has not been conducted on the mitigation measures and commitments outlined by the GNWT.

With respect to the Project, as a result of a temporal boundary of up to 20 years construction, and an evolving socio-economic environment in the NWT, confidence in prediction of the Project's socio-economic effects ranges from low to moderate. In most cases, this lower level of confidence or greater uncertainty can be addressed through ongoing engagement, updating and expanding TK and land use studies, implementation of monitoring, adaptive management and follow-up programs. These activities and the information they generate can inform a mitigation and follow-up framework to verify if key assumptions or baseline conditions have changed during the life of the Project. This in turn would allow the GNWT to adaptively manage the effects of the Project.

9.14.1 Assumptions

Best efforts were made to assess the potential effects of the Project. A conservative approach was used in assessing potential effects where there is uncertainty. Where the results from other disciplines were integrated into the assessment, the assumptions and conservative approach reported in their respective sections of this chapter are included in the assessment of effects on socio-economic VCs.

A number of assumptions have been used in the assessment of effects described in this chapter:

- **Workforce Composition:** It is assumed that approximately 50% of the project workforce will be from the local Sahtu and Dehcho communities or from elsewhere in the NWT, and 50% will be from outside of the Territory as described in the Project Description.
- **Qualifications and Training:** It is assumed that most employment opportunities related to the Project will require some level of certification, training and/or educational upgrading.
- **Housing and Accommodation:** The number of houses and forms of temporary accommodation in the LAA communities will not change between the time of this assessment and the beginning of project construction. All the non-local workforce will be accommodated in the Project's construction worker camps.
- **Public Infrastructure:** The Project's construction worker camps will be situated within the municipal boundaries of LAA communities and will make use of community potable water, wastewater and solid waste management facilities and services, but will not use community electricity and telecommunication infrastructure. The GNWT will require that the contractor and construction camps use on-site healthcare services to avoid affecting the delivery of healthcare services in the LAA.
- **Protective Services:** Construction, operations and maintenance of the Hwy 1 extension will not affect the number of RCMP officers stationed in the LAA communities.

Currently, the absence of a project budget requires reliance on other data sources to determine potential economic effects. Where necessary, consideration was given to similar assessments developed for the Inuvik-Tuktoyaktuk Highway and the Tłı̄chǫ Highway.

9.14.2 Gaps and Uncertainties

A number of key informational gaps exist with respect to the socio-economic environment that contribute to the uncertainty of effects prediction:

- Effects pathways that may relate to Wrigley have not been confirmed with community organizations or community members through engagement.
- Post-Secondary Enrollment and Completion Rates: The analysis of the potential effects on education, training and skills does not consider post-secondary graduation rates and uses high-school graduation rates as a proxy for the proportion of the population who may be eligible and interested in pursuing trades related programs.
- Availability of Instructors and required Educational Infrastructure:
 - The analysis of the potential effects on education, training and skills does not consider data on the availability of qualified instructors in communities needed to deliver additional trades training programs.
 - The analysis does not consider data on the availability of the specialized tools/equipment and learning environments that may be needed to deliver additional training (notably in the trades).
- Skills and Qualifications of Labour Force:
 - Detailed data are not available that describe the current level of skills, training and qualifications of the labour force.
 - As a result, is not possible to carry-out a comparative and gap analysis on current skills level relative to the skill level required to participate in the Project.
 - Because a gap analysis can not be completed, it is not possible to identify the training and educational programs required to meet the needs of the Project.
- Project ROW: In the absence of a detailed map of the project ROW, only general potential effects on land uses (rather than site-specific, or quantifiable information on specific land uses that will be affected) could be determined.

The SEIA for the Project also makes use of the “precautionary principle”, which is used to address the uncertainty that is associated with poorly understood risks, or potential adverse effects that have a higher level of uncertainty. As stated by the MVEIRB, the various definitions of the precautionary principle have in common,

“... the general requirement of taking action in situations of potentially serious or irreversible threats to health or the environment, where there is a need to reduce potential hazards before there is strong proof of harm, taking into account the likely costs and benefits of action and inaction.” (MVEIRB, no date).

The temporal boundary of the Project is up to 20 years and with socio-economic related VCs such as human health and community wellness, the further out into the future, the less certainty exists for predictions and assessment of potential effects.

The long-term changes to the local and regional economy in NWT are a key uncertainty related to the effects of the Project on both education, training and skills and non-traditional land and resource use. With an anticipated completion date of 2046, it is uncertain how the local / regional social and economic context may change during this 20-year period, (e.g., where potential new and emerging employment, tourism and other business opportunities will emerge). Economic activities and LAA community population changes due to the Project will depend on the timing of project operations with respect to economic and market cycles (e.g., if project operations begins at the time of a slump in commodity prices, increase in mineral and/or oil and gas exploration and development may not occur until commodity prices improve).

9.15 Follow-Up and Monitoring

Follow-up and monitoring related to socio-economic VCs will be initiated at each phase of the Project. These activities will inform a precautionary approach and contribute to the understanding of changing existing conditions of socio-economic VCs, effects prediction (both project-related and cumulative effects and the effectiveness of mitigation measures. Potential new/emerging unexpected effects, including cumulative effects, of the Project that were not identified in the DAR will also be identified).

Ongoing engagement activities will identify community concerns and adverse trends in the conditions of socio-economic VCs, and will be a key component of the Community Readiness Strategy and work of the MVHCWG that has been identified as a key component of the Socio-Economic 'Mitigation Strategies and Associated GNWT Commitments' contained in Section 9.16.1. Adaptive management in response to changing social and economic conditions will be employed by the appropriate authority(s) in an effort to mitigate adverse socio-economic trends, while enhancing/increasing potential benefits.

The approach to monitoring and follow-up for the socio-economic VCs described in this section should be reviewed in conjunction with the 'Mitigation Strategies and Associated GNWT Commitments' (Section 9.16), which provides useful context and background with respect to the MVHCWG (see Figure 9.4 in Section 9.16.1) that is responsible for the implementation of the Community Readiness Strategy via three Sub-Working Groups and five plans:

- Road Safety and Security Sub-Working Group (2 plans: a Safety and Security Plan for Vulnerable Community Members and a Road Safety Plan)
- Training & Employment Sub-Working Group (1 plan: Contractor Training and Employment Plan)
- Social Monitoring and Adaptive Management Sub-Working Group (2 plans: Social Monitoring Plan and a Well-Being Adaptive Management Plan)

The approach to monitoring and follow-up will consider the development and implementation of the Working Group/Sub-Working Groups and their respective plans (procedural aspects), as well as the understanding of potential project-related effects on the socio-economic environment (substantive aspects).

9.15.1 Guiding Principles

The principles that will guide follow-up and monitoring related to socio-economic VCs include:

1. Follow-up and monitoring will focus resources on key VCs/indicators for significant adverse effects and/or effects, including cumulative effects, that are a priority for communities, as well as positive effects/opportunities
2. At this point in the process, the approach to follow-up and monitoring is non-prescriptive (with the exception of the Section 9.16 'Mitigation Strategies and Associated GNWT Commitments', which contains a number of strategies / commitments directly relevant to monitoring and follow-up). The approach is intended as a foundation for further discussion with various parties, including communities, following completion of the project approval process (e.g., via Working Group, Sub-Working Groups, communities). This will occur during the establishment of Working Group/Sub-Working Groups and the development and implementation of the five plans.
3. The approach to follow-up and monitoring will be developed in collaboration with meaningful engagement.

A number of the strategies/commitments noted in Section 9.16 'Mitigation Strategies and Associated GNWT Commitments' will guide the follow-up and monitoring, including the following:

- *The foundation of this mitigative approach is community readiness and preparedness, continued engagement, and collaboration. In order to effectively identify, monitor and mitigate risks associated with the Project and potential negative impacts on individuals, families, and communities, the GNWT has and will continue to work closely with GNWT departments, Indigenous Governments, hamlets, community members, and interested stakeholders to prepare for the construction and operation of the Project and to monitor and adaptively manage effects of the Project. (Section 9.16.2)*
- *Through the implementation of these plans, the GNWT will avoid, mitigate, and adaptively manage potential negative effects associated with the Project. The development of the plans will involve local peoples and local knowledge integration and be developed collaboratively with communities. (Section 9.16.2)*
- *The Social Monitoring and Adaptive Management Sub-Working Group is responsible for annually monitoring changes in community well-being indicators related to Project activities and/or effects and responding with appropriate adaptive management measures. (Section 9.16.2.3)*

- *Activities identified as part of the Well-Being Adaptive Management Plan will be informed by and build on existing GNWT policies and programs related to Project effects. (Section 9.16.2.3.1)*
- *The Social Monitoring Plan provides the basis for the Social Monitoring and Adaptive Management Sub-Working Group and the MVHCWG to monitor socio-economic and well-being indicators, identify changes and trends. It will track the implementation of the activities identified in the Well-Being Adaptive Management Plan, the Contractor Training and Employment Plan, the Road Safety Plan and the Safety and Security Plan for Vulnerable Community Members. (Section 9.16.2.3.2)*

9.15.2 Preliminary Draft Monitoring and Follow-up Framework

The monitoring and follow-up framework for socio-economic VCs will focus on substantive and procedural aspects of the Project:

- Understanding changing existing conditions of socio-economic VCs in the LAA and RAA, the effectiveness of project mitigation measures, accuracy of effects prediction as documented in the DAR (both project-related effects and cumulative effects, and potential new/emerging effects of the Project that were not identified in the DAR)
- The development and implementation of the MVHCWG, the Sub-Working Groups, and their respective plans

The monitoring and follow-up framework will ensure that:

1. The Working Group and three Sub-Working Groups develop and implement the five specific relevant plans described in Section 9.16.2
2. Monitoring is in place to ensure that substantive and procedural commitments are achieved:
 - a. *Substantive in Support of the Plans:*
 - i. Information is available to support the development and implementation of the five plans (including the *Social Monitoring Plan* and *Well-Being Adaptive Management Plan*)
 - ii. Identification of relevant data/indicators already collected for other purposes (e.g., existing government-led, local or regional community-based monitoring)
 - iii. Identification and collection of relevant project-specific data/indicators
 - b. *Substantive in Support of Understanding Potential Effects of the Project:*
 - i. Potential adverse effects, including cumulative effects, with emphasis on effects identified as significant, or that are a priority for communities
 - ii. Potential benefits/positive effects
 - iii. Identification of new/emerging effects not identified in the DAR

- iv. Allow for attribution of effects to the Project, or proportional attribution in cases where there are multiple factors contributing to changes in the socio-economic environment
- c. *Procedural:*
 - i. The Working Group, Sub-Working Groups and five plans are developed and implemented within the identified timelines and compliant with the approaches described in Section 9.16, and the Working Group/Sub-Working Group processes (e.g., Sub-Working Groups are established, are following the guiding principles and meeting process as described in the DAR) are implemented/functional.
 - ii. Ensure that the groups/plans include mechanisms for adaptive management to address any adverse effects that are worse than predicted or were not predicted, as well as instances where positive effects/benefits or opportunities were not fully realized as predicted.

9.16 Summary of Mitigation and Commitments

The GNWT has developed a series of socio-economic commitments in the form of a suite of mitigation strategies, an adaptive management and monitoring framework, and additional VC-specific mitigation measures. The proposed mitigations are building on existing GNWT programs and services available across the NWT. Any funding requests for the proposed mitigations will include funding for the specific GNWT department providing support.

9.16.1 Mitigation Strategies and Associated GNWT Commitments

A Community Readiness Strategy has been developed to mitigate the potential negative socio-economic effects of the Project on the LAA and RAA communities and enhance the potential positive effects. The overall strategy is described in this section and includes sections that outline the specific role and commitments of the GNWT for each component. The Strategy will be led by a MVHCWG and involves the work of several sub-working groups that are focused on specific subject areas under the Strategy, each with associated specific plans.

The foundation of this mitigative approach is community readiness and preparedness, continued engagement, and collaboration. In order to effectively identify, monitor and mitigate risks associated with the Project and potential negative impacts on individuals, families, and communities, the GNWT has and will continue to work closely with GNWT departments, Indigenous Governments, Indigenous Organizations, hamlets, community members, and other interested parties to prepare for the construction and operation of the MVH and to monitor and adaptively manage effects of the Project.

The individual components of the strategy are referenced in the appropriate Mitigation sections of the effects assessments contained in Sections 9.5 through 9.9. In some cases, specific mitigation strategies have been identified for particular effects of the Project that are not part of the broader Socio-Economic Mitigation Strategy, these are contained in Section 9.16.2, immediately following this section. Figure 9.4 provides an overview of the different working groups and plans involved in the implementation of the Community Readiness Strategy, and also illustrates the connections with monitoring and adaptive management activities, which are described in more detail in Section 9.15.

Figure 9.4 Overview of Working Group Structure Associated with Community Readiness Strategy



9.16.2 Community Readiness Strategy

The GNWT will establish a MVHCWG that supports the development and oversight of a Community Readiness Strategy that outlines the overarching approach to enhancing benefits and minimizing risk. The envisioned working group is modelled to act in a similar fashion as the Thchq Highway Corridor Working Group but will be adjusted to reflect the realities and differences of the socio-economic environment along the Mackenzie Valley Highway corridor. Using a community-driven approach that involves shared decision-making and collaborative and participatory processes to address existing conditions and improve programs and services, the GNWT and the federal government can advance reconciliation and improve the quality of life for Indigenous community members.

The GNWT is proposing that the MVHCWG be composed of representatives from:

- Indigenous Governments (e.g., Pehdzéh Kì First Nation, Sahtu Secretariat Inc)
- Community governments
- Community organizations (e.g., Renewable Resources Councils, land corporations)
- Aurora College
- Government of Canada
- the GNWT Departments of JUS, INF, ECE, HSS, MACA, EIA, ITI and Housing NWT
- GNWT Consultants
- Construction Contractor

The MVHCWG will operate using the following guiding principles:

- Community input and involvement in decision-making are a critical component of identifying solutions that are appropriately responsive to community needs.
- A health equity lens will be used in the development of plans and the identification of activities and solutions to issues, to ensure that all segments of the community are able to benefit from the Project and that no groups are disproportionately affected by the Project.
- The MVHCWG responds to issues of community readiness as well as adverse effects that may arise during construction and operations; all concerns are brought to this forum and if and as appropriate, delegated to the appropriate Working Group.

The work of the MVHCWG and the Community Readiness Strategy will begin 1 year prior to the start of construction, be active during construction and will remain in effect for five years post-construction. The MVHCWG will meet face-to-face twice per year during the time that it is in place.

The MVHCWG will include three sub-working groups which will have responsibility for a series of associated plans, as follows:

- Road Safety and Security Sub-Working Group
 - Safety and Security Plan for Vulnerable Community Members
 - Road Safety Plan
- Training and Employment Sub-Working Group
 - Contractor Training and Employment Plan
- Social Monitoring and Adaptive Management Sub-Working Group
 - Social Monitoring Plan
 - Well-Being Adaptive Management Plan

The GNWT Role in and Commitments to MVHCWG:

- Provide base annual funding to support the work of the MVHCWG
- Provide one HSS position to focus on SEIA related monitoring associated with the Project
- Provide one INF position to focus on MVHCWG coordination and to chair meetings associated with the Project

9.16.2.1 Road Safety and Security Sub-Working Group

The Road Safety and Security Sub-Working Group is responsible for two plans: a Safety and Security Plan for Vulnerable Community Members and a Road Safety Plan. The Sub-Working Group will report to the MVHCWG. The Sub-Working Group will ensure that the approach to developing the plans leverages existing programs and identifies needed augmentation through adaptive management. Through the implementation of these plans, the GNWT will avoid, mitigate, and adaptively manage potential negative effects associated with the Project, and is informed by experiences, lessons learned and commitments made on other projects on highway safety and education. The development of the plans will involve local peoples and local knowledge integration and be developed collaboratively with communities.

This Sub-Working Group will be comprised of representatives from the GNWT Departments of INF, MACA, JUS, HSS as well as RCMP, and representatives from community governments and other affected parties (e.g., groups working with youth and women).

The Sub-Working Group will meet face-to-face once per year and three times a year virtually.

The GNWT Role in and Commitments to Road Safety and Security Sub-Working Group and associated plans:

- The GNWT will provide funding to coordinate and handle all logistics and expenses associated with the Road Safety and Security Sub-Working Group.
- The GNWT will ensure that information about the Project is shared with the Road Safety and Security Sub-Working Group to inform decision-making and planning activities.
- GNWT departments (JUS, HSS, EIA, MACA) will provide expert knowledge and advice on components of the plans where applicable and when appropriate.
- GNWT departments (JUS, HSS, EIA, MACA) will work with communities to identify existing programs and services that support LAA communities in achieving the objectives of the plans.
- The GNWT will provide financial and in-kind support to the LAA communities to develop their own Safety and Security Plans.
- The GNWT will provide financial support for one part-time community-based implementation coordinator per LAA community, specifically focused on the work related to the Road Safety Plan and the Safety and Security Plan for Vulnerable Community Members.
 - The positions would be in place for the period of construction and five years of operations.
 - The positions would be responsible to act as a liaison between communities and the Sub-Working Group on issues related to the work of the committee and keep community leadership and members informed about progress.

9.16.2.1.1 Road Safety Plan

Develop a Road Safety Plan (that aligns with the NWT Road Safety Plan, 2015) that supports safety along the Project by addressing the following needs:

- Improving communication along the Project (e.g., signage, communications)
- Raising public awareness about highway safety
 - Conducting highway safety information campaigns on topics such as: drinking/drugs and driving, hitchhiking risks, wildlife risks, winter driving risks, speed, seat belts
- Identifying segments of the population that are most at risk on the Project (e.g., youth, women, new drivers) to consider their unique circumstances and appropriately target education and awareness efforts and materials.
- Enforcing highway safety via implementation of standard practice patrols and check stops along the Project once operational.

9.16.2.1.2 Safety and Security Plan for Vulnerable Community Members

This plan, as it relates to the Project will be developed in collaboration with the GNWT Interdepartmental MMIWG Working Group²⁷ and community-based organizations that are focused on protecting women, children, youth, and vulnerable populations (e.g., 2SLGBTQQIA+, homeless or underhoused) from gender-based violence, family abuse, and family neglect. The plan will:

- Be based on a trauma-informed approach in order to be flexible enough to allow for the uniqueness of each community's and person's situation.
- Align with the GNWT's response to MMIWG – *Doing Our Part: Initial Response to 'Reclaiming Power And Place: The Final Report of the National Inquiry into Missing And Murdered Indigenous Women And Girls'*.
- Will consider findings from the social and well-being monitoring program for the Tłı̨chǫ Highway and the MVH Social Monitoring and Well-Being Adaptive Management Plan for the period of construction and a period of five years of operations after project construction is completed. It will also consider findings and approaches from other jurisdictions (e.g., the 'Community Safety Toolkit' developed by the Carrier Sekani Family Services (2006) along the Highway of Tears).
- Support the provision of safety education to women, youth and children to help them identify and assess risks of violence (physical, sexual, emotional) and reduce harms.
- Support the provision of public safety information throughout the community to build a culture of safety.
- Support the implementation and coordination of health and wellness promotional campaigns that target preparedness for change, addressing safety and security risks associated with the highway and health behaviour change as a result of the Project (e.g., STIs, family violence, mental health and addictions services) to women, children, and vulnerable populations.
- Support increased access to: emergency shelters; safe and affordable transportation (along the highway); communication along the road; education and training opportunities; employment opportunities; and culturally-based (on the land) mental health and addictions programs.

²⁷ Chaired by the Special Advisor to the Minister Responsible for the Status of Women, the working group includes appointed representatives from the departments of Executive and Indigenous Affairs (EIA), Health and Social Services (HSS), Justice (JUS), Education, Culture and Employment (ECE), and the Housing NWT Housing.

9.16.2.2 Training and Employment Sub-Working Group

To enhance positive effects from the Project the GNWT will establish a Training and Employment Sub-Working Group that informs and supports the development and implementation of a Contractor Training and Employment Plan and reports to the MVHCWG. The MVHCWG will collectively determine who should sit on the Working Group from the GNWT, education and industry partners, and community leadership and organizations.

The Sub-Working Group will meet face-to-face once per year and three times a year virtually for the time period it is in place.

The GNWT Role in and Commitments to Training and Employment Sub-Working Group and Associated Plan:

- The GNWT will provide funding to coordinate and handle all logistics and expenses associated with the Training and Employment Sub-Working Group.
- Ensure that information about project timing, progress and issues that arise are shared among all participants and with communities so they can be considered as part of planning for training and employment opportunities to ensure that positive effects of the Project are enhanced for LAA and RAA communities.
- Verifies a community based cultural awareness and anti-racism training is part of the Contractor Training and Employment Plan for non-NWT and non-Indigenous workers.
- The GNWT includes conditions in construction contracts that require the contractor to prepare a Contractor Training and Employment Plan that:
 - Outlines how they will increase on-the-job training for LAA and RAA residents.
 - Demonstrates through reporting that LAA and RAA residents and Indigenous people are being trained.
 - Demonstrates how local and Indigenous labour and businesses will be sourced.
 - Commits to cultural awareness and anti-racism training to mitigate potential adverse effects associated with presence of non-NWT/non-LAA/RAA workers.
 - Details how contractors will communicate and collaborate with LAA and RAA community governments and Indigenous organizations regarding their involvement in construction and operation.

9.16.2.2.1 MVH Contractor Training and Employment Plan

The Contractor Training and Employment Plan will be developed in collaboration by the Training and Employment Sub-Working Group with communities and in partnership with Aurora College and other education partners. The plan will outline the overall approach to education, training, and employment readiness for LAA and RAA residents so they can increase employment opportunities during construction and operations, will leverage existing programs and augment them through adaptive management and as identified through monitoring. The Plan:

- Identifies employment opportunities (types, numbers, timing/schedule and employment hiring requirements) during construction and operations, informed by information from the GNWT and contractors about the project schedule and well in advance of the beginning of construction
- Identifies availability of and gaps in skilled labour for construction employment opportunities in each of the communities including the creation of skill inventories, and seeks to address these to support optimizing training and employment opportunities
- Identifies barriers to increasing uptake in education and training courses (e.g., restricted drivers licences) and develops potential solutions to implement
- Identifies education, skills and training programs and courses required to address lack of available skilled labour for construction and operations in each of the communities, including sharing information about Labour Market Programs that can support communities, employers and organizations
- Identifies education and training programs and courses currently available (and where (local CLC or campus)/how offered (in-person/remote/blended)) and new programs and courses required to meet local need (as well as whether or not additional staffing and space requirements are necessary)
- Identifies potential funding to support education and training prior to construction, during construction and operations
- Plans for employment and local opportunity catchment to reduce a surge in the required labour force during construction, reducing the potential for in-migration to the region
- Explores feasibility of building workshops in each community to support hands-on learning opportunities
- Identifies existing programs that support cultural awareness and anti-racism training to mitigate potential adverse effects associated with presence of non-resident workers
- Ensure all communities are supported to prepare the workforce for employment opportunities through coverage of existing ECE programs and positions (e.g., Career Development Officers)
- Communities will be encouraged to develop community labour market plans to evaluate their needs in relation to the Project.

- ITI staff are available to discuss tourism readiness with communities and has funding available in various programs that can be used by communities to develop community led initiatives such as tourism plans as communities identify a need or desire to create a specific plan related to maximizing benefits and mitigating adverse effects associated with the operation of the Project, including:
 - Identifying barriers or gaps in the current state that need to be addressed to fully realize benefits from tourism
 - Identifying future potential for tourism development and promotion, and
 - Identifies additional needs and supports needed and available to mitigate adverse effects related to tourism as a result of the Project

9.16.2.3 Social Monitoring and Adaptive Management Sub-Working Group

Establish a Social Monitoring and Adaptive Management Sub-Working Group that develops a Social Monitoring Plan and a Well-Being Adaptive Management Plan. The Sub-Working Group reports to the MVHCWG and will be active during construction and for a period of five years during operations. The Sub-Working Group is responsible for annually monitoring changes in community well-being indicators related to project activities and/or effects and responding with appropriate adaptive management measures.

The working group is to be comprised of representatives of the communities and community organizations, and from the GNWT Departments of INF, ECE, HSS, MACA, JUS, Housing NWT, as well as community governments, RCMP, and relevant social and health agencies or other affected parties. Given that project-related social and health effects may be felt in both communities local to the Project (Norman Wells, Tulita, Wrigley) and also extend to regional communities (Fort Good Hope, Colville Lake, Délı̄ne, Fort Simpson), the Working Group will include representatives from both local and regional communities.

The Sub-Working Group will meet face-to-face once per year and three time per year virtually for the time that it is in place.

The GNWT Role in and Commitments to Social Monitoring Sub-Working Group and associated plans:

- The GNWT will provide funding to coordinate and handle all logistics and expenses associated with the Social Monitoring and Adaptive Management Sub-Working Group.
- The GNWT will ensure that information about project timing, progress and issues that arise are shared among all participants and with communities.
- The GNWT will provide funding for expenses related to monitoring and public reporting and communications.

9.16.2.3.1 Well-Being Adaptive Management Plan

The Well-Being Adaptive Management Plan will be collaboratively developed by subject matter experts and community members. It will identify actions to be implemented at the community level in the LAA and/or the broader RAA to mitigate negative effects. The GNWT will provide funding to support the implementation of these mitigations and additional work will be supported by the appropriate responsible program areas.

Activities identified as part of the Well-Being Adaptive Management Plan will be informed by and build on existing GNWT policies and programs related to effects of the Project. Implementation of the Adaptive Management Plan is supported by the GNWT and will be focused in the following areas:

- **Community Safety**
 - Explore the creation of Community Bylaw Officer positions in Tulita and potentially Norman Wells to strengthen community security, and where appropriate work with RCMP on measures related to drug and alcohol abuse, bootlegging, trafficking
 - Identify additional safety related resources to support and develop at the community-level (e.g., education about safe behaviour, creation of community bylaws)
 - Verify that there is increased enforcement and monitoring of security and safety by-laws in the first year of operation of the Project
 - Identify segments of the population particularly at risk of harm (e.g., youth, women) and ensure that their specific circumstances are considered in the planning and development of community safety initiatives
- **Community Wellness**
 - As a part of community readiness, work with communities to ensure that Community Wellness Plans consider project activities, potential effects, and are well positioned to enhance potential benefits and mitigate potential adverse effects associated with the Project during both construction and operations
 - In response to negative changes in monitoring indicators, expand health and wellness related programming in the areas of: drug and alcohol use and abuse, sexual and reproductive health, communicable diseases (e.g. COVID-19, influenza, STIs), healthy relationships, mental health, culture and identity as outlined in the adaptive management plan
 - Identify vulnerable segments of the population that may experience particular barriers or adverse effects related to the Project (e.g., Elders, 2SLGBTQQA+ persons, youth, women) and ensure that their specific needs are considered in the planning and design of wellness mitigations

- **Community Services**
 - Reviews existing uses and demands on services including childcare, schools and recreational facilities and identifies needs associated with any increased demands that may be associated with the Project (e.g., expansion of services)
 - Explore the development of recreational use management plans to manage and control access to formerly inaccessible places, if and as appropriate
 - Reviews existing uses and demands on health and social services and identify service needs and gaps associated with health and wellness that are being exacerbated as a result of adverse effects of the Project (e.g., increased drug and alcohol use may require additional health promotion efforts regarding HSS supports for individuals seeking treatment as well as options for On-the-Land healing in the community or region)
- **Substance Abuse and Bootlegging**
 - Support access to on-the-land treatment funding program and facilitate promotion of other addictions treatment and aftercare options
 - Explore the benefits of the Nishi program in response to concerns raised related to the Effects of the Project on substance abuse and use levels - the training through this program provides counsellors, health care workers, social workers, educators, community service agencies, government agencies, and others with tools and resources to help heal the trauma caused by addictions and abuse
 - Review existing policies on prohibition of alcohol, and through consultation with communities, RCMP and health staff, explore other strategies for managing alcohol and drug use in communities
 - Review the Tłıchʼo Highway monitoring report(s) and consider report results, including spikes in indicators, mitigative responses and adaptive management measures, and incorporate lessons learned where appropriate
 - HSS continue to provide education and awareness campaigns on the harms of alcohol and drug use, including specifically provide more information for local health nurses and counsellors on treatment and awareness of substance abuse
 - The RCMP continue to assess needs and allocate resources accordingly with any increased demands. There are no JUS commitments to the increase the existing Victim Services funding agreement related to the MVH. Agreements are made with community organizations and the Government of Canada and are reviewed periodically

9.16.2.3.2 Social Monitoring Plan

The Social Monitoring Plan provides the basis for the Social Monitoring and Adaptive Management Sub-Working Group and the MVHCWG to monitor socio-economic and well-being indicators. It will track the implementation of the activities identified in the Well-Being Adaptive Management Plan, the Contractor Training and Employment Plan, the Road Safety Plan and the Safety and Security Plan for Vulnerable Community Members. It will consider and apply the follow-up and monitoring framework that is described in Section 9.15.

- The Social Monitoring Plan will include identification of appropriate well-being indicators, associated trends and thresholds for change, and measure the overall effects of the Project on community well-being.
- The Social Monitoring Plan will track the indicators that are identified in the Plan during the construction of the Project and for the first five years of operations.
- The Social Monitoring and Adaptive Management Sub-Working Group Working Group will review and discuss the monitoring results on an annual basis and will provide annual reports to the communities, as well extend an invitation to meet and present directly to communities.

9.16.3 Additional Mitigation Measures

As indicated in Section 9.16.1, in a few cases, there were some specific mitigation measures identified for particular effects of the Project that were outside of the scope of the broader Community Readiness Strategy outlined in Section 9.16.1 because they were specific to project design considerations or reference other existing monitoring or mitigation plans. These are detailed in the appropriate effects assessment mitigation sections and are also summarized in Table 9.41.

Table 9.41 Additional Mitigation Measures

Socio-Economic Effect and VC	Mitigation Measures
Food Security (Human Health and Community Wellness)	<p>For those adverse effects of the Project on wildlife or vegetation that in turn reduce access to or availability of traditional foods, there are several mitigation measures that have been identified in the WMMP:</p> <ul style="list-style-type: none"> • Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities, in accordance with the WMMP. • The GNWT will work with the SRRB and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization. • Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project. Personnel will not feed, harass, or hunt wildlife while working on the Project.

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<p>Change in Nuisance (Air and Noise) (Human Health and Community Wellness)</p>	<p>The GNWT has committed to a series of measures to mitigate the Project's adverse effects on air quality and noise levels, which would in turn have an adverse impact on nuisance levels.</p> <p>For air quality:</p> <ul style="list-style-type: none"> • Cold starts of equipment will be limited to the extent possible. • Incinerators will be operated in accordance with manufacturer's specifications and emissions will meet Canadian Council of Ministers of the Environment Canada Wide Standards for Dioxins & Furans and Mercury. • Road surfaces will be repaired and maintained to reduce rolling resistance of vehicles. • The contractor will be encouraged to use modern construction equipment that has lower GHG emissions. • The contractor will be encouraged to use passenger vehicles (e.g., passenger van or bus) to move crews. • Vehicles and equipment will be maintained regularly. <p>For noise levels:</p> <ul style="list-style-type: none"> • The GNWT will engage with communities to inform them of the activities and the noise sources that will occur prior to construction. • The GNWT will develop a system to track complaints and responses to manage and mitigate feedback from the public regarding noise concerns. • Blasting activities will be limited to daytime hours to the extent practical. • Communities will be informed of time periods and characteristics of noise that may exceed the recommended noise threshold. • Methods to reduce the powder factor will be considered (e.g., through a combination of increased hole spacing, decreased column height of explosives, increased depth of stemming material in the blasthole, variable diameter blastholes) to reduce noise. • Project vehicles will avoid the use of residential roads, where possible. • The use of modified blasting techniques will be considered to reduce noise, including: use of electronic detonation instead of explosive detonation cord; use of air decking which involves the use of an inverted cone in the blasthole to constrain energy within the rock mass; timing sequence to develop an echelon effect; and, coordinating blast patterns towards a partially open face. • Transportation of construction materials and equipment via barge will be used to reduce the number of trucks for construction resupply along Hwy 1. • Use of residential roads by construction equipment will be limited, where possible. • Vehicles and equipment will be equipped with manufacturer recommended noise muffling equipment.

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<p>Change in Drinking and Recreational Water Quality (Human Health and Community Wellness)</p>	<p>The Water and Sediment Quality Chapter (Chapter 16) outlines a series of mitigation measures intended to reduce or eliminate the risk of changes in water and sediment quality. These measures are part of the GNWT's commitments that:</p> <ul style="list-style-type: none"> • A project-specific ESCP will be developed and implemented. • A project-specific PPP will be developed and implemented. <p>The GNWT has also committed to monitoring water and sediment quality to verify the effectiveness of mitigation measures and carry out adaptive management activities as needed.</p>
<p>Change in Public Safety (Human Health and Community Wellness)</p>	<p>Chapter 25, Accidents and Malfunctions, includes several commitments related to operation of the Project that are intended to reduce the potential for transportation accidents. These in turn would mitigate the effects of traffic accidents on public safety. These measures include:</p> <ul style="list-style-type: none"> • Regular public updates on road conditions and closures via the GNWT INF website. Road closure signage will be posted at the physical site where appropriate. • On-going maintenance of the road to repair degraded areas will provide safer driving conditions. • Operational use of the road will include highway enforcement of speed limits and safe driving laws. • Signage will be posted to identify known animal crossings or key habitat areas to prevent animal collisions with vehicles. <p>Additionally, the GNWT will require that contractors provide medical transportation services to its own workers, and this will be reflected in the Emergency Response Plan.</p>
<p>Change in Traditional Economy (Employment and Economy)</p>	<p>For those adverse effects of the Project on wildlife or vegetation that in turn reduce access to or availability of traditional foods, there are several mitigation measures that have been identified in the WMMP:</p> <ul style="list-style-type: none"> • Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities, in accordance with the WMMP. • The GNWT will work with the SRRB and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization. • Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project. Personnel will not feed, harass, or hunt wildlife while working on the Project.
<p>Change in Housing and Accommodation</p>	<p>Once construction is complete, the GNWT will investigate the potential repurposing of construction camps for use as housing in LAA communities.</p>

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Socio-Economic Effect and VC	Mitigation Measures
<p>Change in Social Infrastructure and Services (Infrastructure, Services and Institutional Capacity)</p>	<p>Chapter 25, Accidents and Malfunctions, includes several commitments related to construction and operation of the Project that are intended to reduce the potential for transportation accidents. These in turn would mitigate the effects of accidents on social infrastructure and services. These measures include:</p> <ul style="list-style-type: none"> • Implementation of best management and industry practices, as appropriate, to prevent or reduce the occurrence of vehicle accidents and driver error which may lead to transportation accidents due to collisions, roll over, or loss of control, such as: <ul style="list-style-type: none"> – Project vehicles will be driven by trained and competent drivers. – The project site during construction and operations will rely on traffic control speed limits, weight restrictions, and signage for safe driving conditions. – Project vehicles and equipment will undergo inspection prior to use by an operator. – Project vehicles will be required to have beacon lights and flagging. – Radio communication controls between project vehicle and equipment operators. – Zero access policy for members of the public during construction. – Regular updates on road changes during construction and operations and maintenance. • All on-site contractors will have industry-compliant and satisfactory Health, Safety and Environmental policies, programs, and manuals that will be successfully implemented throughout the Project. • The GNWT and its contractors will follow all management plans and the ERP, which addresses potential transportation accidents and malfunctions for the Project. • Regular public updates on road conditions and closures via the GNWT INF website. Road closure signage will be posted at the physical site where appropriate. • On-going maintenance of the road to repair degraded areas will provide safer driving conditions. • Operational use of the road will include highway enforcement of speed limits and safe driving laws. • Signage will be posted to identify known animal crossings or key habitat areas to prevent animal collisions with vehicles. • Additionally, the GNWT will require that contractors provide medical transportation services to its own workers, and this will be reflected in the Emergency Response Plan.
<p>Change in Public Infrastructure and Services (Infrastructure, services and institutional capacity)</p>	<ul style="list-style-type: none"> • The GNWT will obtain approval and agreement from the Town of Norman Wells, the Hamlet of Tulita and Wrigley to use their community water supplies, their sewage lagoon and solid waste disposal facilities. • A WMP will be developed and implemented.

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Change in Non-Traditional Land Use (Non-Traditional Land Use)	<p>Operations and Maintenance:</p> <ul style="list-style-type: none"> Meeting with LAA community governments to plan for traffic increases prior to opening of the Project, including signage and designated parking spaces within the LAA communities.
Change in Access to Non-Traditional Land Use (Non-traditional land use)	<p>Construction:</p> <ul style="list-style-type: none"> Construction personnel will be prohibited from using recreational all-terrain vehicles and snowmachines while working on the Project. Travel of construction-related vehicles will be confined to existing infrastructure roads and trails as much as possible to avoid disturbing vegetated areas. Removal of vegetation will be limited to the width of the ROW and workspaces. Transportation of construction materials and equipment via barge will be used to reduce the number of trucks for construction resupply along the Mackenzie Highway (Highway No. 1)
Change in Aesthetics (Non-Traditional Land and Resource Use)	<p>The GNWT has committed to a series of measures to mitigate the Project's adverse effects on air quality and noise levels, which would in turn have an adverse impact on aesthetics.</p> <p>For air quality:</p> <ul style="list-style-type: none"> Cold starts of equipment will be limited to the extent possible. Incinerators will be operated in accordance with manufacturer's specifications and emissions will meet Canadian Council of Ministers of the Environment Canada Wide Standards for Dioxins & Furans and Mercury. Road surfaces will be repaired and maintained to reduce rolling resistance of vehicles. The contractor will be encouraged to use modern construction equipment that has lower GHG emissions. The contractor will be encouraged to use passenger vehicles (e.g., passenger van or bus) to move crews. Vehicles and equipment will be maintained regularly. <p>For noise levels:</p> <ul style="list-style-type: none"> The GNWT will engage with communities to inform them of the activities and the noise sources that will occur prior to construction. Blasting activities will be limited to daytime hours to the extent practical. Communities will be informed of time periods and characteristics of noise that may exceed the recommended noise threshold. Methods to reduce the powder factor will be considered (e.g., through a combination of increased hole spacing, decreased column height of explosives, increased depth of stemming material in the blasthole, variable diameter blastholes) to reduce noise. Project vehicles will avoid the use of residential roads, where possible. The use of modified blasting techniques will be considered to reduce noise, including: use of electronic detonation instead of explosive detonation cord; use of air decking which involves the use of an inverted cone in the blasthole to constrain energy within the rock mass; timing sequence to develop an echelon effect; and, coordinating blast patterns towards a partially open face.

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Change in Aesthetics (Non-Traditional Land and Resource Use) (cont'd)	<ul style="list-style-type: none">• Transportation of construction materials and equipment via barge will be used to reduce the number of trucks for construction resupply along Hwy 1.• Use of residential roads by construction equipment will be limited, where possible.• Vehicles and equipment will be equipped with manufacturer recommended noise muffling equipment.
<ul style="list-style-type: none">• Change in Non-Traditional Land and Resource Use• Non-Traditional Land and Resource Use	<p>For those adverse effects of the Project on wildlife or vegetation that in turn reduce access to or availability of traditional foods, there are several mitigation measures that have been identified in the WMMP:</p> <ul style="list-style-type: none">• Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities, in accordance with the WMMP.• The GNWT will work with the SRRB and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization.• Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project. Personnel will not feed, harass, or hunt wildlife while working on the Project.

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10.0 ASSESSMENT OF POTENTIAL EFFECTS ON CARIBOU AND MOOSE

Caribou and Moose have been selected as a valued component (VC) because of the importance of caribou (*Rangifer tarandus* species) and moose (*Alces alces*) to people and the potential to be affected by the Mackenzie Valley Highway Project (the Project). The caribou and moose VC encompasses the boreal ecotype of woodland caribou (*Rangifer tarandus caribou*; hereafter referred to as boreal caribou), barren-ground caribou (*Rangifer tarandus groenlandicus*) of the Bluenose-East herd, and moose (*Alces alces*). Based on historical (i.e., 1996 to 2018) barren-ground caribou herd ranges and calving areas in the Northwest Territories (NWT), the Bluenose-East herd was determined to be the only barren-ground caribou herd with the potential to overlap the Project (NWT Species at Risk, 2022a).

The assessment of effects on caribou and moose contributes to the key line of inquiry (KLOI) of caribou, moose, and harvesting as described in the Terms of Reference (ToR) for the Developer’s Assessment Report (Mackenzie Valley Environmental Impact Review Board [MVEIRB, 2015; Public Registry {PR}#66]). A KLOI is a high priority issue, requiring a comprehensive assessment of potential effects due to its importance to communities along the existing Mackenzie Valley Winter Road (MVWR) right-of-way (ROW).

The assessment of effects on caribou and moose is related to other VCs. Changes to vegetation (Chapter 18), changes in noise (Chapter 13), air quality (including dust deposition; see Chapter 12), and water and sediment quality (Chapter 16) may affect terrestrial and aquatic habitats, which, in turn, may affect caribou and moose. As such, the residual effects of the Project on vegetation, noise, air quality, and surface water and sediment quality VCs were also used to assess potential effects of the Project on caribou and moose.

Changes in caribou and moose may influence other VCs. For example, changes in caribou and moose can affect other wildlife species (see Chapter 19), biodiversity (see Chapter 21), and traditional land and resource use and culture (see Chapter 11).

Boreal caribou are listed as threatened under Schedule 1 of the federal *Species at Risk Act* (SARA) and under the territorial *Species at Risk (NWT) Act*. Barren-ground caribou are designated as threatened by the Committee on the Status of Endangered Wildlife but are not listed under Schedule 1 of SARA (Government of Canada, 2019). Barren-ground caribou are listed as threatened under the territorial *Species at Risk (NWT) Act* (Conference of Management Authorities [CMA], 2020a). Moose are not listed federally and are territorially ranked as secure (Working Group on General Status of NWT Species [WGGSNS], 2021).

Boreal caribou and moose use habitats along the existing MVWR ROW, whereas the current annual range of barren-ground caribou of the Bluenose-East herd is located east of the Project and does not overlap the existing MVWR ROW (Technical Data Report [TDR] for Caribou and Moose; see Appendix 10A; Environmental Dynamics Inc. [EDI], 2023).

The assessment of potential effects on the Caribou and Moose VC concludes that with the application of mitigation measures, residual effects resulting from the Project on caribou and moose will be adverse. Residual effects and cumulative effects will not cause or further contribute to the exceedance of a conservation-based threshold, except for residual effects of the Project on boreal caribou from a change in habitat, which will further contribute to the exceedance of a conservation-based threshold. This effect is predicted to be significant. Other residual effects and cumulative effects are not expected to threaten the long-term persistence or viability of caribou and moose populations in the Caribou and Moose local assessment area (LAA) and therefore will be not significant.

10.1 Scope of Assessment

10.1.1 Regulatory and Policy Setting

The assessment of potential project-related effects on caribou and moose is guided by the ToR (MVEIRB, 2015 [PR#66]) and notable federal and territorial legislation and guidance.

10.1.1.1 Federal

The federal SARA (S.C. 2002, c. 29) protects species at risk in Canada. The legislation provides a framework to facilitate the recovery of species listed as threatened, endangered, or extirpated and to prevent species listed as special concern from becoming threatened or endangered (Government of Canada, 2016). Species at risk and their habitats are protected under SARA, which prohibits: (1) the killing, harming, harassing, capturing, or taking of threatened, endangered, or extirpated species (sections 32 and 36); and (2) the destruction of any part of the critical habitat of threatened, endangered, or extirpated species (sections 58, 60, and 61) (S.C. 2002, c. 29).

10.1.1.2 Territorial

The *Species at Risk (NWT) Act* (S.N.W.T. 2009, c.16) is used to identify, protect, and recover plant and animal species at risk in the Northwest Territories (the Government of the Northwest Territories [GNWT], 2022a). The Act facilitates the assessment and management of species at risk and their habitats to prevent further declines and promote recovery (GNWT, 2022a).

The *Wildlife Act* (S.N.W.T. 2013, c.30) provides general provisions for regulating activities related to the harvest and protection of wild animals in the NWT. The Act defines wildlife as “all species of vertebrates and invertebrates found wild in nature in the NWT” (S.N.W.T. 2013, c.30) and includes mammals, birds, reptiles, amphibians, and insects (GNWT, 2018).

10.1.1.3 Sahtu Land Use Plan

Specific to the areas to which the Sahtu Land Use Plan (SLUP) applies, the Project must meet the 13 general conformity requirements (CR) of the SLUP (Sahtú Land Use Planning Board [SLUPB], 2023). The SLUP’s conformity requirements include consideration of wildlife in CR#7 which are reproduced below as they relate to the Caribou and Moose VC:

“1) Land use activities must be designed using the most current information for identified species of interest and species at risk as obtained from the GNWT-ENR, CWS, DFO, PCA, the SRRB and the local RRCs.

2) Impacts to wildlife, their habitat and migration patterns, and important community harvesting areas must be prevented or mitigated to the extent possible.”

“a) In particular, all reasonable steps should be taken to follow the horizontal setbacks and minimum flight altitudes identified in Table 4 [of the SLUP] when near habitat sites during sensitive periods described in that table, unless human safety is of concern, and measures are developed with the appropriate organizations and the RRC to mitigate impacts to these species and their habitat.”

Conformity Requirement #2 requires that *“The proposed activities must be designed and carried out with due regard for community concerns and incorporate relevant traditional knowledge.”*

Additionally, per CR#14, the Project must be designed and carried out in a manner that protects, respects, or takes into account the values of the Conservation Zones (CZ) and Special Management Zones (SMZ) potentially affected by the Project as directed in the SLUP’s Zone Descriptions (SLUPB, 2023), including the following:

- Petiniṛah (Bear Rock) CZ (Zone #32)
- Mio Lake CZ (Zone #36)
- Norman Range SMZ (Zone #50)
- K’ąąłq Tué (Willow Lake Wetlands) SMZ (Zone #62)
- Deh Cho (Mackenzie River) SMZ (Zone #63)

10.1.2 Influence of Engagement

The GNWT has engaged with Indigenous Governments, Indigenous Organizations, and other affected parties. Detailed information regarding these engagement activities is presented in Chapter 2 (Consultation and Engagement), Chapter 3 (Traditional Knowledge), and Chapter 11 (culture and traditional land use). The GNWT has recently initiated Consultation.

Through the project-specific engagement program delivered between 2010-2012 and 2021-2023, including project-specific traditional land and resource use (TLRU) studies, and through a review of publicly available TLRU information, Indigenous Governments, Indigenous Organizations, and other affected parties shared information, expressed concerns, and provided recommendations related to caribou and moose. This feedback has been considered and summarized in Table 10.1 and has been integrated into the assessment of potential effects on caribou and moose that follows.

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10.0 Assessment of Potential Effects on Caribou and Moose

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Table 10.1 Summary of Engagement Feedback: Caribou and Moose

Comment	Source	GNWT Response	Where Addressed
Indigenous Governments and Indigenous Organizations identified important caribou habitat and harvesting areas within the Caribou and Moose LAA.	Dehcho First Nations, 2011; IMG-Golder Corporation, 2006; McDonald, 2011; SLUPB, 2023; NWRRC, 2023	The GNWT has reviewed and considered the important habitats and harvesting areas identified by Indigenous Governments and Indigenous Organizations.	For information about important wildlife habitat, see Section 10.2.2. See also Section 11.2.3.2 and Section 11.2.3.3 for additional information about important harvesting areas.
Indigenous Governments and Indigenous Organizations identified important moose habitat and harvesting areas within the Caribou and Moose LAA.	Dessau, 2012 (PR#13); NWRRC, 2023; SLUPB, 2023; SLUPB, 2022		
Engagement participants expressed concern about increased exposure of boreal caribou near Tulita along the MVWR. Engagement participants expressed concern around lack of range and protection plans for moose and caribou.	April to July 2022 Engagement	The GNWT has identified mitigation measures to reduce the effects on moose and caribou. A Wildlife Management and Monitoring Plan (WMMP) will be developed and implemented.	For mitigation measures to reduce effects on caribou and moose, see Table 10.7. See also: Section 10.4.2 Change in Habitat Section 10.4.3 Change in Movement Section 10.4.4 Change in Mortality Risk Section 10.4.5 Change in Health Section 10.8 Follow-up Monitoring and Management Volume 5 for Management Plans.
Dehcho First Nations and Pehdzéh Kì First Nation reported that caribou are more sensitive to habitat loss (than other wildlife), which increases exposure of boreal caribou to wolf predation. Concerns have been raised about the potential of future development and cumulative effects on harvesting boreal caribou for TLRU, in relation to increasing wolf predation and habitat loss.	Dehcho First Nations, 2011; IMG-Golder Corporation, 2006	Wildlife monitors will assess for the presence of wildlife in or near the PDA during project activities and mitigation will occur in accordance with the approved WMMP. Currently, outfitters are not permitted to outfit moose or caribou harvest outside of outfitter	

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Comment	Source	GNWT Response	Where Addressed
<p>Norman Wells Renewable Resources Council (NWRRC) and Tulita Renewable Resources Council (TRRC) study participants reported that boreal caribou avoid the winter roads due to sensory disturbance (i.e., noise, pollution), and raised concerns about the effects of future road construction and operations, which have the potential to affect the availability and accessibility of caribou for cultural use within proximity of the highway. NWRRC participants raised concerns that land users will have to travel further to hunt boreal caribou once the Project is underway.</p>	<p>NWRRC, 2023; TRRC, 2022</p>	<p>zones in the mountains (GNWT, 2021a). Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project. Personnel will not feed or harass wildlife while working on the Project. Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP.</p>	
<p>Dehcho First Nations and Pehdzéh Kì First Nation, NWRRC and TRRC TLRU study participants reported that caribou are more sensitive to development activities (than other wildlife). Concerns have been raised about the potential of future development and cumulative effects on harvesting boreal caribou for TLRU, including increased non-resident hunters.</p> <p>Engagement participants reported that in the past caribou would come close to or in the Mackenzie River (Deh Cho) from the east side, but now caribou are moving further away due to disturbances.</p>	<p>Dehcho First Nations, 2011; IMG-Golder Corporation, 2006; NWRRC, 2023; TRRC, 2022; April to July 2022 Engagement</p>	<p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties during advancement of project design and planning.</p>	

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Comment	Source	GNWT Response	Where Addressed
<p>Dehcho First Nations and Sahtu community members and NWRRC study participants reported that potential project effects on moose along the MVWR and the within the Caribou and Moose LAA include increased hunting pressure by non-resident hunters and increased fatalities of moose because of increased traffic in the area.</p>	<p>NWRRC, 2023; Dessau, 2012 (PR#13)</p>	<p>The GNWT will work with Sahtú Renewable Resources Board (SRRB) and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization.</p>	
<p>NWRRC study participants reported that potential project effects on moose include the effect of noise and existing effects on moose in the TLRU study area. The intensity of noise can affect the level of response in wildlife, particularly moose. Engagement participants expressed concern about blasting activities scaring the moose.</p>	<p>NWRRC, 2023; November to December 2022 Engagement</p>		
<p>Dehcho First Nations reported potential pathways which may influence moose, including direct disturbance to calving habitats and preferred habitats (for preferred food, i.e., lichens) such as wetlands and marshes, as well as migration routes and corridors.</p>	<p>Dehcho First Nations, 2011; McDonald, 2010</p>		
<p>Engagement participants expressed concern for wildlife, in particular moose habitat, as the new all-season road may result in poaching. Participants expressed that there is increasing importance to protect country food access, including moose and moose habitat.</p>	<p>April to July 2022 Engagement</p>		

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10.0 Assessment of Potential Effects on Caribou and Moose

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Comment	Source	GNWT Response	Where Addressed
<p>Engagement participants stated that easier access to game is not a bad thing as long as people are not overharvesting; this applies not just to sustenance harvesters but recreational harvesters as well. Participants requested that the GNWT consult with experienced hunters on the proposed route to avoid important habitat, including caribou mating grounds.</p>	<p>April to July 2022 Engagement</p>		
<p>Engagement participants expressed concern about the creation of borrow sources and their effects on key species such as moose and caribou; participants requested that moose habitats, such as willow and little creeks, be maintained. Engagement participants recommended that the Project be rerouted around moose pastures.</p>	<p>April to July 2022 Engagement</p>		
<p>Engagement participants explained that caribou avoid culverts and migrate around them because the noise of the wind tunneling through the culverts scares them away. The land has natural vibrations and when there are heavy loads traveling on the road, more vibration is created. Participants requested that vibration levels be monitored before and after construction.</p>	<p>November to December 2022 Engagement</p>		

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October 2023

Comment	Source	GNWT Response	Where Addressed
Engagement participants stated that there may be an increase of hunters along the highway, in addition to wildlife effects as a result of building the road and vehicles travelling down the road; they recommended a 5- or 10-year moratorium on hunting to protect and monitor the baseline of the caribou and the moose, explaining that the outfitters in the mountains are going after the big ones and will now have new access.	November 2022 to February 2023 Engagement		
Study participants reported instances of non-resident workers in the Caribou and Moose LAA releasing wildlife from traps and feeding wildlife. NWRRC expressed concern about feeding wildlife because wildlife will look forward to human interaction and may need to be put down.	NWRRC, 2023		Section 10.4.4.2

10.1.3 Potential Effects, Pathways and Measurable Parameters

Table 10.2 summarizes the Project's potential effects on caribou and moose, the pathways by which they may affect caribou and moose, and the measurable parameters (i.e., parameters that can be qualified or quantified) for evaluating effects. Potential effects and measurable parameters were selected based on professional judgment, recent environmental assessments for road projects in the NWT, and regulatory concerns for certain species.

Table 10.2 Potential Effects, Effects Pathways and Measurable Parameters for Caribou and Moose

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in habitat	Construction and operations and maintenance of the Project could result in a direct loss (e.g., through vegetation clearing) and indirect alteration (e.g., through sensory disturbance) of caribou and moose habitat.	Quantitative evaluation of the amount (hectares [ha]) of caribou and moose habitat directly lost and indirectly influenced by the project-related disturbances.
Change in movement	Construction, and operations and maintenance of the Project could alter caribou and moose movement patterns or movement corridors.	Qualitative evaluation of the project effects on caribou and moose movement (e.g., barrier permeability)
Change in mortality risk	Construction and operations and maintenance of the Project could increase mortality risk or the number of caribou and moose fatalities through: <ul style="list-style-type: none"> • Direct pathways (e.g., through collisions with vehicles and Project equipment) • Indirect pathways (e.g., through increased harvest pressure via improved access and increased predation via apparent competition with more productive alternative prey species or facilitated predation by wolves [<i>Canis lupus</i>], and black and grizzly bears [<i>Ursus americanus</i> and <i>Ursus arctos</i>, respectively]) 	Qualitative evaluation of direct and indirect mortality risks for caribou and moose: <ul style="list-style-type: none"> • Risk of mortality associated with increased harvest pressure through improved hunter access to the LAA • Risk of mortality associated with collisions with vehicles and project equipment • Risk of mortality associated with increased predation via apparent competition (with more productive alternative prey species) or facilitated predation by wolves and bears
Change in health	<ul style="list-style-type: none"> • Construction and operations and maintenance of the Project could expose caribou and moose to contaminants or emissions that may affect their health and condition. • Construction and operations and maintenance of the Project could result in changes in energetics and physical condition because of sensory disturbance, increased predation, and increased hunting pressure. 	Qualitative evaluation of changes in health and physical condition of caribou and moose (e.g., overall appearance, weight, or presence of diseases and parasites) relative to baseline information

10.1.4 Boundaries

10.1.4.1 Spatial Boundaries

The PDA and Caribou and Moose LAA are the spatial boundaries used to evaluate residual and cumulative project effects on caribou and moose. The areas are described below and illustrated in Figure 10.1.

- **Project Development Area (PDA):** The area of direct project disturbance within which works and activities will occur (i.e., the footprint). This includes a new two-lane gravel highway, a 60 metres (m) wide highway ROW, laydown and staging areas, maintenance yards, construction camps, and quarry/borrow sites with access roads on a 30 m ROW. The size of the PDA is 2,315.2 ha, with 807.9 ha in the Dehcho Region and 1,507.3 ha in the Sahtu Region.
- **Caribou and Moose LAA:** The Caribou and Moose LAA is the area within 15 kilometres (km) of the PDA. The Caribou and Moose LAA is 1,010,983.4 ha, with 359,038 ha in the Dehcho Region and 651,945.4 ha in the Sahtu Region. That area establishes an assessment area relevant to wide-ranging ungulates and appropriate to the Project’s scale. The area provides context for characterizing the significance of potential Project and cumulative effects. The Caribou and Moose LAA extends to the regional assessment area (RAA) boundary used for other wildlife species. To differentiate the LAA used for caribou and moose from the LAA and RAA used for other wildlife, it is hereafter referred to as the Caribou and Moose LAA. There is no RAA for caribou and moose.

The Caribou and Moose LAA was selected as a balance between areas either too large and irrelevant to the scale of the Project, or too small and does not inform on regional habitat conditions. The spatial bounds considered project scale, ecological relevance, environmental assessment best practices, practicality (e.g., CEEA 1996, Hegmann et al 1999, João 2002, Peeters et al. 2018, BC EAO 2020), and public and MVEIRB comments on assessment area boundaries used for the environmental assessment of a comparative project—the Tłı̨ch̨o All-Season Road Project (EA-1617-01).

Defining the caribou and moose LAA was not straightforward. The Caribou and Moose LAA was a trade-off between ecological (e.g., population-level) and project-scale (e.g., disturbance within reason) boundaries. Too large an area dilutes the potential effect of the Project (by making comparisons to vast and potentially unrelated areas to the Project), and too small an area exaggerates (e.g., focused solely on the footprint of the Project within comparing to remaining, uninfluenced areas) potential effects.

Neither moose nor caribou have discrete population or population management boundaries that would directly relate to the project's potential residual or cumulative effects. The boreal caribou NT1 range is expansive; there are no defined moose population boundaries; the Project crosses through caribou sub-population boundaries and wildlife management zones; and, land use plan boundaries extend well beyond the influence of the Project.

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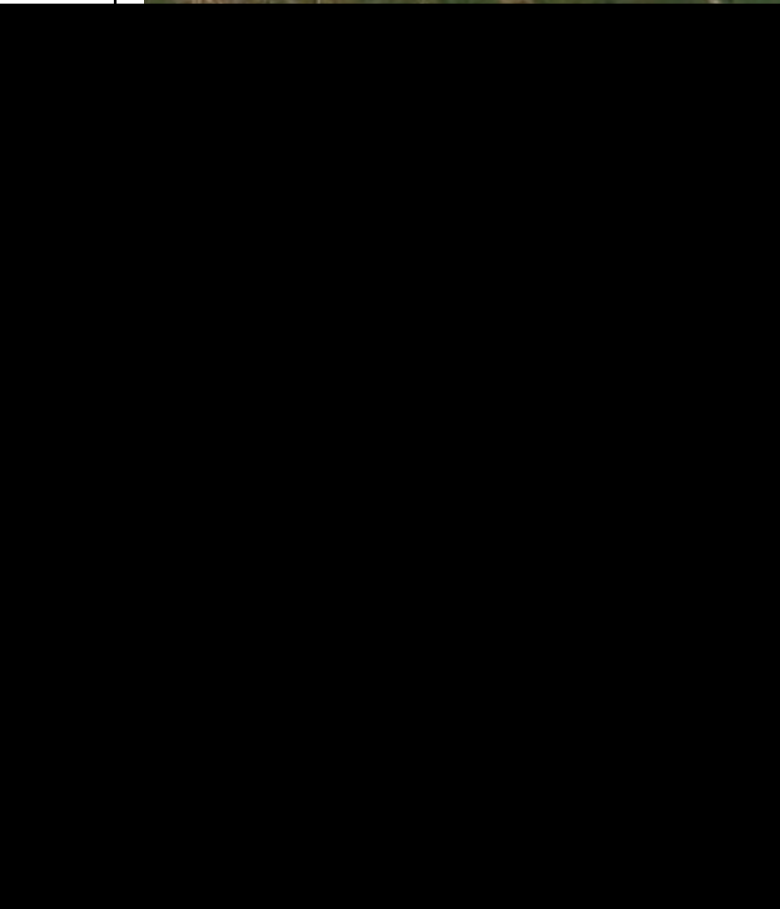
An area within 15 km of the PDA was selected as a reasonable area to characterize the potential effects of the Project on moose and caribou. Given local habitat, known distribution, and the nature of the Project (a relatively low-traffic, all-season road connecting communities), it is a reasonable area for the following specific reasons:

- 15 km is the estimated maximum distance caribou moved in 24 hours, and that scale was used as a measure of second-order habitat selection by DeMars et al. (2020).
- The potential zone of influence from roads is unlikely to extend to 15 km. Polfus et al. (2011) found that the distribution of a small sample of collared northern mountain woodland caribou in northern BC were influenced by high-use roads (paved or plowed during winter) to 2 km, and low-use roads (gravel/dirt roads) out to 1 km. Leblond et al. (2013) found that the distribution of 53 collared boreal caribou was affected within 5 km of a highway before, during and after modifications (construction to widen) of a 90 m wide, four-lane highway, with an average traffic of 186 vehicles per hour in southeast Quebec (i.e., a substantially larger road than the Project). In its review of the Tłı̄chǫ All-Season Road Project, the MVEIRB agreed with the Wek’èezhì Renewable Resources Board’s suggested 2,500 m buffer on each side of that road would likely capture that project’s effects on boreal caribou effective habitat (MVEIRB, 2018; EA-1617-01 [PR#286]).

The annual range of barren-ground caribou (of the Bluenose-East herd) is currently east of and outside of the Caribou and Moose LAA. Their historical annual range overlaps with the eastern portion of the Caribou and Moose LAA (Section 10.2.2.2). Moose use the Mackenzie River (Deh Cho) and its shores, islands, and surrounding habitat, which overlap the Caribou and Moose LAA. Moose use the Mackenzie River (Deh Cho) and its shores, islands, and surrounding habitat, which overlap the Caribou and Moose LAA.

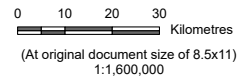
The Inuvik to Tuktoyaktuk Highway Project used a 15 km regional study area (Kiggiak – EBA Consulting Ltd. 2011). The Tłı̄chǫ All Season Road used the boreal caribou NT1 population boundary as a regional study area for the assessment on caribou, and a 35 km radius buffer for the assessment on moose (Golder Associates Ltd. 2017). However, the MVEIRB found the scale of NT1 to be inappropriately large and diluted the effects on caribou (MVEIRB, 2018; EA-1617-01 [PR#286]). There was no discussion on the suitability of the area used for moose.

Based on the species distributions, the Caribou and Moose LAA adequately captures the potential residual and cumulative effects of the Project interacting with the effects of other past, present, and reasonably foreseeable future projects.



Canyon Creek Air Season
 Access Road (Constructed)
 Prohibition Creek Access
 Road (In Construction)
 Proposed Great Bear River
 Bridge

Caribou and Moose Local
 Assessment Area
 Community
 Northwest Territories
 Highway
 Winter Road
 District Boundary
 Region Boundary
 Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by AT on 8/7/2023
 TR by AJ on 8/7/2023

Client/Project: 144903025-0096 REVA

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No.

10.1

**Caribou and Moose Local
 Assessment Area**

Notes

- Coordinate System: NAD 1983 Northwest Territories Lambert
- Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics. n.d. Inventory of Landscape Change Map Viewer, GNWT. Centre for Geomatics. n.d. Open Data, MVLWB. n.d. Public Registry, Sahtu Land and Water Board. n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd. 2015-2016
- Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS. Imagery date: 2021

10.1.4.2 Temporal Boundaries

The following temporal boundaries are used in the assessment of potential effects on caribou and moose:

- Construction phase:** The Project will take approximately 10 years to construct over a timeframe of up to 20 years. The conceptual schedule assumes the highway will be constructed in three consecutive segments, beginning in approximately 2026: Wrigley north to the Dehcho–Sahtu border (102 km); Tulita south to the Dehcho–Sahtu border (134 km); and Tulita north to the Prohibition Creek Access Road (45 km). The conceptual schedule assumes the Project would be fully constructed and provide all-season connection to Norman Wells sometime between 2041 and 2046.
- Operations and maintenance phase:** The operations and maintenance phase will commence in a staged manner once construction of each segment has been completed. The operations and maintenance phase is considered indeterminate as the highway is intended to be permanent infrastructure.

A closure and reclamation phase is not applicable to the Project. Closure and reclamation of temporary workspaces, and borrow sources and quarries used only for construction are included within the construction phase.

10.1.5 Residual Effects Characterization

Table 10.3 presents definitions for characterizing residual effects on caribou and moose. The criteria describe the potential residual effects after mitigation measures have been implemented. The difference between caribou and moose in the magnitude characterization for direct change in habitat is based on the species’ different conservation status (Section 10.2.2).

Table 10.3 Characterization of Residual Effects on Caribou and Moose

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	<p>Adverse: A residual effect that moves measurable parameters of caribou and moose in a negative direction relative to baseline</p> <p>Neutral: No net change in measurable parameters for the caribou and moose relative to baseline</p>
Likelihood	The probability that the residual effect will occur	<p>Unlikely: The residual effect is almost certainly not to occur.</p> <p>Possible: The residual effect could occur.</p> <p>Certain: The residual effect will certainly occur.</p>

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Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of direct change in caribou and moose habitat	<p>Low: The Project affects less than 5% of caribou habitat and less than 10% of moose habitat in the Caribou and Moose LAA.</p> <p>Moderate: The Project affects between 5% and 10% of caribou habitat and between 10% and 20% of moose habitat in the Caribou and Moose LAA.</p> <p>High: The Project changes more than 10% of caribou habitat and more than 20% of moose habitat in the Caribou and Moose LAA.</p>
	<p>The indirect change in caribou and moose habitat</p> <p>The change in caribou and moose abundance and/or distribution</p> <p>The change in caribou and moose health</p>	<p>Low: Measurable changes in indirect habitat change and the abundance, distribution, or health of caribou and moose in the Caribou and Moose LAA are not anticipated; however, minimal effects may occur.</p> <p>Moderate: Measurable changes in indirect habitat change and the abundance, distribution, or health of caribou and moose in the Caribou and Moose LAA may become a management concern.</p> <p>High: Measurable changes in indirect habitat change and the abundance, distribution, or health of caribou and moose may occur and expected exceedances in the baseline values can represent a management concern.</p>
Geographic Extent	The geographic area in which a residual effect occurs	<p>PDA: The residual effect is expected to be restricted to the PDA.</p> <p>Caribou and Moose LAA: The residual effect is expected to extend into the Caribou and Moose LAA.</p>
Timing ¹	Considers when the residual effect is expected to occur relative to sensitive periods for caribou and moose	<p>No sensitivity: The residual effect is not expected to occur during critical life stages (e.g., outside of calving and post-calving season).</p> <p>Moderate sensitivity: The residual effect may occur during a lower sensitive period of a critical life stage (e.g., during the period leading up to calving or during a period after post-calving) or during a less sensitive critical life stage (e.g., rutting).</p> <p>High sensitivity: The residual effect occurs during a critical life stage (e.g., happens during calving and post-calving season).</p>
Duration	The time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured	<p>Short-term: The residual effect is expected to be restricted to one segment of the construction phase (for up to or less than 5 years).</p> <p>Medium-term: The residual effect could extend through construction (for up to 20 years).</p> <p>Long-term: The residual effect is expected to extend beyond construction and into or through operations and maintenance (for more than 20 years).</p>

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	<p>Single event: The residual effect is expected to occur once.</p> <p>Irregular event: The residual effect is expected to occur at no set schedule.</p> <p>Regular event: The residual effect is expected to occur at regular intervals.</p> <p>Continuous: The residual effect is expected to occur continuously.</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	<p>Reversible: The residual effect is likely to be reversed after activity completion and reclamation.</p> <p>Irreversible: The residual effect is unlikely to be reversed.</p>

Note:

¹ The critical life stages for boreal caribou are: 1) late winter (March 16 to April 5 for the Dehcho and Sahtu regions combined) when deep snow increases the energetic costs of movement, particularly for pregnant females; and 2) calving/post-calving (May 1 to July 12 for the Dehcho and Sahtu regions combined) when calves are most susceptible to mortality (GNWT, 2022b). The critical life stages for moose include calving/post-calving (May 15 to July 15), when calves are most susceptible to predation and disturbance (Rausch et al., 2008; GovBC, 2009; British Columbia Ministry of Forests, Lands and Natural Resource Operations [BC MFLNRO], 2014; Environment Yukon, 2016a). Therefore, the combined critical life stages for boreal caribou and moose are March 16 to April 5 and May 1 to July 15.

10.1.6 Significance Definition

A significant adverse residual effect on caribou and moose is one that, following the application of avoidance and mitigation measures: 1) causes or further contributes to the exceedance of a conservation-based threshold; or 2) threatens the long-term persistence or viability of caribou and moose populations in the Caribou and Moose LAA.

Environment and Climate Change Canada (ECCC, 2020) provides a conservation-based undisturbed habitat threshold for boreal caribou as 65% of undisturbed habitat in their range to maintain a self-sustaining local population (i.e., no more than 35% disturbed habitat). The GNWT (2019) applies the same threshold to the NT1 but accounts for natural wildfire occurrence in the separate Range Planning Regions within NT1. For regions with naturally lower levels of wildfire (e.g., Sahtu Region), the minimum acceptable likelihood of self-sustaining caribou populations is set at 67%, corresponding to a maximum total disturbance level of 30%. For regions with naturally high levels of wildfire (e.g., Southern NWT), the minimum acceptable likelihood of a self-sustaining population is set at 50%, corresponding to a maximum total disturbance limit of 40%. Middleton and Nisbet (1997) define a viable population as one with enough individuals to persist over a given period.

Moose densities and caribou populations for the Sahtu and Decho regions areas were summarized in the Caribou and Moose TDR (Appendix 10A; EDI, 2023). Moose densities are 1–7 moose /100 km² at low density and 4–7 moose/100 km² at high density. Moose are believed to be high in the Dehcho region (Dehcho First Nations, 2011). Using the mid-points (4 moose/100 km² at low density and 5.5 moose/100 km² at high density), and the areas of each region in the Caribou and Moose LAA (Sahtu: 6,188 km²; Dehcho: 3,326 km²). Based on area alone, recognized as a simplistic approach, there could be about 248 moose in the Sahtu and 183 moose in the Dehcho portions of the Caribou and Moose LAA. There are an estimated 1,677 caribou in the entire Sahtu and 2,318 caribou in the Dehcho (SARC 2022). As above, using the simplistic area calculation that is based on the proportion of the Caribou and Moose LAA to the total regional areas, 37 caribou in the Sahtu and 50 caribou in the Dehcho regions are accounted for in the Caribou and Moose LAA.

Should project effects on mortality (direct or indirect) prove substantial, further analysis could be completed on the viability of caribou and moose as a closed population within the Caribou and Moose LAA.

10.2 Existing Conditions for Caribou and Moose

Residual effects (Section 10.4) are assessed relative to the existing or baseline conditions for caribou and moose. This section provides a brief overview of baseline conditions for caribou and moose in the Caribou and Moose LAA based on existing conditions reported in the Caribou and Moose TDR (Appendix 10A; EDI, 2023).

10.2.1 Methods

The Caribou and Moose TDR (Appendix 10A; EDI, 2023) was developed to address the ToR (MVEIRB, 2015 [PR#66]) using a review of currently available information. Relevant caribou and moose information was reviewed from multiple sources, including: traditional knowledge (TK) and TLRU information, scientific literature and unpublished documents. The review results were used to characterize baseline conditions for caribou and moose within the Caribou and Moose LAA. An overview of this information is provided in Section 10.2.2.

10.2.2 Overview

10.2.2.1 Boreal Caribou

Boreal caribou is listed as threatened under Schedule 1 of the federal SARA and the territorial *Species at Risk (NWT) Act* (NWT Species at Risk, 2022b). Boreal caribou move within their NWT range according to their seasonal needs (e.g., lichen availability or suitable calving habitat). They spend most of the year in open bog and closed canopied black spruce habitats, although there may be some seasonal movement to preferred calving and wintering areas. Females disperse at low densities across the landscape during the calving and post-calving periods (May 1 to July 12 for the Dehcho and Sahtu regions combined; GNWT, 2022b) and tend to favour treed islands surrounded by open water in peatlands, lakes, and ponds to reduce predation risk (Species at Risk Committee

[SARC], 2022). During summer, foraging areas consist primarily of open coniferous forests with abundant lichen, low shrubs, riparian areas, and sparsely vegetated and recently burned habitats (Nagy et al., 2005). During and after the fall rut, boreal caribou use a greater variety of habitats. In winter, they prefer open coniferous forests with terrestrial and arboreal lichens in areas where snow is shallow and soft (SARC, 2022), providing favourable conditions for foraging of terrestrial lichens and travel.

Indigenous and resident hunters in the NWT lawfully harvest boreal caribou. While overall boreal caribou harvest to date is low, there are concerns about the potential of local overharvesting, particularly in the vicinity of communities, roads, and waterbodies that may facilitate access to boreal caribou habitat (ECCC, 2020; SARC, 2022). As described in the TDR for Caribou and Moose (see Appendix 10A; EDI, 2023), in the NWT, the boreal caribou harvest is regulated, and resident hunters can hunt one male caribou between July 15 and December 15 annually (GNWT, 2021a). Non-resident hunters cannot harvest boreal caribou in the NWT. Indigenous hunters can hunt boreal caribou without restrictions all year and General Hunting License holders (“an Aboriginal [i.e., Indigenous] person that is a member or eligible to be a member of an NWT organization listed in the regulations”) can hunt male caribou only (with a tag) between July 15 and December 15 (GNWT, 2021a). The TRRC reported that caribou are harvested year-round within the TLRU study area (TRRC, 2022).

While the GNWT currently monitors resident hunter harvest and population parameters for boreal caribou, such as survival rates and calf recruitment rates, no accurate estimates of Indigenous harvest or current population sizes for boreal caribou in the NWT are available (GNWT, 2020e). Current population monitoring data indicate that without human harvest, NWT boreal caribou are either stable or have the capacity for a small annual population increase in the areas studied (GNWT, 2020e). The monitoring results indicate that southern areas in the NWT boreal caribou range may not have the capacity to withstand any harvest and northern areas may support limited harvest levels without resulting in population declines. However, as these calculations do not include estimates of Indigenous harvest or accurate population estimates, it is not possible to determine absolute sustainable harvest levels for boreal caribou.

The development of roads and trails has the potential to increase access for harvesters and predators (CMA, 2020b) and may create energetically costly disturbances (through increased stress and avoidance behaviour), and/or create barriers to boreal caribou movement (Caribou and Moose TDR; see Appendix 10A; EDI, 2023). Boreal caribou may be affected indirectly by the Project via access roads potentially connecting to the completed all-season highway. Linear features, such as roads and trails, may improve hunter access to previously inaccessible areas, resulting in additional harvest and associated mortality (ECCC, 2020).

In the NWT, boreal caribou have a continuous range that has not yet experienced anthropogenic habitat fragmentation and degradation at the same level as in other Canadian jurisdictions. Accounting for fires ≤ 40 years old and existing anthropogenic disturbances plus a 500 m buffer, there is a combined 52.3% of existing disturbed habitat in the Caribou and Moose LAA, which exceeds the 35% threshold identified by ECCC (2011, 2020), or the 30–40% threshold that varies

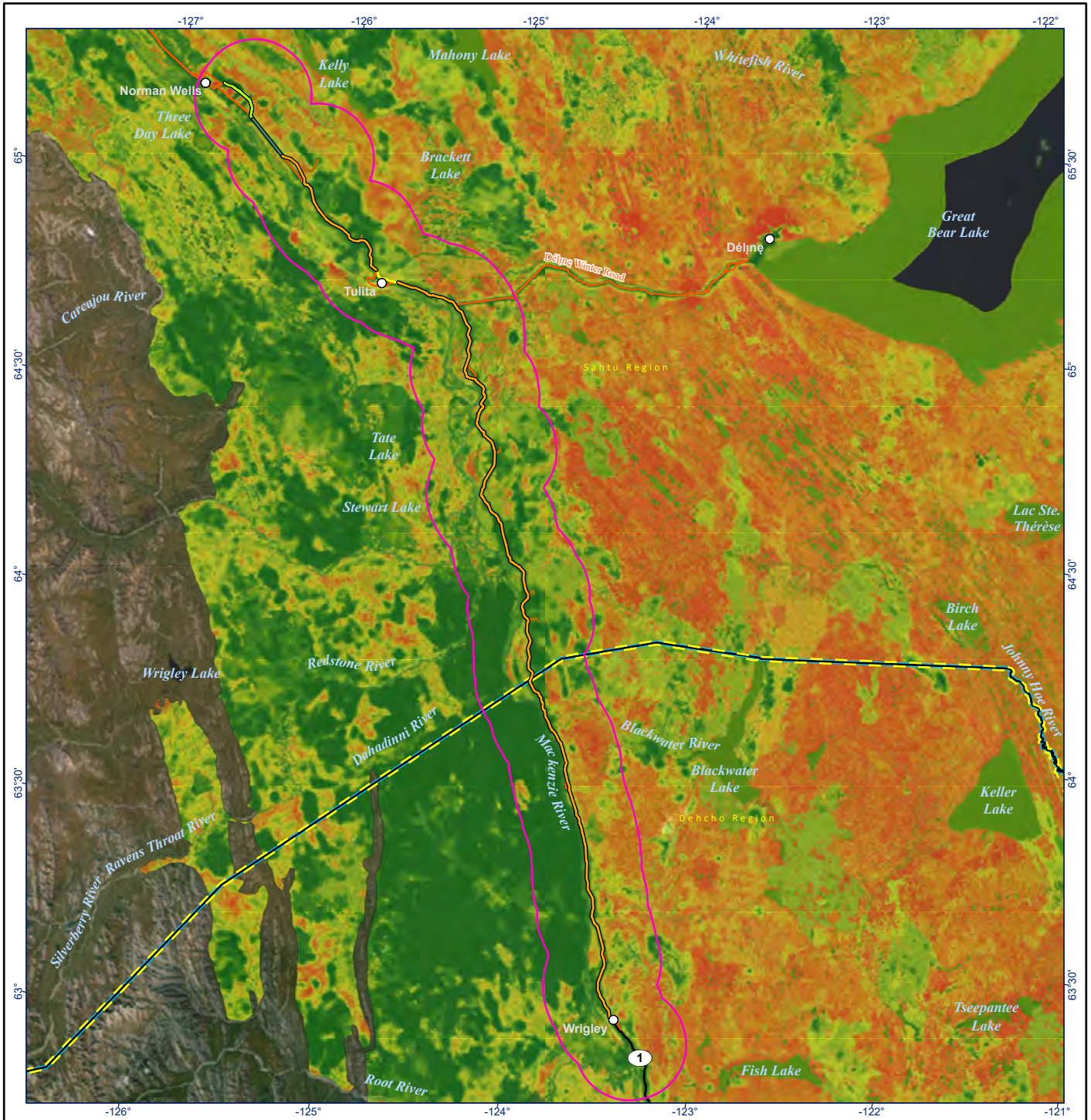
by Range Planning Regions in NT1 (GNWT 2019) (see the discussion in Section 10.1.6 and the area calculations in Section 10.5.2.3.1).

Boreal caribou in the NWT do not form cohesive herds. Instead, they are one continuous population of loosely distributed individuals occurring at low densities (individually or in small groups) across their range (GNWT, 2019). Because boreal caribou are naturally found at low densities, large areas of secure, undisturbed habitat are necessary for a healthy population, especially since females spatially separate from each other during the calving season. A study in the NWT showed that boreal caribou that had access to large areas (over 500 square kilometres [km²]) of unburned habitat without linear infrastructure (e.g., seismic lines) had higher population growth rates than those that did not (Nagy, 2011). Factors such as the pattern and severity of a burn or the width and vegetation attributes of a seismic line may influence how boreal caribou are affected by these disturbances. In some areas of their range, large rivers, burned forests, and anthropogenic developments (e.g., pipelines, roads) can act as barriers to movement (GNWT, 2019).

As described in the Caribou and Moose TDR (Appendix 10A; EDI, 2023), a model was developed predicting habitat selection by boreal caribou based on land cover type, time since last burn, distance to and density of anthropogenic disturbance features, and considering the analyses of 16 years of caribou collar location data. The results show that, within the Caribou and Moose LAA, areas west of the PDA and some areas east of the PDA (in the Sahtu Region) were predicted to be least selected areas by boreal caribou (DeMars et al., 2020; ENR, 2020a; Figure 10.2). The current lower habitat suitability within and directly adjacent to the PDA is partly based on the model prediction that boreal caribou avoid major roads, and the existing MVWR was included as such in the model. In the Dehcho Region, areas likely to be selected by boreal caribou are closer to the PDA than in the Sahtu Region. In both regions, areas further east of the PDA, within and beyond the Caribou and Moose LAA, were predicted to be higher use areas for boreal caribou year-round (DeMars et al., 2020; ENR, 2020a; Figure 10.2).

Wildfires and anthropogenic disturbances affect the availability of large areas of secure, undisturbed habitat for boreal caribou in the NWT. Recent data published by ECCC estimates that, across their NWT range, 35% of boreal caribou habitat has been disturbed, 28% from wildfires and 9% from anthropogenic sources (ECCC, 2020). Regionally, the percentage of undisturbed habitat in 2017 was approximately 79% in the Sahtu Region and 53% in the Southern NWT (i.e., the Dehcho and South Slave regions combined) (GNWT, 2019). The other portions of the NT1 range, the Inuvialuit, Gwich'in, and Wek'èezhì regions, also have high amounts of undisturbed boreal caribou habitat (98%, 72%, and 66%, respectively) (GNWT, 2019).

Several historical and current caribou harvesting areas in the Caribou and Moose LAA were identified through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies. Dehcho First Nations, Pehdzéh Kì First Nation, Sahtu Dene and Métis reported the 24 locations within the Caribou and Moose LAA listed in Table 10.4 (5658 NWT Ltd. and GNWT, 2011 [PR#16]; Dessau, 2012 [PR#13]; Dehcho First Nations, 2011; IMG-Golder, 2006; Golder, 2015; McDonald, 2011; NWRRC, 2023; SLUPB, 2023; SLUBP, 2022; TRRC, 2022).



Predicted Habitat Selection

- 1 (Low)
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 (High)
- Proposed Mackenzie Valley Highway Project Route

- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Proposed Great Bear River Bridge
- Proposed Borrow / Rock Quarry Site and Access
- Caribou and Moose Local Assessment Area
- Community
- Northwest Territories Highway
- Winter Road
- Region Boundary
- Settlement Area Boundary

0 10 20 Kilometres
 (At original document size of 8.5x11)
 1:1,600,000



Project Location Prepared by CES on 8/7/2023
 Wrigley to Norman Wells, NWT TR by CS on 8/7/2023

Client/Project 144903025-0098 REV B
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Figure No. **10.2**
 Title

Predicted All Year Habitat Selection by Boreal Caribou

Notes

1. Coordinate System: NAD 1983 Northwest Territories Lambert
2. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics, n.d. Inventory of Landscape Change Map Viewer, GNWT, Centre for Geomatics, n.d. Open Data, MVLWB, n.d. Public Registry, Sahtu Land and Water Board, n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd. 2015-2016
3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS, Imagery date: 2021

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Mackenzie Valley Highway Project – Developer’s Assessment Report

Volume 2: Assessment of Key Lines of Inquiry

10.0 Assessment of Potential Effects on Caribou and Moose

October 2023

Table 10.4 Traditional Caribou Harvesting and Habitat Areas Identified by Indigenous Governments, Indigenous Organizations, and Other Affected Parties in the Caribou and Moose LAA

Location¹	Within Caribou and Moose LAA	Identified By:
Dehcho Region	✓	Dehcho First Nations
Around the town of Wrigley	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Pehdzéh Kì N’deh area ²	✓	Pehdzéh Kì First Nation
Ochre River (Mackenzie River tributary)	✓	Dehcho First Nations; Pehdzéh Kì First Nation
White Sand Creek (between kilometre marker [KM] 730 and KM 731)	✓	Dehcho First Nations; Pehdzéh Kì First Nation
McConnell Range (between Tulita and Wrigley)	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Franklin Mountains	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Nota Creek	✓	NWRRC
Prohibition Creek	✓	NWRRC
Canyon Creek	✓	NWRRC
Mackenzie Valley (North of Wrigley) ³	✓	Dehcho First Nations; Pehdzéh Kì First Nation
MVWR KM 750, KM 754, KM 776, KM 777, KM 781, KM 790 (all large ungulates) (locations are approximately halfway between Tulita and Wrigley)	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Mackenzie River/Deh Cho (Mackenzie River)	✓	Sahtu Dene and Métis
Between MVWR KM 900 and KM 930 (Barren-ground caribou only)	✓	Sahtu Region (Sahtu Renewable Resources Board [SRRB])
Between MVWR KM 990 and KM 1030 (Barren-ground caribou only)	✓	Sahtu Region (SRRB)
Little Bear River	✓	Sahtu Dene and Métis
West of MVWR KM 840 (Boreal caribou only)	✓	Sahtu Region (SRRB)
West of highway, between MVWR KM 810 and KM 830 (Boreal caribou only)	✓	Sahtu Region (SRRB)
South of MVWR KM 960 ⁴ (around Norman Wells) (Boreal caribou only)	✓	Sahtu Region (SRRB)

Mackenzie Valley Highway Project – Developer’s Assessment Report

Volume 2: Assessment of Key Lines of Inquiry

10.0 Assessment of Potential Effects on Caribou and Moose

October 2023

Location ¹	Within Caribou and Moose LAA	Identified By:
Norman Range Ecoregion (Barren-ground caribou only)	✓	Sahtu Region (SRRB)
Bear Rock (Petınızah) area	✓	Communities in the Sahtu Region (SRRB); TRRC
North of Tulita; along the highway between Norman Wells ⁴	✓	Sahtu Region (SRRB)
East of Tulita; along the river ⁴	✓	November 2022 to February 2023 Engagement
Great Bear River (as it intersects with the Caribou and Moose LAA)	✓	TRRC

Notes:

- 1 Wildfire and anthropogenic disturbances that overlap are not counted twice in the total disturbance estimate.
- 2 The boundary of this area is not identified or disclosed in this report; a Pehdzéh Kì N’Deh area is referenced in Dehcho Land Use Planning Committee ([DLUPC], 2006)
- 3 Location is identified as Wrigley
- 4 Specific location was not identified

10.2.2.1.1 Dehcho Region

Boreal caribou are common throughout the Dehcho Region (Dehcho First Nations, 2011). Boreal caribou numbers in the NWT are currently estimated at 6,000 to 7,000, with approximately 2,300 caribou in the Dehcho Region (GNWT, 2019). Recruitment rates calculated from composition surveys in the Dehcho Region (Larter et al., 2019) were consistently higher than the minimum recruitment rate required for stable population growth (Environment Yukon, 2016b), but annual adult female survival rates in the Dehcho Region (Larter et al., 2019) were lower than those reported for other areas in the NWT (Nagy, 2011; McLaren, 2017). Estimated growth rates for the entire NWT boreal caribou population are not available. While boreal caribou in some of the northern range management areas were found to be increasing, collar studies in southern NWT areas suggest an overall long-term decline (including for the Dehcho and South Slave regions; SARC, 2022). Currently, there is no wildlife management board in the Dehcho Region.

The Project traverses an area known as the Pehdzéh Kì N’deh area (DLUPC, 2006), which is an area of ecological and cultural significance. Boreal caribou are year-round inhabitants of that area (centered around the community of Wrigley) and use the shores of Blackwater Lake and Fish Lake (outside the Caribou and Moose LAA) as calving areas. The McConnell Range between Wrigley and Tulita is a summering area for boreal caribou, and the higher elevation regions are suspected calving areas (IMG-Golder Corporation, 2006).

In the Dehcho Region, boreal caribou exhibit seasonal movements in some areas. In others, they remain mostly in large, multi-habitat areas and shift use patterns based on seasonal habitat preferences (Dehcho First Nations, 2011). In lower elevation areas, boreal caribou spread out

(McDonald, 2010). Boreal caribou are only hunted when opportunistically encountered by Sahtu hunters. The Sahtu Renewable Resources Board (SRRB) is co-managing wildlife, including boreal caribou, in the Sahtu Region.

McDonald (2010) summarized information collected from Sahtu residents who had observed that boreal caribou do not migrate very far during the year. The amount of caribou habitat had remained relatively stable due to the low incidence of wildfire disturbance. Based on available habitat, it was believed at the time that the boreal caribou population also remained stable (McDonald, 2010). During summer, small groups of boreal caribou have been observed in open meadows on high ground in the Tulita area. Boreal caribou can also be found near rivers and lakes during high insect infestation. Boreal caribou primary food sources in the Sahtu Region include willow tips, grasses, lichen, and mosses; salt licks are actively sought out (McDonald, 2010).

Sahtu residents stated that there were more boreal caribou in the region at the time of the study than in the past, as evidenced by reports of seeing more signs of caribou groups (McDonald, 2010). This was attributed to decreased industrial activities throughout their habitat, as boreal caribou are believed to avoid developed areas, including roads and seismic lines. Boreal caribou are typically found in remote forest areas and avoid winter roads (McDonald, 2010). Vehicle collisions with boreal caribou have not been reported in the Sahtu Region.

The NWRRC TLRU study participants reported that most caribou hunting occurs along the MVWR between Norman Wells and Tulita in the fall and winter when the road is open (NWRRC, 2023). Recent TK from the TRRC indicates that caribou and moose are harvested within the LAA along the MVWR, but sightings of both species are declining. The TRRC also reported a mineral lick near Bear Rock (Petinırah) (TRRC, 2022; see Section 3.1.2.2 in Appendix 10A; EDI, 2023).

10.2.2.2 Barren-ground Caribou

Barren-ground caribou has been assessed as threatened by the Committee on the Status of Endangered Wildlife in Canada but is not listed under Schedule 1 of the federal SARA. The species is listed as threatened under the territorial *Species at Risk (NWT) Act* (NWT Species at Risk, 2022a).

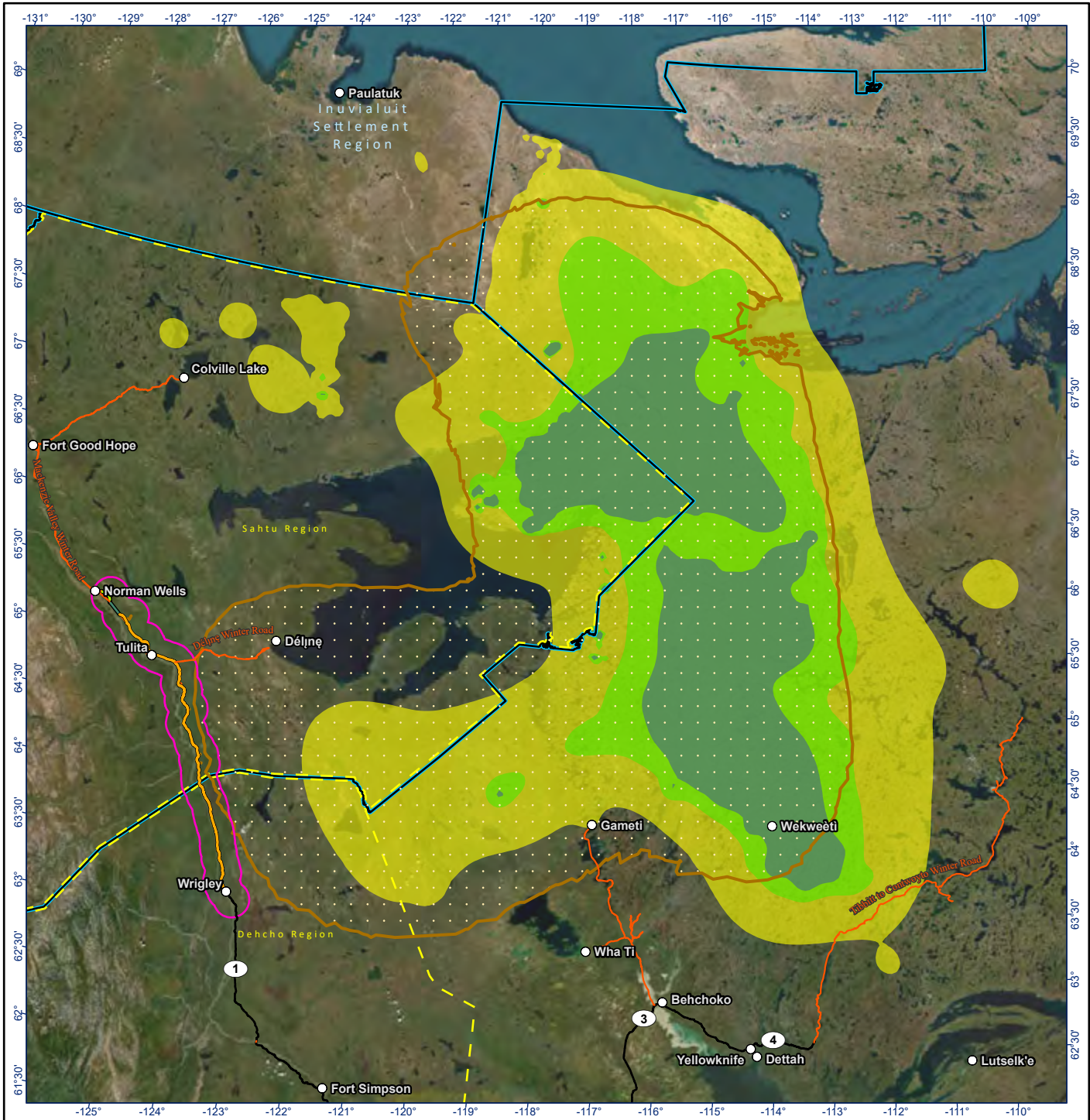
The Project traverses the Pehdzéh Kì N’deh area, an area of ecological and cultural significance identified by Dehcho First Nations (DLUPC, 2006). Some barren-ground caribou of the Bluenose-East herd are found in this area north of Blackwater Lake and Keller Lake (outside the Caribou and Moose LAA; IMG-Golder Corporation, 2006). In the Wrigley area, overlap has historically been observed between boreal caribou and barren-ground caribou ranges during mid-winter months, particularly around Fish Lake (outside the Caribou and Moose LAA; Dehcho First Nations, 2011). It is believed that these barren-ground caribou came down from the Sahtu Region and have only recently returned to the Wrigley area after being away for approximately 50 years. Sahtu residents harvest barren-ground caribou in the Norman Range Ecoregion, a small part of which overlaps with the LAA northwest of Tulita (SLUPB, 2023). Additionally, according to map data provided by the SRRB, barren-ground caribou have in the past been harvested along the existing MVWR ROW around KM 900 and 930, and between KM 990 and 1030 (5658 NWT Ltd. and GNWT, 2011 [PR#16]).

In 2014, the Advisory Committee for Cooperation on Wildlife Management (ACCWM) published a barren-ground caribou management plan in for the Cape Bathurst, Bluenose-West, and Bluenose-East barren-ground caribou herds in collaboration with the communities that harvest from the three herds (ACCWM, 2014). Individual action plans were then developed for each of the three herds to provide details on actions recommended to be implemented based on each herd’s status, including the 2022/2023 Bluenose-East Action Plan (ACCWM, 2022). In November 2021, the ACCWM determined that the Bluenose-East herd status to be both Red (low) and Yellow (intermediate and increasing) and that all management actions outlined in the 2014 management plan apply to this herd (ACCWM, 2022).

Barren-ground caribou are migratory and often travel long distances throughout the year (SARC, 2017). The current range of the Bluenose-East herd includes parts of the eastern NWT and western Nunavut, where the herd calves and spends the summer in tundra habitats along the Arctic coast east of Kugluktuk (Nagy et al., 2005; SARC, 2017). In the fall, the herd migrates south, wintering below the treeline south, east, and northeast of Great Bear Lake (Nagy et al., 2005; SARC, 2017). At its closest occurrence to Project, during winter, the herd may use an area east of the Caribou and Moose LAA, mainly in the Dehcho Region (Nagy et al., 2005; Figure 10.3). As spring arrives, the herd migrates northwards back to their calving grounds along the Arctic coast (Nagy et al., 2005; SARC, 2017).

During winter, in habitats below the treeline, habitat selection is driven by stand age, forage availability (particularly lichen), snow depth, and predator abundance (SARC, 2017). Where lichen cover is disturbed and regeneration is slow, barren-ground caribou may avoid the area for several decades until the lichen cover returns (SARC, 2017; CMA, 2020b). When barren-ground caribou travel throughout their winter ranges, they tend to select more open habitats (e.g., frozen lakes, open wetlands) where wind-hardened snow facilitates easier movement and predators are more visible (SARC, 2017).

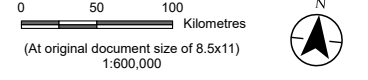
Figure 10.3 depicts the Bluenose-East herd annual range in the Dehcho and Sahtu regions based on GPS telemetry data (2012 to 2022) (ECC, 2023). The annual range was estimated by combining the utilization distributions (UDs) of 607 caribou-year combinations. The UD expresses the probability distribution of caribou space use on the landscape. To derive individual-level UD, a fixed-kernel density estimator was used with a scaled reference bandwidth (Worton 1989, Nagy et al. 2011). Each UD grid was equivalent in extent to cover the area surrounding all GPS locations and was calculated at a 500m x 500m resolution. Once estimated, the 607 UD were combined (i.e., cells summed across the 607 grids and normalized) and isopleths (95%, 75% and 50%) were calculated. The isopleths delineate the probability of caribou occurrence. For example, the 95% isopleth identifies the boundaries within which there is a 95% probability of caribou occurrence in the broader annual range. In contrast, the 50% isopleth identifies the ‘core’ range, where space use is most frequent. Although the annual range of the Bluenose-East herd historically overlapped with the eastern portion of the Caribou and Moose LAA (Figure 10.3), the current range calculated from the most recent telemetry data available (2012 to 2022) shows no overlap with the Caribou and Moose LAA.



Utilization Distribution for Bluenose-East Caribou (2012-2022)

- 95%
- 75%
- 50%
- Barren-ground Caribou Historical Range (1996-2009)
- Proposed Mackenzie Valley Highway Project Route
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)

- Proposed Great Bear River Bridge
- Proposed Borrow / Rock Quarry Site and Access
- Caribou and Moose Local Assessment Area
- Community
- Northwest Territories Highway
- Winter Road
- Region Boundary
- Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by AT on 8/10/2023
 TR by AJ on 8/10/2023

Client/Project: 144903025-0099 REV'B

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Figure No. **10.3**

Annual Range and Utilization Distribution of Barren-ground Caribou (Bluenose East Herd)

Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics, n.d. Inventory of Landscape Change Map Viewer; GNWT, Centre for Geomatics, n.d. Open Data, MVLWB, n.d. Public Registry, Sahtu Land and Water Board, n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd. 2015-2016, Nagy et al. 2011 (Historical Range), Environment and Climate Change, 2023. Bluenose East Collar Locations (2012-2022), NWT Wildlife Management Information System. Government of the NWT, Yellowknife, NT.
 3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan World Imagery, Earthstar Geographics World Hillshade: Esri, USGS. Imagery date: 2021

Barren-ground caribou herds in the NWT have historically experienced large population fluctuations with their abundance naturally cycling between highs and lows (SARC, 2017; CMA, 2020b). Recent substantial declines and population estimates suggest that herd numbers are at historic lows (SARC, 2017; CMA, 2020b). Survey data collected between 1989 and 2016 show an 89% decrease in the size of the Bluenose-East herd during that period (SARC, 2017). A population estimate for the Bluenose-East herd, completed in 2018, estimated approximately 19,000 caribou in the herd, an estimated 50% less than the previous population estimate from 2015 (Boulanger et al., 2019). A calving ground photo survey of the Bluenose-East barren-ground caribou herd completed in June 2021 west of Kugluktuk, Nunavut, resulted in estimates that were comparable to 2018 estimates. That result indicates that the herd may have stabilized between 2018 and 2021, after a rapid decline observed from 2010 to 2018 (Boulanger et al., 2022). The estimates for the herd in June 2021 were 12,863 (95% Confidence Interval (CI) 10,816–15,298) breeding females, 13,991 (95%CI 11,805–16,585) adult females, and 23,202 (95%CI 19,247–20,822) adult caribou (i.e., at least two years old). Additional analyses showed that the observed stability of the Bluenose-East herd was partially due to increased calf productivity and that adult female survival rates are still at levels lower than needed for herd recovery (Boulanger et al., 2022).

Predation affects the reproduction and survival rates of barren-ground caribou in the NWT, which, in turn, influences caribou abundance (SARC, 2017; CMA, 2020b). When barren-ground caribou populations are already declining or at low numbers, predation (mostly by wolves and grizzly bears) may accelerate decline and complicate recovery efforts (SARC, 2017). Wolves are considered the primary predator of barren-ground caribou and target all sex and age classes throughout the year (CMA, 2020b; GNWT, 2020a). To support the survival and recovery of some barren-ground caribou herds (including the Bluenose-East herd), the GNWT and Tłı̨chǫ Government prepared a joint proposal aimed at removing 60 to 80% of wolves from the herds’ winter ranges in the North Slave region to reduce wolf predation on caribou (GNWT, 2020a).

The annual range of the Bluenose-East herd does not overlap with the Caribou and Moose LAA (Figure 10.3). Barren-ground caribou are excluded from the residual effects assessment (Section 10.4) because of no direct interaction with the Project. However, roads and trails connected to the Project may improve hunter access to previously inaccessible areas. That improved access could result in additional harvest and an associated increase in mortality (ECCC, 2020). Harvest is additive to natural mortality and may accelerate a decline and hinder recovery efforts (SARC, 2017; CMA, 2020b). Therefore, barren-ground caribou are included in the cumulative effects assessment (i.e., change in mortality risk; Section 10.5.4).

As described in the TDR for Caribou and Moose (see Appendix 10A; EDI, 2023), developing roads and trails can potentially increase access for harvesters and predators (CMA, 2020b). This improved access may create energetically costly disturbances (through increased stress and avoidance behaviour), and/or create barriers to barren-ground caribou movement and alter migration routes. Land use in the Bluenose-East barren-ground caribou range is relatively low. Increasing road developments that facilitate easier hunter and predator access into caribou ranges may adversely affect populations and impede their recovery (CMA, 2020b).

The potential effects of hunting on herd abundance are likely not an issue where harvest restrictions have been implemented (SARC, 2017). Since 2006, non-resident and resident harvest has been closed for the Bluenose-East herd (SARC, 2017; GNWT, 2020b). It is unknown to what extent poaching is currently adding or may contribute in the future to barren-ground caribou mortality. Harvest by communities was reduced after public hearings in the Sahtu Region and other regions (SARC, 2017) Due to substantial declines observed in the Bluenose-East herd, and following processes laid out in land claim agreements, Indigenous harvest across the Bluenose-East herd's range has been restricted. In the Sahtú, the Délı̄ne community-based caribou plan approved after the 2016 public hearing includes a limit of 150 caribou (majority bull harvest). The new draft Délı̄ne plan includes a limit of 80 bulls. In Wek'èezhì the current maximum harvest is 193 bulls and in Nunavut the limit is 170 (1:1 bull to cow ratio). In 2022, the Thı̄chǒ Government and the GNWT submitted a joint proposal for the continuation of management actions to promote the recovery of the Bluenose-East barren-ground caribou herd, including harvest restrictions (i.e., zero harvest for non-Indigenous hunters and a total allowable harvest for Indigenous hunters), harvest monitoring, predator control (i.e., wolf management), and education. It was recognized that recent harvest levels remained well below the established total allowable harvest of Bluenose-East caribou (i.e., 193 bulls annually) with 74 (in 2018-2019), 76 (in 2019–2020), and 63 (in 2020–2021) in the Thı̄chǒ Region and with 25 (in 2018–2019), 0 (in 2019–2020), and 90 (55 bulls, 35 cows; in 2020-2021) in the Sahtu Region (TG and GNWT, 2022). The annual harvest in the Dehcho and Sahtu Regions comprises 1.6 and 17.2 % of the herd, with most harvested in Thı̄chǒ Region (39.3%) and Nunavut (35.8%).

10.2.2.3 Moose

Moose occur across the entire NWT, with an estimated population size of 25,000 to 40,000 animals (GNWT, 2022c). Moose are not listed federally or territorially in the NWT and are ranked as secure (WGGSNS, 2021; GNWT, 2022c). Moose are solitary and do not form permanent groups except for the social bonds between females and calves. They may temporarily group (or yard) together during winter when snow is deep, which often restricts moose movements to small areas that become well-packed and heavily used (GNWT, 2022c). The calving and post-calving periods (May 15 to July 15) are the most sensitive periods for moose, particularly for females and their calves (Rausch et al., 2008; Government of British Columbia [GovBC], 2009; BC MFLNRO, 2014; Environment Yukon, 2016a). When giving birth, females are typically in poorer physical condition due to harsh weather conditions and limited food availability during the preceding winter months. After their calves are born, females face additional energy demands from lactation. Therefore, females generally reach their poorest physical condition during the post-calving period. Disturbance during the calving and post-calving periods can cause fleeing responses, increased movement of calves associated with increased nutritional demands, decreased physical condition and, subsequently, increased susceptibility to predation.

River valleys and floodplains provide the best year-round habitat and are particularly important in winter (Latour, 1992). Moose are generally non-migratory and prefer areas with semi-open, early successional habitats with willow (*Salix* species) and aspen (*Populus* species) near lakes, rivers, floodplains, wetlands, stream banks, and sand bars (Stenhouse et al., 1995; GNWT, 2022c, 2022d).

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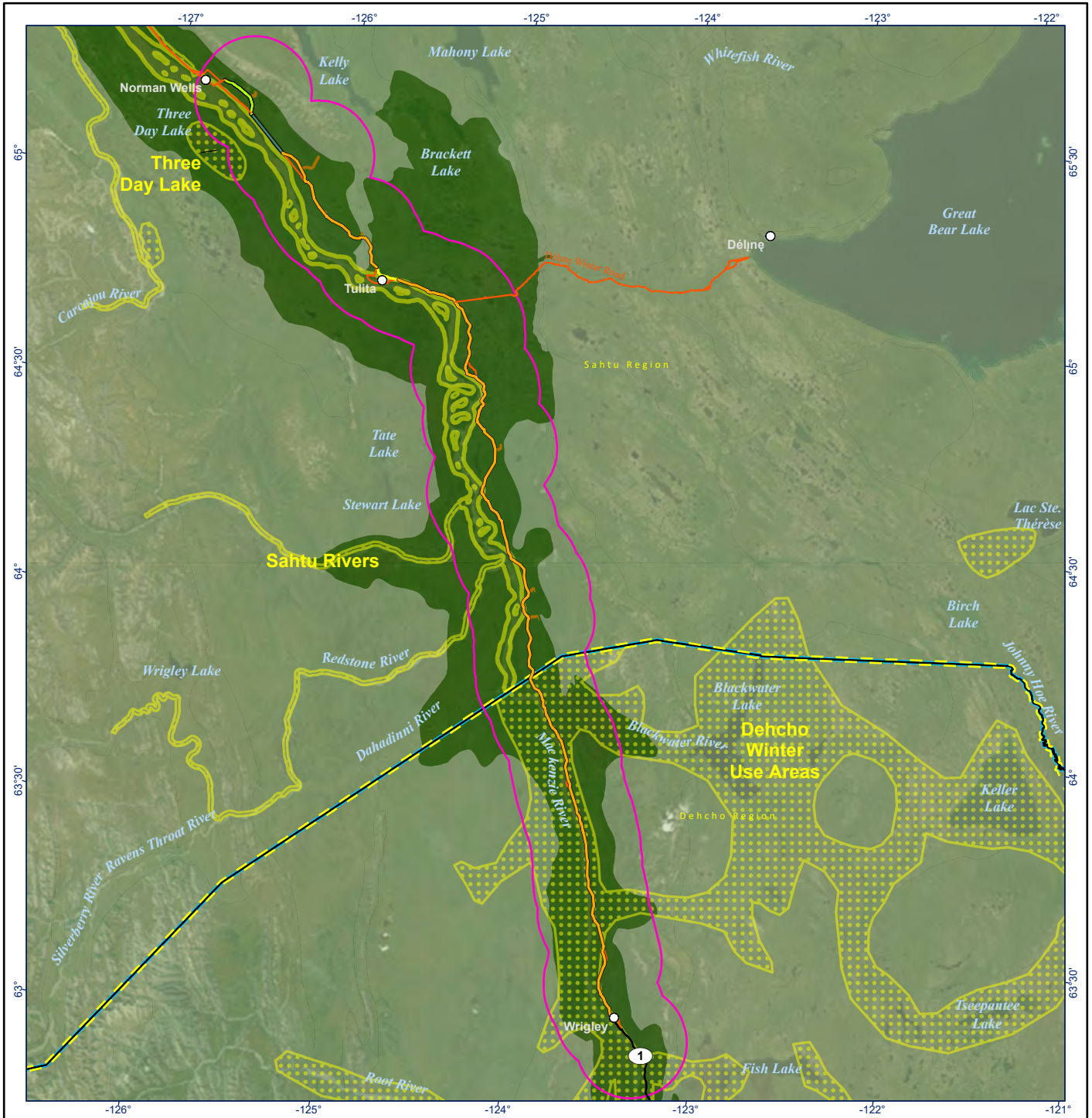
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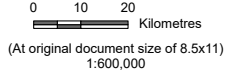
Moose also commonly use areas of regenerating burns (approximately 15 to 30 years following wildfire) and other regenerating disturbance areas. Across the NWT, moose are most common along the Mackenzie River (Deh Cho), where they use early successional habitats (Figure 10.4). Data provided by the GNWT, including moose surveys completed between 1984 and 2020 and observations collected as part of ongoing environmental monitoring programs between 1999 and 2016, show that moose use the Mackenzie River (Deh Cho) and its islands and shores (including areas within the LAA in the Dehcho and Sahtu Regions) and the surrounding area (Environment and Natural Resources [ENR], 2020b). During a reconnaissance flight in October 2020, moose tracks were observed occasionally along the existing MVWR ROW, indicating the use of the ROW by moose (see Appendix 10A; EDI, 2022).

As described in the TDR for Caribou and Moose (see Appendix 10A; EDI, 2022), hunting pressure on moose is believed to be high near roads, waterways, and many communities. In the NWT, the moose hunting season is a measure to regulate the harvest for resident and non-resident hunters (GNWT, 2021a). In the Dehcho Region, resident hunters can hunt one moose between September 1 and January 31, while the Sahtu harvest period for resident hunters starts at the same time and ends November 30 (GNWT, 2021a). Non-resident hunters can only hunt one moose between September 1 and October 31 with outfitting guides. Outfitters operate in the mountains of these two regions, outside the Caribou and Moose LAA. Indigenous hunters and General Hunting License holders can hunt during any season without a bag limit. Uncertainties exist about actual harvest levels. While resident hunter returns are reported annually (although they may be under-reported), non-resident hunter harvest is reported by the outfitters (in the mountains, outside the Caribou and Moose LAA). Indigenous moose harvest is not reported (ENR, 2020d). The Project may indirectly affect Moose via access roads potentially connecting to the completed all-season Project. Linear features, such as roads and trails, may improve hunter access to previously inaccessible areas, resulting in additional harvest and associated mortality (ECCC, 2020).

Through the project-specific engagement program, a review of publicly available and project-specific TLRU studies, approximately 25 moose harvesting and habitat areas were identified by Sahtu Dene and Métis, TRRC, Pehdzéh Kì First Nation, and Dehcho First Nations within the Caribou and Moose LAA and listed in Table 10.5 (Dessau, 2012 [PR#13]; 5658 NWT Ltd. and GNWT, 2011 [PR#16]; Dehcho First Nations, 2011; IMG-Golder, 2006; NWRRC, 2023; SLUPB, 2023; SLUBP, 2022; TRRC, 2022).



- Important Moose Area
- Moose Distribution**
- Common
- Transient, Localised
- Proposed Mackenzie Valley Highway Project Route
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Proposed Great Bear River Bridge
- Proposed Borrow / Rock Quarry Site and Access
- Caribou and Moose Local Assessment Area
- Northwest Territories Highway
- Winter Road
- Region Boundary
- Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by AT on 8/9/2023
 TR by AJ on 8/9/2023

Client/Project: 144903025-0100 REVA

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No. **10.4**

Title: **Moose Habitat in the Caribou and Moose LAA**

Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics, n.d. Inventory of Landscape Change Map Viewer, GNWT, Centre for Geomatics, n.d. Open Data, MVLWB, n.d. Public Registry, Sahtu Land and Water Board, n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd. 2015-2016
 3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery date: 2021

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Table 10.5 Moose Harvesting and Habitat Areas Identified by Indigenous Governments, Indigenous Organizations, and Other Affected Parties in the Caribou and Moose LAA

Location	Within Caribou and Moose LAA	Identified By:
Dehcho Region	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Franklin Mountains	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Pehdzéh Kì N’deh area ¹	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Proposed Great Bear River Bridge (area)	✓	Sahtu Dene and Métis; TRRC
Bear Rock (Petınızah) area	-✓	Sahtu Dene and Métis; TRRC
Between MVWR KM 708 and KM 709	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Little Bear River	✓	Sahtu Dene and Métis
Between Bob’s Canyon to Vermillion Creek South	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Vermillion Creek	✓	NWRRC
Nota Creek	✓	NWRRC
Prohibition Creek	✓	Dehcho First Nations; Pehdzéh Kì First Nation; NWRRC
Bluefish Creek	✓	NWRRC
Sucker Creek	✓	NWRRC
Canyon Creek	✓	NWRRC
Between White Sand Creek and Eestsaytoo Lake	✓	Dehcho First Nations; Pehdzéh Kì First Nation
MVWR KM 750, 754,776, 777, 781, 790 (all large ungulates)	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Between KM 880 and KM 970	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Around MVWR KM 1050 (near Norman Wells)	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Deh Cho (Mackenzie River), specifically within SMZ No. 63	✓	Sahtu Dene and Métis
Windy Island	✓	Sahtu Dene and Métis
Four Mile Island	✓	Sahtu Dene and Métis
Twenty Mile Island	✓	NWRRC
Six Mile Island	✓	NWRRC
Ten Mile Island	✓	NWRRC

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Location	Within Caribou and Moose LAA	Identified By:
Norman Range Ecoregion, a small part of which overlaps with the Caribou and Moose LAA	✓	Sahtu Dene and Métis
Blackwater River (as it intersects with the Caribou and Moose LAA and PDA)	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Great Bear River (as it intersects with the Caribou and Moose LAA)	✓	TRRC

Note:

¹ As described in DLUPC (2006)

Important Wildlife Areas (IWAs) for moose were mapped with common use areas and transient use areas, all found within the Caribou and Moose LAA (Figure 10.4; Wilson and Haas, 2012). Moose IWAs were identified based on best available knowledge, discussions with communities, co-management boards, the GNWT staff, and others (Wilson and Haas, 2012). Three moose IWAs overlap with the PDA and Caribou and Moose LAA (Wilson and Haas, 2012, also see Caribou and Moose TDR [Appendix 10A; EDI, 2022]).

- **Sahtu Rivers (Area ID: 29):** Riparian areas along the Mackenzie River (Deh Cho) its tributaries, including islands in the Mackenzie River (Deh Cho) with consistently high moose densities. The riparian areas offer valuable moose habitat, and ice and flood action along the river drainages keep the vegetation in an early successional stage consisting of willow and alder (*Alnus* species), two important food sources for moose.
- **Three Day Lake (Area ID: 33):** Located southwest of Norman Wells and known for having some of the highest moose densities in the Sahtu Region. Moose use this area in summer and fall, but high snowdrifts deter the animals during winter.
- **Dehcho Winter Use (Area ID: 37):** Represents areas with high moose densities found in the winter based on surveys and local TK.

More region-specific information about moose is provided for the Dehcho and Sahtu Regions.

10.2.2.3.1 Dehcho Region

Moose occur at high densities throughout the Dehcho Region (Dehcho First Nations, 2011). The Project primarily passes through an area known as the Pehdzéh Kì N'deh area (DLUPC, 2006), which is known to provide habitat for moose (Dessau, 2012). Pehdzéh Kì First Nation identified Bobs’ Canyon Creek and Vermilion Creek, along the MVWR between Bob’s Canyon Creek and Vermilion Creek, as good moose habitat and pasturing areas for moose (Dessau, 2012 [PR#13]). Moose are found throughout this zone year-round and are typically observed along river valleys and the shores of larger lakes (IMG-Golder Corporation, 2006). They also use post-burn vegetative communities, such as the recently burned area in the southeast portion of the Pehdzéh Kì N'deh

area. Year-round moose range and several moose pastures have been identified along the existing MVWR ROW between KM 708 and KM 790 (Dessau, 2012 [PR#13]). Moose are acknowledged as the most important subsistence harvest species in the Dehcho Region (IMG-Golder Corporation, 2006). Recent studies in the Dehcho Region concluded that the Dehcho moose population is healthy (Larter, 2009; Larter et al., 2019), and the observed limited growth of the population could be attributed to habitat availability, harvest, and predation.

10.2.2.3.2 Sahtu Region

The Project traverses the Deh Cho (Mackenzie River) SMZ (Zone # 63) of the SLUP, an area designated to protect the water quality, riparian habitat, cultural/heritage sites, and areas that are important for wildlife and wildlife harvesting, including for moose (SLUPB, 2023). Riparian areas within this SMZ exhibit high moose densities during winter. The Project also intersects the Petinı́zah (Bear Rock) CZ (Zone #32), which is an important area for wildlife, including moose (SLUPB, 2023). Traditional Knowledge from the TRRC indicates that moose are commonly seen on the MVWR, including mothers and young calves, and that moose are harvested along the MVWR in the winter. The TRRC also reported a mineral lick near Bear Rock (Petinı́zah) that attracts moose to the area (TRRC, 2022; see Section 3.1.2.2 in Appendix 10A [EDI, 2023]). The TRRC reported that moose calve in mossy areas usually by lakes and islands, and that lakes along the MVWR are important for moose calving, as are areas around Vermilion Creek (NWRRC, 2023). There was an area noted on the west side of the [Great] Bear River that contains abundant vegetation for moose (TRRC, 2022). In addition to these zones, calving areas for moose were identified on islands in the Mackenzie River (Deh Cho) to the southwest and southeast of Tulita, including Windy Island and Four Mile Island, both of which have extensive willow growth (EBA, 2006; SLUPB, 2023). NWRRC study participants identified important pasturing areas and habitat for moose including Jungle Ridge Creek, Vermilion Creek, Ten Mile Island, Six Mile Island, Twenty Mile Island, and around Petinı́zah (Bear Rock) CZ (Zone #32) (NWRRC, 2023). Moose habitat was identified directly on the west side of the proposed Great Bear River Bridge in Tulita (SLUPB, 2023).

While moose densities are comparatively low in the NWT, populations are believed to be stable and mainly driven by factors such as the frequency and age of major wildfires, local hunting, and predation. Densities across the NWT are low compared to other North American jurisdictions, with an overall density of 1 to 7 moose per 100 km² (GNWT, 2022c). At a localized scale, densities range from 0.6 moose/100 km² in the Mackenzie Delta to 17 moose per 100 km² in some parts of the Sahtu Region (Treseder and Graf, 1985; EBA, 2003; Imperial Oil, 2004). A study of moose mortality completed near Norman Wells (Stenhouse et al., 1995) found that wolf predation was a key source of mortality; however, survival rates of calves were reported to be high compared with findings in other North American jurisdictions (Gasaway et al., 1992). People from all Sahtu communities have observed an increase in wolf population numbers, believed to result from a decrease in wolf trapping activities (McDonald, 2010). Other observations include a general increase in the abundance of potential prey species, including moose (SLUPB, 2023).

Annual harvest in the Mackenzie Valley is moderate, averaging approximately 6% of the studied populations (e.g., this amounts to 27 to 30 moose in a study area west of Norman Wells) due to low human occupation and limited access (Stenhouse et al., 1995; Veitch et al., 1995; Swallow et al., 2003) and appears to be within sustainable limits (Veitch et al., 1995). However, harvest can be higher locally where access is available (e.g., near communities, roads, and waterbodies; e.g., Brackett et al., 1985; Treseder and Graf, 1985; GNWT, 2022c). The population estimates and harvest data in these estimates were applicable at the time of original publication; both populations of moose and harvest have likely changed over time. A harvest study in the Sahtu Region between 1998 and 2005 showed that most moose harvests by Sahtu Dene and Métis harvesters occurred in riparian areas along the Mackenzie River (Deh Cho) (SRRB, 2016). Some harvest locations were also recorded along lakeshores in the eastern portion of the Sahtu Region and the Mackenzie Mountains (outside the Caribou and Moose LAA). Sahtu residents also harvest moose in the Norman Range Ecoregion, a small part of which overlaps with the LAA northwest of Tulita (SLUPB, 2023). The harvest study found consistency in moose harvest estimates from year to year with no obvious variations in harvest levels (SRRB, 2021).

10.3 Project Interactions with Caribou and Moose

Anticipated interactions between project activities and caribou and moose, leading to potential effects (Section 10.1.3), are identified in Table 10.6 with a check mark (✓). These are discussed in Section 10.4, in the context of effects pathways, standard and project-specific mitigation / enhancement, and residual effects. Justification for the absence of an interaction (indicated by a dash [-]) is provided following the table.

Table 10.6 Project-Environment Interactions with Caribou and Moose

Physical Activities	Timing	Environmental Effects			
		Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Health
Construction Phase					
Mobilization of equipment, materials, and fuel, resupply, and demobilization	Summer and winter	✓	✓	✓	✓
Establishment and operation of camps	Year-round	✓	✓	✓	-
Site preparation of ROW, access, and workspaces	Winter	✓	✓	✓	✓
Borrow source and quarry development and operations, including blasting, crushing, sorting, and stockpiling	Year-round	✓	✓	✓	✓
Material haul	Year-round	✓	✓	✓	✓

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Physical Activities	Timing	Environmental Effects			
		Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Health
Embankment and quarry access road construction, including road cuts	Winter; road cuts in summer or winter	✓	✓	✓	✓
Culvert installations	Summer or winter	✓	✓	-	-
Road base, compaction, and surfacing	Summer	✓	✓	✓	✓
Water withdrawal to support construction activities	Year-round	-	✓	✓	-
Closure and reclamation of MVWR and temporary borrow sources quarries, camps, and workspaces	Summer	✓	✓	-	-
Employment and contracted goods and services ¹	Year-round	-	-	-	-
Operations and Maintenance Phase					
Borrow source and quarry operations, including blasting, crushing, sorting, and stockpiling	Summer	✓	✓	-	✓
Material haul and stockpiling	Summer	✓	✓	✓	✓
Operation of and activities at maintenance yards	Year-round	-	✓	-	-
Water withdrawal for dust control	Summer	-	✓	✓	-
Employment and contracted goods and services ¹	Year-round	-	-	-	-
Presence and public use of the highway	Year-round	✓	✓	✓	✓
Highway and access road maintenance, including snow clearing, repair, grading, dust control	Year-round	✓	✓	✓	-
Vegetation control	Summer	✓	✓	✓	-
Bridge and culvert maintenance	As needed	✓	✓	✓	-

Notes:

✓ = Potential interaction

- = No interaction

¹ Project employment and contracted services are generated by most project activities and components and are the main drivers of many socio-economic effects. This category does not refer to on-site activities. Rather than acknowledging this by placing a check mark against each of these activities, “Employment and Expenditures” have been introduced as an additional component under each project phase.

Project activities can affect caribou and moose directly or indirectly and positively or adversely. A direct effect is characterized by an interaction that occurs at the same time and place (e.g., mortality resulting from a vehicle collision) and exhibits no intermediate effects, whereas an indirect effect is characterized by an interaction that occurs at a later time and space and with intermediary steps (e.g., possibility of facilitated predation following construction of new roads/trails) (Latham et al., 2011a; Whittington et al., 2011). The anticipated interactions listed in Table 10.6 potentially adversely affect caribou and moose.

During operations and maintenance, operation of and activities at maintenance yards are not anticipated to result in a change in habitat as these activities will use existing disturbances and indirect habitat effects are captured through the presence and public use of the adjacent highway. Water withdrawal for dust control will occur within limits that will not affect ecological function (Section 15.4.3.3) and therefore are not anticipated to change caribou and moose habitat.

During construction, culvert installations and closure and reclamation of MVWR and temporary borrow sources/quarries, camps, and workspaces are not anticipated to interact with caribou and moose health or mortality. The establishment and operation of camps is not expected to interact with caribou and moose health.

As mentioned in Section 10.1.2, during engagement, local participants expressed concerns that caribou may avoid installed culverts because of vibrations and associated noise when trucks with heavy loads are traveling across them on the Project. This potential interaction is noted under the presence and public use of the highway (Table 10.6).

10.4 Assessment of Residual Effects on Caribou and Moose

Based on project interactions with the environment identified in Table 10.6, the Project may affect caribou and moose through changes to habitat, movement, mortality risk, and health. This section describes potential project effects on caribou and moose (including effects pathways), mitigation measures (Table 10.7), and residual effects (after implementation of mitigation measures), and analytical assessment techniques used to assess these potential effects.

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Table 10.7 Potential Effects and Mitigation Measures for Caribou and Moose

Effect Name	Effect Pathways	Mitigation Measures
Change in Habitat	Construction and operations and maintenance of the Project could result in a direct and/or indirect loss of caribou and moose habitat.	The Project will use previously disturbed areas for project activities and project infrastructure and workspaces, to the extent practical.
		Clearing will be limited to areas required for construction and safe operations.
		A buffer strip of undisturbed vegetation of at least 30 m wide will be maintained between the highway ROW and other new areas to be cleared.
		Removal of vegetation will be limited to the width of the ROW and workspaces.
		Equipment originating from outside of the NWT will be cleaned prior to mobilization to avoid introduction of invasive species.
		Vegetation buffers will be used as visual barriers and to protect riparian vegetation, as appropriate.
		Riparian vegetation will be maintained whenever possible.
		Travel of vehicles will be confined to existing infrastructure, roads, and trails as much as possible to avoid disturbing vegetated areas.
		Machinery on-site will be in a clean condition and free of invasive species and noxious weeds.
		Equipment will be maintained in good working order.
		Equipment will be operated on designated workspaces or existing roads only.
		Equipment idling will be discouraged or limited.
		Water only will be used for dust suppression, except as provided for in the GNWT Guideline for Dust Suppression.
		Vehicle speeds will be limited to 50 kilometres per hour (km/h) on unfinished project road surfaces.
		A WMMP will be developed and implemented. The WMMP will contain detailed monitoring and mitigation measures to be implemented for the duration of the construction and operations of the Project.
		The Project will follow setback distances specified in the WMMP for all construction and maintenance activities.
Blast mats will be used when blasting near receptors sensitive to noise.		
Vehicles and equipment will be equipped with manufacturer-recommended noise muffling equipment.		
Construction equipment will be regularly maintained.		

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Effect Name	Effect Pathways	Mitigation Measures
Change in Habitat (cont'd)		Construction and quarry development activities will be reduced, where possible and spatial overlap is expected, during sensitive periods for wildlife, in accordance with the WMMP.
		Wildlife monitors will assess for the presence of wildlife in or near the PDA during project activities and mitigation will occur in accordance with the approved WMMP.
		Organic material and topsoil will be set aside for use during reclamation, where possible.
		Temporary access roads, quarries, and workspaces not needed after construction will be closed and reclaimed.
		Closure and reclamation will promote re-establishment of vegetation.
		Site grading at closure will approximate pre-development conditions.
		Borrow source vegetated surface material, where present, will be replaced after excavation is completed.
Change in Movement	Construction and operations and maintenance of the Project could alter caribou and moose movement patterns or movement corridors.	The Project will use previously disturbed areas for project activities and project infrastructure and workspaces, to the extent practical.
		Clearing will be limited to areas required for construction and safe operations.
		A buffer strip of undisturbed vegetation of at least 30 m wide will be maintained between the highway ROW and other new areas to be cleared.
		Removal of vegetation will be limited to the width of the ROW and workspaces.
		Vegetation buffers will be used as visual barriers and to protect riparian vegetation, as appropriate.
		Equipment idling will be discouraged or limited.
		Project vehicles will be operated on designated workspaces or existing roads only.
		The height of snowbanks will be limited to the extent possible and to a height of less than 1 m.
		Vehicle speeds will be limited to speed of 50 km/h on unfinished project road surfaces.
		The Project will follow setback distances specified in the WMMP for all construction and maintenance activities.
Vehicles and equipment will be equipped with manufacturer-recommended noise muffling equipment.		

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10.0 Assessment of Potential Effects on Caribou and Moose

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Effect Name	Effect Pathways	Mitigation Measures
<p>Change in Movement (cont'd)</p>		<p>A WMMP will be developed and implemented. The WMMP will contain detailed monitoring and mitigation measures to be implemented for the duration of the construction and operations of the Project.</p>
		<p>Construction and quarry development activities will be reduced, where possible and where spatial overlap is expected, during sensitive periods for wildlife, in accordance with the WMMP.</p>
		<p>Temporary access roads, quarries, and workspaces not needed after construction will be closed and reclaimed.</p>
		<p>Closure and reclamation will promote re-establishment of vegetation.</p>
		<p>Site grading at closure will approximate pre-development conditions.</p>
		<p>Borrow source vegetated surface material, where present, will be replaced after excavation is completed.</p>
<p>Change in Mortality Risk</p>	<p>Construction and operations and maintenance of the Project could increase mortality risk or the number of caribou and moose fatalities through direct pathways.</p> <p>Construction and operations and maintenance of the Project could increase mortality risk or the number of caribou and moose fatalities through indirect pathways including harvesting.</p>	<p>The Project will use previously disturbed areas for project activities and project infrastructure and workspaces, to the extent practical.</p>
		<p>Clearing will be limited to areas required for construction and safe operations.</p>
		<p>A buffer strip of undisturbed vegetation of at least 30 m wide will be maintained between the highway ROW and other new areas to be cleared.</p>
		<p>Project vehicles will be confined to existing infrastructure roads and trails as much as possible to avoid disturbing vegetated areas.</p>
		<p>Removal of vegetation will be limited to the width of the ROW and workspaces.</p>
		<p>Vegetation buffers will be used as visual barriers and to protect riparian vegetation, as appropriate.</p>
		<p>A WMMP will be developed and implemented. The WMMP will contain detailed monitoring and mitigation measures to be implemented for the duration of the construction and operations of the Project.</p>
		<p>Personnel will not feed or harass wildlife while working on the Project.</p>
<p>Personnel will be prohibited from hunting and fishing while housed in work camps for the Project.</p>		

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Effect Name	Effect Pathways	Mitigation Measures
Change in Mortality Risk (cont'd)		Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP.
		Construction and quarry development activities will be reduced, where possible and spatial overlap is expected, during sensitive periods for wildlife, in accordance with the WMMP.
		Wildlife monitors will assess for the presence of wildlife in or near the PDA during project activities and mitigation will occur in accordance with the approved WMMP.
		The Project will follow setback distances specified in the WMMP.
		Access to construction areas will be limited to project personnel only for safety reasons.
		Equipment, wastes, and contaminated soils will be removed once construction is completed.
		Areas and containers used to store project wastes will be constructed, operated, and maintained in a manner to prevent waste from discharging to the surrounding environment.
		Vehicle speeds will be limited to speed of 50 km/h on unfinished project road surfaces.
		Speed limits will be posted on public highway.
		Caribou and moose will have the right of way on all project infrastructure during construction as detailed in the WMMP.
		Wildlife crossing locations will be identified and marked.
		Vegetation control (brushing) will be implemented along ROW to decrease potential forage attraction and increase visibility for driver safety.
		The height of snowbanks will be limited to the extent possible and to a height of less than 1 m.
Pre-construction surveys will be completed to identify possible wildlife habitat features along the ROW (like mineral licks) and potential crossing locations.		
Public access to active borrow sites and quarries and associated access routes will be restricted.		
Temporary access roads, quarries, and workspaces not needed after construction will be closed and reclaimed.		

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Effect Name	Effect Pathways	Mitigation Measures
Change in Health	Construction, and operations and maintenance of the Project could expose caribou and moose to contaminants or emissions that may affect their health and condition.	Spill contingency measures will be implemented in accordance with the Spill Contingency Plan (SCP).
		Fuel will be stored in containers with secondary containment capable of containing 110% of the largest container.
	Construction, and operations and maintenance of the Project could result in changes in energetics and physical condition because of sensory disturbance, increased predation, and increased hunting pressure.	Fuel handling and refueling will be in accordance with an Operating Procedure to be included in the Spill Contingency Plan.
		Areas and containers used to store project wastes will be constructed, operated, and maintained in a manner to prevent waste from discharging to the surrounding environment.
		Maintenance yards will have a liner installed or concrete under areas of vehicle storage and maintenance.
		Vehicles parked for more than 2 hours will use drip trays.
		Project vehicles will be operated on designated winter roads or constructed embankment only.
		Travel of project vehicles will be confined to existing infrastructure, roads, and trails as much as possible to avoid disturbing vegetated areas.
		Only material with low acid rock drainage (ARD) and metal leaching (ML) potential will be used for the Project.
		Excavated spoil material will be stored at least 30 m from the watercourse.
		Snow fill temporary crossings will be constructed of clean snow fill.
		Machinery on-site will be in a clean condition and free of invasive alien species.
		Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m from the high-water mark and in a manner to prevent any deleterious substances from entering the water.
		Machinery will not be left in any waterbody.
		Equipment will be maintained in good working order.
		Equipment idling will be discouraged or limited.
Blast mats will be used when blasting near receptors sensitive to noise.		
Water only will be used for dust suppression, except as provided for in the GNWT Guideline for Dust Suppression.		
Vehicle speeds will be limited to speed of 50 km/h on unfinished project road surfaces.		

Effect Name	Effect Pathways	Mitigation Measures
Change in Health (cont'd)		Incinerators will be operated in accordance with manufacturer’s specifications and emissions will meet Canadian Council of Ministers of the Environment Canada Wide Standards for Dioxins & Furans and Mercury.
		A WMMP will be developed and implemented. The WMMP will contain detailed monitoring and mitigation measures to be implemented for the duration of the construction and operations of the Project.
		Equipment, wastes, and contaminated soils will be removed once construction is completed.

10.4.1 Analytical Assessment Techniques

The general approach to assessing potential effects on caribou and moose follows the sequence and methods outlined in Chapter 4 (Assessment Methods). Analytical assessment techniques specific to each effect are described. Project-related residual effects are only assessed for boreal caribou and moose because the current range of barren-ground caribou (Bluenose-East herd) does not overlap the Caribou and Moose LAA (Section 10.2.2.2).

10.4.1.1 Change in Habitat

Change in habitat was assessed by comparing expected project-related direct and indirect changes in the amount of currently selected (for caribou) or suitable (for moose) habitat compared to baseline conditions for each project phase (i.e., construction, and operations and maintenance).

Direct change in habitat was assessed as the direct loss of habitat (e.g., through vegetation clearing) within the PDA for each project phase, where currently selected/suitable habitat for boreal caribou and moose is physically removed or disturbed to the extent that it is rendered functionally unsuitable for use. Since Project-related clearing will not occur outside the PDA, direct habitat effects are not expected to extend beyond the PDA.

- For boreal caribou, direct change in habitat was quantified by calculating the loss of habitat that boreal caribou select within the PDA. The All-Year Resource Selection Function (RSF) habitat model (Figure 10.3) developed by the GNWT (ENR, 2020a; Caribou and Moose TDR [see Appendix 10A; EDI, 2023]) is the habitat basis for the effects assessment. The RSF models used collar location data, land cover type, time since the last burn, and distance to and density of anthropogenic disturbance features to predict areas that caribou are more likely to select (DeMars et al., 2020). Selected habitat in the All-Year RSF model includes the bins ≥ 6 (all of which have selection ratios ≥ 1 , reflecting “selection”; bins 1 to 5 had selection ratios ≤ 1 , suggesting “avoidance” or “least selected”).
- For moose, direct change in habitat was assessed quantitatively by calculating the loss of habitat within moose IWAs (Wilson and Haas, 2012; Section 10.2.2.3) as well as common and transient habitat that overlaps with the PDA. All the habitat in the PDA and the Caribou and Moose LAA is considered suitable foraging and/or cover habitat for moose.

Indirect change in habitat was assessed as the indirect alteration of habitat (e.g., through sensory disturbance) within the Caribou and Moose LAA (excluding the PDA) for each project phase, where selected/suitable habitat for boreal caribou and moose remains physically intact but is rendered less selected/less suitable for use (i.e., reduced habitat effectiveness), potentially resulting in reduced use or avoidance by individual animals. Project-related disturbances such as dust deposition (Chapter 12) and noise (Chapter 13) are considered components of a zone of influence (ZOI) associated with the PDA that has an indirect effect (i.e., influences individual animal use of, rather than affecting the habitat itself) on adjacent habitat.

Indirect change in habitat was evaluated using a scientific approach used by Environment Canada for boreal caribou (EC 2011, ECCC 2020), a literature review, and a review of available TK information to predict sensory disturbance on caribou and moose that make habitat adjacent to a project footprint less effective. For boreal caribou, indirect change in habitat incorporated Environment Canada’s (EC 2011) approach, using a 500 m buffer on anthropogenic (human) disturbances. That 500 m buffer best represents the combined effects of increased predation and avoidance on caribou population trends (ECCC 2020).

A 250 m ZOI was chosen for moose to estimate indirect habitat loss based on research in the Laurentian mountains of Quebec (Laurian et al. 2012). However, the distance at which moose may avoid the highway is likely to vary on a seasonal basis and may be much lower in summer when moose tend to neither avoid nor select for highways or avoid them at much lower distances compared to other seasons (Laurian et al. 2012, Wattles et al. 2018). Conversely, the ZOI may be higher in winter when moose might avoid highways at distances greater than 250 m, depending on the sex and time of day (Laurian et al. 2012, Wattles et al. 2018).

10.4.1.2 Change in Movement, Mortality Risk, and Health

Change in movement, mortality risk, and health were assessed qualitatively by evaluating the relative change in movement (e.g., bisecting potential movement corridors), mortality (e.g., vehicle collisions, increased harvest), and health (e.g., contamination, increased stress) compared to baseline conditions for boreal caribou and moose for each project phase. The qualitative assessment included a literature review, review of available TK information, and professional judgment to predict effects on boreal caribou and moose.

In addition to the information presented in this document, a concurrent study on the movement of boreal caribou was conducted. The work evaluated local movement patterns by assessing the potential effects of the MVWR on the movement of boreal caribou, including whether the winter road is a filter to movement. Using integrated step selection analysis (iSSA) (Avgar et al., 2016), habitat selection models were developed that accounted for movement parameters (step lengths and turn angles) to infer seasonal movement patterns of boreal caribou in the region.

Three models were developed and tested to determine which best explains caribou habitat selection and movement: (a) a base effect model, (b) an MVWR-effect model, and (c) an all-disturbance-effect model. For the two disturbance models (b and c), interaction terms between movement parameters and the distance to MVWR/disturbance were included to investigate how the distance to those features affected caribou movement. These interaction terms are only relevant when a caribou’s location occurs within a 15-km distance from those disturbance features (i.e., within the Caribou and Moose LAA). Simulations validated the model structures and investigated whether disturbance models (models b and c) had better predictive ability than a base effect model (model a).

Additional simulations were conducted to test for a barrier effect on caribou movement for seasons where disturbance models perform best. Using 28 different initial starting points approximately 15 km from the MVWR, caribou movements were simulated each season. The objective was to determine whether the MVWR acted as a barrier to movement and limited habitat connectivity, given the expected habitat selection and movement patterns by caribou. Simulations both with and without a potential barrier effect were developed (i.e., MVWR/disturbance models versus base effect) to identify: (a) potential movement corridors that may be “blocked” by the MVWR and (b) the change in landscape use in the presence of a barrier effect.

10.4.1.3 Assumptions and the Conservation Approach

A conservative approach was used to address uncertainty in the effects assessment, increasing confidence in the significance determination (Section 10.1.6). Assumptions used to address uncertainty are identified as part of the description of analytical assessment techniques for each residual effect (Sections 10.4.2, 10.4.3, 10.4.4, and 10.4.5). The prediction confidence of the assessment for caribou and moose (Section 10.7) incorporates and describes these assumptions.

10.4.2 Change in Habitat

10.4.2.1 Effect Pathways

Construction and operations and maintenance of the Project could result in direct loss and/or indirect alteration of boreal caribou and moose habitat. Direct habitat loss occurs where selected/suitable habitat is physically removed or disturbed to the extent that it is rendered functionally unsuitable for use, potentially resulting in the displacement of individual animals. Project-related sources of direct habitat loss include vegetation clearing and ground disturbance. Direct habitat loss is expected to occur within the PDA during the Project. The effects are not expected to extend into the Caribou and Moose LAA.

Direct loss of habitat may affect boreal caribou and moose in various ways, such as the loss of calving habitat, foraging habitat, security cover, thermal cover, and movement corridors. Direct disturbance of preferred habitat types (e.g., lichen patches) and wetlands and marshes may affect caribou (Dehcho First Nations, 2011; McDonald, 2015). Individuals may be forced into smaller home ranges or displaced into other, possibly less selected/less suitable areas, which may result in inter- and/or intra-specific competition for resources, and/or increased predation risk

(Beauchesne et al., 2014; Calizza et al., 2017; Rudolph et al., 2017; Mumma et al., 2018; Neufeld et al., 2020; Nagy-Reis et al., 2021). The resulting physiological stress could have implications for health, reproductive output, and survival (Benítez-López et al., 2010; Beyer et al., 2013; Rudolph et al., 2017; Mumma et al., 2018; Nagy-Reis et al., 2021).

Indirect habitat alteration occurs where selected/suitable habitat remains physically intact but is rendered less selected/less suitable for use (i.e., reduced habitat effectiveness), potentially resulting in reduced use or avoidance by individual animals. Project-related sources of indirect habitat alteration include habitat fragmentation, edge effects, and sensory disturbance. Indirect habitat alteration is expected to occur within the Caribou and Moose LAA (excluding the PDA) during the Project. Overall, direct and indirect habitat loss or alteration resulting from project activities may affect the distribution and/or abundance of boreal caribou and moose within the Caribou and Moose LAA.

Sensory disturbance includes the effects of noise, light, dust emissions, and human presence on habitat suitability. Noise-related effects on some wildlife species have been reported to occur when noise levels exceed 40 A-weighted decibels (dBA), which may result in avoidance, but physiological consequences (e.g., stress) to terrestrial mammals has not been identified below 52 dBA (Shannon et al., 2016). Baseline noise in the region without any development or winter traffic has been estimated at 35 and 32 dBA during the day and night, respectively (IOL, 2004; see Section 13.2.2). The distance at which the noise associated with construction activities is expected to attenuate to 40 dBA is 2.0 km for road construction activities and 2.5 km for quarry and borrow source activities (see Section 13.4.2). For distances larger than 5 km from the PDA, the project noise effects are expected to attenuate well below the baseline sound level due to natural atmospheric attenuation and ground absorption over distance (see Section 13.4.1). Sensory disturbance may elicit behavioural and/or physiological responses (e.g., increased energy expenditures, elevated stress levels; described in Section 10.4.5) in affected individuals and/or may result in reduced use or avoidance of disturbed areas (Schindler et al., 2006; Benítez-López et al., 2010; Beyer et al., 2013). Norman Wells Renewable Resources Council and TRRC study participants reported that boreal caribou avoid winter roads due to sensory disturbance (i.e., noise, pollution) and raised concerns that effects of future road construction and operation may affect the availability and accessibility of caribou for cultural use close to the highway. NWRRC participants raised concerns that land users must travel further to hunt boreal caribou once the Project is underway.

Boreal caribou may avoid anthropogenic disturbances with varying levels of human activity (Schindler et al., 2006; Weir et al., 2007; Polfus et al., 2011), while moose may avoid areas with high road densities (Beyer et al., 2013) or select areas with human activity (e.g., around camps), possibly to avoid predators (Stephens and Peterson, 1984). Anthropogenic noise may cause short-term habitat avoidance when the noise sources are present, but individuals may return when noise levels decrease; however, loud noises (e.g., blasting) may cause long-term habitat avoidance (Bowles, 1995). Vehicle traffic, which can cause both visual and auditory disturbance, may result in some individuals avoiding areas with increasing traffic and disturbance intensity (Northrup et al., 2012; Leblond et al., 2013). Dust emissions generated from project activities may affect the palatability of vegetation (Chen et al., 2017). Dust may also alter the productivity of adjacent forests and wetlands by influencing diversity of species, photosynthesis, respiration, and transpiration, which could have

implications for habitat suitability and foraging opportunities (Farmer, 1993; Creuzer, 2016; see Chapter 18). The potential displacement of individuals into other, possibly less suitable areas may result in inter- and/or intra-specific competition for resources, and/or increased predation risk (Beauchesne et al., 2014; Calizza et al., 2017; Rudolph et al., 2017; Mumma et al., 2018; Neufeld et al., 2020; Nagy-Reis et al., 2021). The resulting physiological stress could affect health, reproductive output, and survival (Schindler et al., 2006; Benítez-López et al., 2010; Beyer et al., 2013).

Several factors may cause moose to avoid roads, including noise (sensory disturbance), human presence, and/or potential for increased mortality risk (collision risk with vehicles). Moose tend to be closer to roads at night when traffic is lower than daytime traffic (Neumann et al. 2013, Wattles et al. 2018). Distances at which moose avoid roads are highly variable and depend on many factors, such as sex, season, available forage, vehicle traffic, and vehicle speed (Yost et al. 2001, Laurian et al. 2012, Loosen et al. 2012, Wattles et al. 2018).

Moose avoid highways by distances of 0 – 1,500 m, depending on factors such as season, forage availability, motor vehicle traffic, predation pressure, and sex (Yost and Wright 2001, Laurian et al. 2008, Laurian et al. 2012, Loosen et al. 2013, Neumann et al. 2013, Wattles et al. 2018). The higher the level of traffic and higher vehicle speeds, the greater the distance at which moose avoid highways (Neumann et al. 2013, Wattles et al. 2018). In an area of Massachusetts, USA, with a high road density, moose avoided roads between 500 m in summer and winter during daytime to a maximum of 1,500 m at night during fall (Wattles et al. 2018). However, roads are not consistently avoided nor are they the strongest influence on habitat use. Availability of forage has a greater influence on moose habitat use than the presence of a road or the traffic on a road (Laurian et al. 2012, Yost and Wright 2001). In the Laurentian area of Quebec, in an area more comparable to the MVWR than other studies reviewed, moose tended to avoid the area closest to the highway but selected for median distances away from the highway. The two highways in the Laurian et al. (2012) study were paved with a mean width of 20 m, speed limit of 90 km/hr, had heavy traffic (1,400 vehicles/day on Highway 169 and 2,800 vehicles/day on Highway 175), and the study took place in the northern part of the Laurentian Wildlife Reserve. Laurian et al (2012) found in spring males and females avoided highways by up to 100 m as compared to distances >1,500 m but males selected for distances 750 – 1,500 m while females selected for distances 250 – 750 m away from highways as compared to distances >1,500 m (Laurian et al. 2012). In summer males neither avoided nor selected for any of the distance classes from 0 – 1,500 m away from highways but females avoided the closest distance class (0-100 m) and selected for distances 750 – 1500 m as compared to distances >1,500 m (Laurian et al. 2012). In autumn, males avoided being within 250 m of a highway and females did not select for or avoid any distance classes away from a highway. In winter, males avoided being within 750 m of a highway and females avoided being within 100 m of a highway as compared to distances >1,500 m (Laurian et al. 2012). In some areas, habitat adjacent to paved roads may even be used as a refuge from predators for calving females, if carnivores tend to avoid roads (Berger 2007).

Habitat fragmentation occurs when continuous habitat is fragmented by natural processes (e.g., wildfires) or anthropogenic disturbances (e.g., vegetation clearing) into smaller, spatially distinct patches (Andrén, 1994; Goldrup, 2003; Beauchesne et al., 2014; Crooks et al., 2017). Habitat fragmentation may affect boreal caribou and moose in a variety of ways, such as changes in habitat connectivity (i.e., access to selected/suitable habitat) or the creation of isolated patches of suitable habitat that no longer support life requisites (Andrén, 1994; Goldrup, 2003; Benítez-López et al., 2010; Beauchesne et al., 2014; Muhly et al., 2015, Crooks et al., 2017). A minimum patch size is often required for an individual to occupy or use an isolated patch on a landscape (Crooks et al., 2017). When available suitable habitat is below a minimum patch size threshold, a reduction in occupancy may occur despite the continued presence of selected/suitable habitat. As a result, patch size at the individual and population level may have a species-specific effect on the use of selected/suitable habitat and could influence health, reproductive output, and survival (Benítez-López et al., 2010; Beyer et al., 2013; Beauchesne et al., 2014; Muhly et al., 2015).

To estimate an indicator of habitat fragmentation, seismic line and road density estimates are often used across western Canadian jurisdictions when assessing effects on species that prefer forested habitats (ENR, 2015). In the NWT, seismic lines are the largest anthropogenic landscape disturbance and a potential cause of habitat fragmentation. Assessments in Alberta indicate that woodland caribou occurrence decreases with increasing linear development density and associated habitat fragmentation (ENR, 2015).

Edge effects include the influence of recently cleared areas on adjacent intact habitats. Gradients of light intensity, temperature, wind, relative humidity, and snow accumulation and melt may occur along the interface between cleared areas and intact habitats (Bannerman, 1998; Kremsater and Bunnell, 1999), which could influence ecosystem structure and function over time and alter habitat suitability. Some species (e.g., moose) may benefit from edge effects (e.g., increased forage opportunities), and their abundance may increase in edge habitats, while other species (e.g., forest-dwelling boreal caribou) may use edge habitats less frequently or avoid them (Bannerman, 1998; Kremsater and Bunnell, 1999; Schindler et al., 2006; Benítez-López et al., 2010; Beyer et al., 2013; Fortin et al., 2013). The potential influx of individuals into edge habitats, or the potential displacement of individuals into other, possibly less selected/less suitable areas, may result in inter- and/or intra-specific competition for resources, and/or increased predation risk (Bannerman, 1998; Fortin et al., 2013; Calizza et al., 2017; Neufeld et al., 2020). The resulting physiological stress could affect health, reproductive output, and survival (Schindler et al., 2006; Benítez-López et al., 2010; Beyer et al., 2013).

10.4.2.1.1 Construction

Direct loss of boreal caribou and moose habitat will occur within the PDA during site preparation and construction activities. That includes the removal of habitats (i.e., vegetation clearing and ground disturbance), including establishment and operation of camps; site preparation of the ROW, access, and workspaces; borrow source and quarry development and operations (including blasting, crushing, sorting, and stockpiling); embankment and quarry access road construction (including road cuts); culvert installations; and closure and reclamation of the MVWR and temporary borrow sources/quarries, camps, and workspaces (Table 10.6).

Indirect alteration of boreal caribou and moose habitat is expected to occur within the Caribou and Moose LAA during site preparation and construction activities that result in reduced habitat effectiveness (i.e., habitat fragmentation, edge effects, and sensory disturbance), including mobilization of equipment, materials, and fuel, resupply, and demobilization; establishment and operation of camps; site preparation of the ROW, access, and workspaces; borrow source and quarry development and operations (including blasting, crushing, sorting, and stockpiling); material haul; embankment and quarry access road construction (including road cuts); culvert installations; road base, compaction, and surfacing; and closure and reclamation of the MVWR and temporary borrow sources/quarries, camps, and workspaces (Table 10.6).

10.4.2.1.2 Operations and Maintenance

Operations and maintenance of the Project will not result in additional direct loss of boreal caribou or moose habitat within the PDA. However, the effects of direct habitat loss on boreal caribou and moose expected from the construction phase will remain for the life of the Project.

Indirect alteration of boreal caribou and moose habitat is expected to occur within the Caribou and Moose LAA during operations and maintenance activities that cause sensory disturbance and air emissions (including dust), including borrow source and quarry operations (including blasting, crushing, sorting, and stockpiling); material haul and stockpiling; operation of and activities at maintenance yards; the presence and use of the highway and associated public traffic; highway and access road maintenance (including snow clearing, repair, grading, dust control); vegetation control; and bridge and culvert maintenance (Table 10.6).

Operations and maintenance activities are not expected to result in additional indirect alteration of boreal caribou or moose habitat within the Caribou and Moose LAA through habitat fragmentation or edge effects; however, the effects of indirect habitat alteration on boreal caribou and moose via habitat fragmentation and edge effects during the construction phase are likely to persist through the life of the Project.

10.4.2.2 Mitigation

As discussed in the Detailed Project Description (see Chapter 5), project routing and design have integrated the existing MVWR ROW to the extent practicable, which will reduce potential project-related changes in habitat. In addition to a project-specific WMMP, SCP, and Traffic Management Plan (TMP) that will be implemented during the construction and operations and maintenance phases, standard industry practices and mitigation measures will also be implemented and are summarized in Table 10.7. Key mitigation measures to avoid or reduce changes in habitat include:

- The Project will use previously disturbed areas for project activities and project infrastructure and workspaces, to the extent practical.
- Clearing will be limited to areas required for construction and safe operations.
- Removal of vegetation will be limited to the width of the ROW and workspaces.

- Construction and quarry development activities will be reduced, where possible and spatial overlap is expected, during sensitive periods for wildlife, in accordance with the WMMP.
- Wildlife monitors will assess for the presence of wildlife in or near the PDA during project activities and mitigation will occur in accordance with the approved WMMP.
- Temporary access roads, quarries, and workspaces not needed after construction will be closed and reclaimed.
- Closure and reclamation will promote the re-establishment of vegetation.

The GNWT, particularly GNWT-ECC, is interested in developing guidance documents concerning offsetting for biodiversity. In the short term, this interest is focused on the potential uses of offsetting for the conservation of boreal and barren-ground caribou and the mitigation of development effects on these species. In the medium and longer term, there is interest in developing a system to deliver offsets to a broad range of biodiversity systematically and efficiently (Unger, 2022, pers. comm.).

This interest is partly motivated by recent project permitting decisions by the MVEIRB and the Wek’èezhii Land and Water Board, which required offsetting but did not provide clear guidance on how offsetting should be undertaken.

The WMMP guidelines include offsetting as the final step in the hierarchy of mitigation measures that can be undertaken to mitigate environmental effects (GNWT, 2021b). Offsetting and the mitigation hierarchy are also referenced throughout the Framework for Boreal Caribou Range Planning (GNWT, 2019). The GNWT-ECC is currently reviewing internal draft documents, which could form the basis for the GNWT’s policies for offsetting (Unger, 2022, pers. comm.). The GNWT will apply relevant policies for offsetting for biodiversity to the Project if/when such policies are in effect.

10.4.2.3 Residual Effects

10.4.2.3.1 Construction

10.4.2.3.1.1 Direct Loss of Boreal Caribou Habitat

The construction of the ROW, the borrow sources, and associated access (i.e., the PDA) is estimated to result in the direct loss of 2,315.2 ha of general habitat (some of which is previously disturbed by humans); of that, 94.3 ha are considered selected boreal caribou habitat (based on the boreal caribou RSF model; DeMars et al., 2020). This direct habitat loss is expected to result in a 0.03% decrease in selected caribou habitat within the Caribou and Moose LAA compared to existing baseline conditions (Table 10.8). This change in boreal caribou habitat is expected to occur entirely in the Sahtu Region as the PDA in the Dehcho Region does not include available selected boreal caribou habitat; therefore, there is no loss of currently selected habitat in the Dehcho portion of the LAA.

Table 10.8 Expected Direct Loss of Currently Selected Boreal Caribou Habitat in the Caribou and Moose Local Assessment Area

Region	Total Selected Boreal Caribou Habitat in the Caribou and Moose LAA (ha)	Percent of Selected Boreal Caribou Habitat in the Caribou and Moose LAA (relative amount in %)	Total Selected Boreal Caribou Habitat Lost from the PDA (ha)	Percent of Selected Boreal Caribou Habitat Lost in the Caribou and Moose LAA (relative amount in %)
Sahtu Region	193,734	29.4	94.3	0.05
Dehcho Region	128,447	35.8	0.0	0.00
Total in Caribou and Moose LAA	322,181	31.9	94.3	0.03

By following the existing MVWR (see Chapter 5) and using other existing disturbed areas in the PDA, 47.8 % of the PDA (i.e., 1,104.9 ha) will be constructed on areas with existing anthropogenic and natural disturbances (including burned areas). These already-disturbed areas are acknowledged to provide limited selected habitat for boreal caribou. The existing MVWR was accounted for in the RSF models developed by the GNWT (ENR, 2020a) (Section 10.4.1). Therefore, based on existing anthropogenic disturbances in the PDA, the amount of selected boreal caribou habitat (if present) expected to be directly affected by the Project is of low magnitude (Table 10.8).

While direct loss of boreal caribou habitat is expected during the construction phase in the PDA, the existing MVWR is already contributing to direct habitat changes. Mitigation measures identified in Table 10.7 are expected to reduce the potential for the residual effect of change in habitat on boreal caribou during the construction phase.

10.4.2.3.1.2 Direct Loss of Moose Habitat

The construction of the ROW, borrow sources, and associated access (i.e., the PDA) is estimated to result in the direct loss of 2,315.2 ha of moose habitat (some of which is previously disturbed by humans; of that, 787.9 ha are within moose IWAs). The direct loss is a 0.2% decrease in moose habitat at the scale of the Caribou and Moose LAA compared to existing baseline conditions. By regional portions of the Caribou and Moose LAA, habitat loss is 1,507 ha (0.2%) in the Sahtu and 807.9 ha (0.2%) in the Dehcho (Table 10.9).

Table 10.9 Existing Moose Habitat in the Caribou and Moose Local Assessment Area and Expected Change in Habitat

Region	Moose Habitat in the Caribou and Moose LAA	Amount of Moose Habitat in the Caribou and Moose LAA (ha)	Percent of Moose Habitat in the Caribou and Moose LAA (relative amount in %)	Amount of Moose Habitat Lost from the PDA (ha)	Percent of Moose Habitat Lost in the Caribou and Moose LAA (relative amount in %)
Sahtu Region	Sahtu Rivers (#29) IWA	33,125.0	5.1	75.5	<0.01
	Three Day Lake (#33) IWA	5,407.0	0.8	0.0	0.0
	Common and Transient Use	613,413.4	94.1	1,431.8	0.2
	Regional total	651,945.4		1,507.3	0.2
Dehcho Region	Dehcho Winter Use Areas (#37) IWA	211,283.0	58.8	712.4	0.2
	Common and Transient Use	147,755.0	41.2	95.5	<0.1
	Regional total	359,038.0		807.9	0.2
Total Moose Habitat in Caribou and Moose LAA	IWAs	249,815.0	24.7	787.9	0.1
	Common and Transient Use	761,168.4	75.3	1,527.3	0.2
	Total	1,010,983.4	100.0	2,315.2	0.2

These values of direct habitat loss are a conservative estimate because 47.8% (i.e., 1,104.9 ha) of the PDA is currently subject to existing anthropogenic disturbances, including the existing MVWR and borrow sources/quarries. These areas may already provide reduced suitability as moose habitat; however, because moose have been observed using the MVWR corridor (Caribou and Moose TDR [see Appendix 10A; EDI, 2023]), no adjustments to the conservative estimate have been made. Therefore, based on existing anthropogenic disturbances in the PDA, the amount of suitable moose habitat expected to be directly affected by the Project is low (Table 10.9).

While the direct loss of moose habitat is expected during the construction phase in the PDA, the existing MVWR is already contributing to direct habitat changes. Mitigation measures are expected to reduce the potential for the residual effect of change in habitat on moose during the construction phase.

10.4.2.3.1.3 Indirect Alteration of Boreal Caribou Habitat

An indirect alteration of boreal caribou or moose habitat is expected through sensory disturbance caused by noise and dust deposition, edge effects on habitat, and fragmentation that can result in habitat avoidance and reduced habitat effectiveness in areas adjacent to the PDA.

Sensory disturbance resulting from project construction is not expected to occur along the entire length of the PDA but will occur in smaller segments scheduled over several years. The conceptual schedule (see Section 5.4.1) assumes that the Project will be constructed in three segments: Wrigley to the Dehcho/Sahtu border (102 km); Tulita south to the Dehcho/Sahtu border (134 km); and Tulita north to the Prohibition Creek Access Road (45 km). The actual schedule and sequence for the construction of each segment will be determined based on funding and regulatory approvals. Each segment may take up to five years to construct. Noise-related effects on some wildlife species have been reported to occur when noise levels exceed 40 dBA, which may result in avoidance, but physiological consequences (e.g., stress) to terrestrial mammals has not been identified below 52 dBA (Shannon et al., 2016). Baseline noise in the region that was assessed in remote areas without any development or winter traffic has been estimated at 32 to 35 dBA during the day and night, respectively (Imperial Oil, 2004; see Section 13.2.2). The distance at which the noise associated with construction activities is expected to attenuate to 40 dBA is 2.0 km for road construction activities and 2.5 km for quarry and borrow source activities (see Section 13.4.2). For distances larger than 5 km from the PDA, the project noise effects are expected to attenuate well below the baseline sound level due to natural atmospheric attenuation and ground absorption over distance (see Section 13.4.1). It is assumed that noise levels will decrease following the conclusion of construction activities in a particular segment of the LAA. Mitigation measures will be implemented to address sensory disturbance (Table 10.7). These measures will likely reduce the effects of indirect habitat changes on boreal caribou and moose due to noise.

In addition to noise, dust deposition resulting from project construction may also contribute to indirect habitat alteration. Effects of dust deposition on vegetation are likely to be limited to within 40 m of the PDA (see Chapter 12).

Edge effects and fragmentation may result from vegetation clearing activities, particularly where the PDA intersects forested habitats. However, the existing MVWR and other disturbed areas (e.g., existing quarries) have already created edge effects and fragmentation (see Chapter 21) and 47.8% of the PDA overlaps these previously disturbed areas.

Indirect project effects associated with edge effects and fragmentation during construction will primarily be mitigated through project routing that largely follows the existing MVWR ROW. The Caribou and Moose LAA is already subject to these disturbances that may have reduced the ecological effectiveness of the surrounding areas. Project construction might exacerbate indirect habitat changes within the Caribou and Moose LAA by increasing the intensity and duration (i.e., year-round construction activities) of these indirect effects.

Regardless of the variability in the ZOI studies discussed in Section 10.4.2.1, Environment Canada (EC 2011) found that a 500 m buffer applied to anthropogenic disturbances on boreal caribou best represented the combined effects of increased predation and avoidance on caribou population trends. In the interest of providing comparable disturbance metrics and measures to that used by the federal government and comparable assessments, a 500 m buffer was applied to the Project’s PDA to measure indirect habitat disturbance on caribou. While that buffer will not account for all indirect changes in boreal caribou habitat, it is intended to indicate anthropogenic habitat disturbance using a method comparable to the national scientific review. Including the 500 m buffer around the PDA, at the scale of the Caribou and Moose LAA, 1,466 ha (0.46%) of selected boreal caribou habitat is expected to be indirectly affected by the Project, 1,450 ha (0.75% of the LAA) in the Sahtu portion of selected boreal caribou habitat in the Caribou and Moose LAA and 17 ha (0.01%) in the Dehcho Region (Table 10.10).

Table 10.10 Expected Indirect Loss of Currently Selected Boreal Caribou Habitat in the Caribou and Moose Local Assessment Area

Region	Total Selected Boreal Caribou Habitat in the Caribou and Moose LAA (ha)	Percent of Selected Boreal Caribou Habitat in the Caribou and Moose LAA (relative amount in %)	Total Selected Boreal Caribou Habitat Altered in a 500 m buffer from the PDA (ha)	Percent of Selected Boreal Caribou Habitat Altered in the Caribou and Moose LAA (relative amount in %)
Sahtu Region	193,734	29.4	1,450	0.75
Dehcho Region	128,447	35.8	17	0.01
Total in Caribou and Moose LAA	322,181	31.9	1,466	0.46

10.4.2.3.1.4 Indirect Alteration of Moose Habitat

Based on the ZOI of 250 m, indirect habitat loss for moose was calculated in the IWA and the Sahtu and Dehcho Regions. Of the three moose IWA, the greatest amount of indirect habitat loss would occur in the Dehcho Winter Use Areas (5,248 ha), followed by Sahtu Rivers IWA (618 ha), and none in the Three Day Lakes IWA (Table 10.11). Total indirect habitat loss in the LAA is estimated to be 17,590 ha, which is <2% of the LAA (Table 10.11). Overall, moose are not expected to completely avoid roads based on previous surveys that reported moose tracks on the MVWR (Section 10.2.2.3). However, they are likely to use the highway and the adjacent habitat less based on studies that have demonstrated lower habitat selection, use, and browsing closer to primary roads or highways (Laurian et al. 2012, Wattles et al. 2018, Loosen et al. 2021).

Table 10.11 Existing Moose Habitat in the Caribou and Moose Local Assessment Area and Expected Indirect Habitat Loss.

Region	Moose Habitat in the Caribou and Moose LAA	Amount of Moose Habitat in the Caribou and Moose LAA (ha)	Percent of Moose Habitat in the Caribou and Moose LAA (relative amount in %)	Amount of Indirect Habitat Loss (ha)	Percent of Indirect Habitat Loss in the Caribou and Moose LAA (relative amount in %)
Sahtu Region	Sahtu Rivers (#29) IWA	33,125.0	5.1	618.2	0.1
	Three Day Lake (#33) IWA	5,407.0	0.8	0.0	0.0
	Common and Transient Use	613,413.4	94.1	10,866.8	1.7
	Regional total	651,945.4	100	11,485.0	1.8
Dehcho Region	Dehcho Winter Use Areas (#37) IWA	211,283.0	58.8	5,248.2	1.5
	Common and Transient Use	147,755.0	41.2	856.8	0.2
	Regional total	359,038.0	100	6,105.0	1.7
Total Moose Habitat in Caribou and Moose LAA	IWAs	249,815.0	24.7	5,866.4	0.6
	Common and Transient Use	761,168.4	75.3	11,723.6	1.2
	Total	1,010,983.4	100	17,590.0	1.7

10.4.2.3.1.5 Summary of Residual Effect Characteristics for Change in Habitat during Construction

Following the implementation of mitigation measures described in Table 10.7, residual effects of change in habitat on boreal caribou and moose during construction are characterized by the following:

- **Direction is adverse:** Construction activities will result in a direct loss and indirect alteration of habitat for boreal caribou and moose.
- **Likelihood is certain:** Construction activities will result in direct loss and indirect alteration of caribou and moose habitat.

- **Magnitude is low:** For currently selected caribou habitat, the Project will result in a direct loss of 94.3 ha (0.03% of the LAA) and an indirect loss of 1,466 ha (0.46% of the LAA), for a total 1,560 ha (0.48%) of selected habitat effect within the Caribou and Moose LAA. For currently suitable moose habitat, there is expected to be a 0.2% direct loss and 1.7% indirect effect within the Caribou and Moose LAA.
- **Geographic extent is the Caribou and Moose LAA:** Direct habitat loss is expected to be restricted to the PDA, but indirect habitat changes through sensory disturbance (e.g., from noise and dust deposition) are expected to extend into the Caribou and Moose LAA.
- **Timing is high sensitivity:** Vegetation clearing is expected to occur in the winter, but construction will likely occur throughout the year, including during sensitive periods for boreal caribou and moose. Table 10.3 describes the combined sensitive periods for boreal caribou and moose from March 16 to April 5 and May 1 to July 15.
- **Duration is long-term:** Direct habitat loss through the construction of the Project will remain for the long-term (i.e., > 20 years). Indirect habitat alteration through sensory disturbance is expected to cease following the construction phase (i.e., up to 20 years). Still, edge effects and fragmentation are expected to persist into the operations and maintenance phase (i.e., > 20 years).
- **Frequency is continuous:** The effects of change in habitat are expected to occur throughout the construction phase (and beyond).
- **Change is irreversible:** Indirect changes in habitat through sensory disturbance (e.g., noise and dust deposition) may cease following the construction phase, but most effects associated with direct and indirect habitat loss or alteration are expected to persist throughout the life of the Project.

10.4.2.3.2 Operations and Maintenance

Additional direct loss of boreal caribou and moose habitat is not expected to occur during the operations and maintenance phase of the Project; the habitat lost during the construction phase will remain unavailable. Continued indirect alteration of boreal caribou and moose habitat is expected through the presence of the highway and associated infrastructure. This will maintain fragmentation and edge effects that were established during the construction phase and while, over time, these effects may be alleviated as shrubs may grow along the edges, these habitats are likely to experience reduced ecological effectiveness or be avoided. These indirect effects of change in habitat may be intensified by sensory disturbances associated with the presence of the highway, associated public traffic, and operations and maintenance activities.

Noise-related effects on some wildlife species occur when noise levels exceed 40 dBA, which may result in avoidance, but physiological consequences (e.g., stress) to terrestrial mammals has not been identified below 52 dBA (Shannon et al., 2016). The distribution of wildlife relative to linear disturbances can also vary over time and space. For example, while boreal caribou have been shown not to select areas on and close to the MVWR (DeMars et al., 2020), moose tracks were observed on and close to the MVWR (see Appendix 10A; EDI, 2023). Baseline noise in the region assessed in remote areas without any development or winter traffic has been estimated at 32 to

35 dBA during the day and night, respectively (Imperial Oil, 2004; see Section 13.2.2). The expected traffic volume on the highway once constructed is 50 vehicles per day for an indeterminate time, whereas the MVWR experiences the same daily volume but only for the winter (see Chapter 5). The distance at which noise associated with the presence of the highway is expected to attenuate to 40 dBA is 100 m for highway traffic and 2.5 km for (infrequent and irregular) borrow source and quarry activities (see Chapter 13). For distances larger than 5 km from the PDA, the project noise effects are expected to attenuate well below the baseline sound level due to natural atmospheric attenuation and ground absorption over distance (see Section 13.4.1). Borrow sources and quarries will not be operated at night. Generally, noise emissions at night during the operations and maintenance phase are likely minimal.

Dust deposition during the operations and maintenance phase will continue to affect vegetation adjacent to the PDA, which includes the potential for altering vegetation communities over time. Effects of dust deposition on vegetation are likely to be limited to within 40 m of the PDA (see Chapter 18).

The presence and use of the highway and quarry/borrow sources, highway and access road maintenance (including snow clearing, repair, grading, dust control), vegetation control, and bridge and culvert maintenance during the operations and maintenance phase of the Project, including associated sensory disturbance (e.g., noise and dust deposition), habitat fragmentation, and edge effects, have the potential to collectively reduce the ecological effectiveness of boreal caribou and moose habitat in areas adjacent to the PDA; however, habitats are likely already experiencing these effects from the currently existing MVWR.

10.4.2.3.2.1 *Boreal Caribou*

Sensory disturbance resulting from vehicular use of the highway during the operations and maintenance phase of the Project, along with continued effects of habitat fragmentation and edge effects, have the potential to reduce habitat effectiveness for boreal caribou in areas adjacent to the PDA (similar to the effects described for the construction phase). The distance at which noise associated with operations and maintenance activities is expected to attenuate to 40 dBA is 100 m for highway traffic and 2.5 km for quarry and borrow source activities (see Chapter 13). For distances larger than 5 km from the PDA, the project noise effects are expected to attenuate below the baseline sound level due to natural atmospheric attenuation and ground absorption over distance (see Section 13.4.1). During the operations and maintenance phase of the Project, traffic will occur year-round (compared to the current winter use only of the MVWR). Noise disturbance will be higher near the quarries and borrow sources, which will be used infrequently during that phase of the Project. Dust deposition during the operations and maintenance phase will continue to affect vegetation adjacent to the PDA, as described, during the construction phase, which includes the potential for altering vegetation communities over time (see Chapter 18).

While an additional direct loss of boreal caribou habitat is not expected during the operations and maintenance phase, continued indirect habitat changes are expected to occur within the Caribou and Moose LAA. Mitigation measures are expected to reduce the potential for the residual effect of change in habitat on boreal caribou during the operations and maintenance phase. As noted previously in Section 10.2.2.1, the Caribou and Moose LAA already has a habitat disturbance level that exceeds a conservation threshold. The project’s small contribution to direct (0.03%) loss and indirect (0.46%) effect, the residual effect of the change in habitat is not expected to alter further the population viability or persistence of boreal caribou within the Caribou and Moose LAA.

10.4.2.3.2.2 *Moose*

Sensory disturbance resulting from vehicular use of the highway and quarry and borrow operations during the operations and maintenance phase of the Project, along with continued effects of habitat fragmentation and edge effects, have the potential to reduce habitat effectiveness for moose in areas adjacent to the PDA (similar to the effects described for the construction phase). The distance at which noise associated with operations and maintenance activities is expected to attenuate to 40 dBA is 100 m for highway traffic and 2.5 km for quarry and borrow source activities (see Chapter 13). For distances larger than 5 km from the PDA, the project noise effects are expected to attenuate below the baseline sound level due to natural atmospheric attenuation and ground absorption over distance (see Section 13.4.1). During the operations and maintenance phase of the Project, traffic will occur year-round (compared to the current winter use only of the MVWR). Noise disturbance will be higher near the quarries and borrow sources, which will be used infrequently during that phase of the Project. Dust deposition during the operations and maintenance phase will continue to affect vegetation adjacent to the PDA, as described during the construction phase, which includes the potential for altering vegetation communities over time (see Chapter 18).

As described in Section 10.2.2.3, moose tracks were observed along several sections of the MVWR ROW, indicating that moose are travelling regularly along this corridor. However, the traffic on the completed highway is expected to occur year-round, which may affect moose habitat through sensory disturbance. As discussed in Section 10.4.2, indirect habitat loss due to the highway is expected based on research that has demonstrated moose avoidance of habitat adjacent to highways. However, the distance to which highways are avoided is highly variable from no avoidance to avoidance up to 1,500 m, depending on season, highway traffic and speed, available forage, predation risk and sex (Yost and Wright 2001, Laurian et al. 2008, Laurian et al. 2012, Loosen et al. 2013, Neumann et al. 2013, Wattles et al. 2018). This makes it challenging to estimate the potential indirect habitat loss from the MVWR. Due to the current low density of roads and relatively lower vehicle traffic to any of the study areas included in the literature review, indirect habitat loss is expected to be on the lower end of previously documented responses. Based on the research from Laurian et al. (2012) an indirect habitat loss of 250 m from the highway was selected. However, due to the lower vehicle traffic on the MVWR, the indirect habitat loss may be far less than this amount. Furthermore, indirect habitat loss will only be for the spring, summer, and fall period, since moose are already experiencing habitat impacts from the MVWR.

While additional direct loss of moose habitat is unlikely during the operations and maintenance phase, continued indirect habitat changes are expected to occur within the Caribou and Moose LAA. Mitigation measures are expected to reduce the potential for the residual effect of change in habitat on moose during the operations and maintenance phase. The residual effect of change in habitat is not expected to alter further the population viability or persistence of moose within the Caribou and Moose LAA.

10.4.2.3.2.3 Summary of Residual Effects Characteristics for Change in Habitat during Operations and Maintenance

Following the implementation of mitigation measures described in Table 10.7, residual effects of change in habitat on boreal caribou and moose during operations and maintenance are characterized by the following:

- **Direction is adverse:** Operations and maintenance activities are likely to result in an indirect alteration of habitat for boreal caribou and moose.
- **Likelihood is certain:** Operations and maintenance activities will indirectly affect caribou and moose habitat.
- **Magnitude is low:** During the operations and maintenance phase, no additional direct loss of boreal caribou or moose habitat is anticipated. Indirect habitat alteration may affect boreal caribou and moose habitat through ongoing sensory disturbance, habitat fragmentation, and edge effects. Indirect habitat alteration is unlikely to result in a measurable change in boreal caribou or moose habitat.
- **Geographic extent is the Caribou and Moose LAA:** Indirect habitat changes through sensory disturbance (e.g., noise and dust deposition), habitat fragmentation, and edge effects are expected in the Caribou and Moose LAA.
- **Timing is high sensitivity:** Operations and maintenance of the Project is expected to occur year-round, including during sensitive periods for boreal caribou and moose. As described in Table 10.3, the combined sensitive periods for boreal caribou and moose are March 16 to April 5 and May 1 to July 15.
- **Duration is long-term:** Sensory disturbance (e.g., noise and dust deposition), habitat fragmentation, and edge effects resulting from operations and maintenance activities are expected to result in effects on boreal caribou and moose habitat for an indeterminate period (i.e., > 20 years).
- **Frequency is continuous:** The effects of change in habitat are expected to occur throughout the operations and maintenance phase.
- **Change is irreversible:** Most effects associated with direct and indirect habitat loss or alteration are expected to persist throughout the life of the Project.

10.4.2.3.3 Summary of Residual Effects Characteristics for Change in Habitat

Table 10.12 summarizes the residual effects characteristics rating for change in boreal caribou and moose habitat during the life of the Project (i.e., the construction and operations and maintenance phases).

Table 10.12 Residual Effects on Caribou and Moose Habitat

Valued Component	Residual Effects Characterization*								
	Project Phase	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Boreal Caribou and Moose	C	A	CE	L	Caribou and Moose LAA	HS	LT	C	I
	O	A	CE	L	Caribou and Moose LAA	HS	LT	C	I

KEY

*See Table 10.3 for detailed definitions

Project Phase

C: Construction

O: Operations and Maintenance

Direction:

A: Adverse

N: Neutral

Likelihood:

U: Unlikely

P: Possible

CE: Certain

Magnitude:

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

10.4.3 Change in Movement

10.4.3.1 Effect Pathways

Construction and operations and maintenance of the Project could alter boreal caribou and moose movement patterns or potential movement corridors. Change in movement includes changes in the daily and seasonal movements of boreal caribou and moose within the Caribou and Moose LAA. Daily movements include those related to daily activities such as foraging, breeding, and avoiding predators within home ranges, while seasonal movements include those related to movements between seasonal ranges (Ament et al., 2014). Change in movement patterns may affect the ability of individuals to interact (e.g., aggregate, access food, breed, and escape predators) and may result in changes to the distribution or abundance of boreal caribou and moose within the Caribou and Moose LAA.

The ability to move between patches of suitable habitat is important for the persistence of boreal caribou and moose populations (Ament et al., 2014; Muhly et al., 2015; Beyer et al., 2016; MacNearney et al., 2016; Fryxell et al., 2020). Anthropogenic disturbances, such as roads, may present real (e.g., physical) or perceived (e.g., sensory) barriers that may alter movements between patches of suitable habitat, potentially resulting in reduced use or avoidance of disturbed areas, which, in turn, may reduce or impede access to resources (e.g., food, cover; e.g., Dyer et al., 2001; Leblond et al., 2013; Ament et al., 2014; Muhly et al., 2015; Beyer et al., 2016). Individuals may display behavioural or physiological responses to potential barriers such as decreased foraging, higher movement rates, and increased vigilance, which may lead to increased energy expenditures and elevated stress levels (Leblond et al., 2013).

The potential effects of barriers may be amplified as the intensity of anthropogenic disturbance increases (e.g., a small road with intermittent traffic compared to a busy highway; areas with lower road densities compared to areas with higher road densities, e.g., Schindler et al., 2006; Weir et al., 2007; Polfus et al., 2011; Beyer et al., 2013; Leblond et al., 2013). Similarly, effects may be magnified during sensitive periods for boreal caribou and moose, including late winter when deep snow increases the energetic costs of movement, particularly for pregnant females, and during calving/post-calving when calves are most susceptible to mortality (GovBC, 2009; GNWT, 2022b). When anthropogenic disturbances reduce or impede access to suitable habitat, individuals may be displaced into other, possibly less suitable areas, perhaps shifting their range entirely, which may affect health, reproductive output, and survival (Dyer et al., 2001; Leblond et al., 2013; Ament et al., 2014; Muhly et al., 2015; Beyer et al., 2016; MacNearney et al., 2016; Fryxell et al., 2020).

Anthropogenic effects on boreal caribou movement are well documented (Reimers and Colman, 2006; ECCC, 2020; DeMars et al., 2020; ENR, 2015) and are mostly associated with creating physical barriers and reducing the likelihood of caribou crossing developments. The creation of most infrastructure is considered semi-permeable as the infrastructure reduces the likelihood of caribou crossing these features (Dyer et al., 2002). The potential effect of change in caribou movement patterns is based on the potential for the Project to cause barriers to boreal caribou movement within and between parts of the range and suitable habitat types. The greatest potential for causing a change to boreal caribou movement patterns is the construction of infrastructure that could act as

a barrier (e.g., roads) and the use of infrastructure that could reduce the likelihood of caribou moving across the feature (e.g., traffic).

Moose movements may also be affected by their attraction to roads treated with salt or other sodium chloride-based de-icing chemicals in winter, although any nutritional benefit may be offset by an increase in mortality risk from vehicle collisions (Dussault et al., 2006; see Section 10.4.4.1).

10.4.3.1.1 Construction

Change in boreal caribou and moose movements may occur within the Caribou and Moose LAA during site preparation and construction activities that may result in the displacement of individuals due to the potential project-related barrier and permeability effects, including mobilization of equipment, materials, and fuel, resupply, and demobilization; establishment and operation of camps; site preparation of the ROW, access, and workspaces; borrow source and quarry development and operations (including blasting, crushing, sorting, and stockpiling); material haul; embankment and quarry access road construction (including road cuts); culvert installations; road base, compaction, and surfacing; and closure and reclamation of the MVWR and temporary borrow sources/quarries, camps, and workspaces (Table 10.6).

10.4.3.1.2 Operations and Maintenance

Change in boreal caribou and moose movements may occur within the LAA during operations and maintenance activities that may result in the displacement of individuals due to potential project-related barrier and permeability effects, including borrow source and quarry operations (including blasting, crushing, sorting, and stockpiling); material haul and stockpiling; operation of and activities at maintenance yards; water withdrawal for dust control; and presence of the highway and associated public traffic (Table 10.6). A study in Quebec found moose were 16 times less likely to cross a highway than expected by chance, indicating highways act as movement barriers (Laurian et al. 2008). However, the study area was in the northern part of the Laurentian Wildlife Reserve of Quebec and studied two highways that have much higher vehicle traffic (1,460 vehicles per day for Highway 169 and 2,800 vehicles/day for Highway 175) than is expected to occur on the Mackenzie Valley Highway (estimated to be 50 vehicles/day). Thus, the impact of the highway as a barrier to movement may be less than Laurian et al. (2008) observed.

10.4.3.2 Mitigation

As discussed in the Detailed Project Description (see Chapter 5), project routing and design integrated the existing MVWR ROW to the extent practicable, which will reduce potential project interactions with change in movement. In addition to a project-specific WMMP (and the Follow-up and Compliance Monitoring Plan, and Traffic Management Plan) that will be implemented during construction and operations and maintenance phases, standard industry practices and mitigation measures will also be implemented and are summarized in Table 10.7. Key mitigation measures to avoid or reduce changes in movement include:

- The Project will use previously disturbed areas for project activities and project infrastructure and workspaces, to the extent practical.
- The height of snowbanks will be limited to the extent possible and to a height of less than 1 m.
- Construction and quarry development activities will be reduced, where possible and where spatial overlap is expected, during sensitive periods for wildlife, in accordance with the WMMP.
- The Project will follow setback distances specified in the WMMP.
- Temporary access roads, quarries and workspaces not needed after construction will be closed and reclaimed.
- Closure and reclamation will promote natural re-establishment of vegetation.

10.4.3.3 Residual Effects

10.4.3.3.1 Construction

As described in the Detailed Project Description (see Chapter 5), Project construction will result in the widening of the existing MVWR ROW (from 20 m to 60 m) and the creation of new 60 m wide portions of ROW where the project routing deviates from the existing MVWR ROW (i.e., in approximately 20 places with each portion being, on average, 1 km long). The total length of new 60 m wide ROW will be about 281 km (102 km in the Dehcho Region and 179 km in the Sahtu Region).

The embankment height will generally be 1.4 to 1.8 m above the ground surface, dependent on soil and ground conditions. Weaker and finer soils require thicker embankment than competent soils or rock. The side slopes of the embankment will generally be at a ratio of one vertical unit to three horizontal units (1V:3H). This may be increased to 1V:2.5H in specific areas such as deep fills. The embankment will be comprised of 300 mm minus blast rock at the base, 50 mm minus crushed granular subbase, and 20 mm minus crushed granular base.

One study specific to determining the effect of road physical features (such as those noted above) on caribou (barren ground) movement found that there was no relationship between caribou crossing and features such as slope, height or rock grain size (ERM, 2016).

Road cuts may be needed where the grades (slope) at a steep valley approach or hill can be reduced by excavating into the hill slope. The current design identifies 14 locations where road cuts may be required. Road cuts are expected to be accommodated within the 60 m wide ROW, but local exceptions may be required in accordance with the final design.

There are going to be road cuts in up to 14 locations. The need for road cuts, road cut locations and size will be confirmed during final design and will be influenced by road operational requirements, public safety, geotechnical conditions, and the suitability of the material from the cuts to be used as road embankment. Alternate design approaches (such as switchbacks) will be considered at each of these locations and will involve modifying design criteria (such as reducing the design and posted speed limits). Through the project-specific engagement process, engagement participants stated that they support the need for road cuts in steep valleys such as at the approaches to existing bridges. Participants in Tulita also favored a road cut along the alignment option further from Bear Rock (Petını́zah), because it could potentially replace the need for a quarry near Bear Rock (Petını́zah).

There are no studies specific to caribou and moose response to road cuts.

The Project also includes new temporary and permanent access roads (each with a 30 m wide ROW) that will be developed to access four temporary and four permanent borrow sources and quarries that are not on or immediately adjacent to the ROW.

10.4.3.3.1.1 Boreal Caribou

The Project has the potential to alter boreal caribou movement patterns and movement corridors. These alterations may be caused by constructing the PDA (i.e., establishing a year-round structure that may be a physical barrier) and through sensory disturbance resulting from construction activities, traffic, and human presence. Based on radio collar information, boreal caribou have been using areas close to the MVWR ROW (Caribou and Moose TDR, Figure 1.1 [see Appendix 10A; EDI, 2022]). Animals were recorded near the MVWR ROW (i.e., within the Caribou and Moose LAA) during all seasons (i.e., calving, spring dispersal, summer, fall, and winter). Crossings may have occurred during these times, but it is unknown if the MVWR was a barrier to movements. Most of the PDA will follow the MVWR ROW, which will be widened from 20 m to 60 m and therefore potentially increase a possible barrier effect.

The anticipated year-round construction of the PDA may reduce permeability (i.e., the PDA may become more difficult to cross) compared to the currently occurring winter traffic only. Construction will be completed in sections and effects associated with sensory disturbance are expected to be localized and short-term in any given location. The conceptual schedule (see Section 5.4.1) assumes that the Project will be constructed in three segments, and each segment may take up to five years to construct.

While alteration of boreal caribou movement patterns and potential movement corridors are expected to occur within the Caribou and Moose LAA during the construction phase, it is not expected that project-related changes in their movement will result in a measurable change in their

distribution and/or abundance in the Caribou and Moose LAA. Mitigation measures identified in Table 10.7 are expected to reduce the potential for the residual effect of change in movement on boreal caribou during the construction phase.

10.4.3.3.1.2 Moose

The Project has the potential to result in the alteration of moose movement patterns and potential movement corridors (Laurian et al. 2008, Wattles et al. 2018). These alterations may be caused by constructing the PDA (i.e., establishing a year-round physical barrier) and through sensory disturbance resulting from construction activities, traffic, and human presence. Based on the available survey and other observation data, moose may have been using and crossing the MVWR ROW for the past decades (Caribou and Moose TDR, Figure 3.3 [see Appendix 10A; EDI, 2023]). Moose surveys (between 1984 and 2020) and incidental or random observations (e.g., during environmental monitoring or other surveys between 1999 and 2016) have provided evidence of moose using the MVWR ROW and adjacent areas (i.e., within the Caribou and Moose LAA) (Caribou and Moose TDR [see Appendix 10A; EDI, 2023]). Observations from moose surveys were made between November and March of any given year and were overlapping with the use of the MVWR by the public (typically between late December and late March to early April; see Chapter 5). Incidental and random observations were recorded year-round, including during the use of the MVWR by the public during winter. These observations suggest that the MVWR is not a complete barrier to moose movements, however, it is possible that there has been a reduction in movement compared to the habitat prior to the MVWR. Most of the PDA will follow the MVWR ROW, which will be widened from 20 m to 60 m and therefore potentially increase a possible barrier effect.

The anticipated year-round construction of the PDA may reduce permeability (i.e., the PDA may become more difficult to cross) compared to the current winter only traffic. Construction will be completed in sections along the three segments, and effects associated with sensory disturbance are expected to be localized and short-term in any given location. The conceptual schedule (see Section 5.4.1) assumes that the Project will be constructed in three segments and each segment may take up to five years to construct.

Moose attraction to project roads treated with de-icing or dust-suppressing products is not expected to affect movement patterns during construction because salt or other sodium chloride-based chemicals will not be used during winter. For summer use, calcium chloride is currently the only approved and locally used dust suppressant for gravel roads across the NWT (ENR, 2013); however, water sourced from the Mackenzie River (Deh Cho) and other authorized local sources will be used for compaction and dust control during construction (see Chapter 5).

While alteration of moose movement patterns and potential movement corridors may occur within the Caribou and Moose LAA during the construction phase, it is unlikely that project-related changes in their movement will result in a measurable change in their distribution and/or abundance in the Caribou and Moose LAA. Mitigation measures identified in Table 10.7 are expected to reduce the potential for the residual effect of change in movement on moose during the construction phase.

10.4.3.3.1.3 *Summary of Residual Effect Characteristics for Change in Movement during Construction*

Following the implementation of mitigation measures described in Table 10.7, residual effects of change in movement on boreal caribou and moose during construction are characterized by the following:

- **Direction is adverse:** Construction activities may alter boreal caribou and moose movement patterns and potential movement corridors.
- **Likelihood is possible:** Construction activities may alter boreal caribou and moose movement patterns and potential movement corridors.
- **Magnitude is low:** Based on the current use of the MVWR ROW and adjacent areas by boreal caribou and moose, it is not expected that project-related changes in their movement will result in a measurable change in their distribution and/or abundance in the Caribou and Moose LAA.
- **Geographic Extent is the Caribou and Moose LAA:** Project-related changes in caribou and moose movement are expected to extend into the Caribou and Moose LAA.
- **Timing is high sensitivity:** Vegetation clearing is expected to occur in the winter, but construction will likely occur throughout the year, including during sensitive periods for boreal caribou and moose. As described in Table 10.3, the combined sensitive periods for boreal caribou and moose are March 16 to April 5 and May 1 to July 15.
- **Duration is long-term:** Barriers to movement through sensory disturbance may be reduced following the construction phase (i.e., up to 20 years) but the physical barrier of the all-season highway is expected to persist throughout the life of the Project (i.e., > 20 years).
- **Frequency is continuous:** The effects of change in movement are expected to occur throughout the construction phase (and beyond).
- **Change is irreversible:** Barriers to movement through sensory disturbance may be reduced following the construction phase, but the effect of the physical barrier of the all-season highway is expected to persist throughout the life of the Project.

10.4.3.3.2 **Operations and Maintenance**

The completed highway, permanent borrow sites and quarries, and associated access roads, in addition to public use of the road and operations and maintenance activities, have the potential to result in the alteration of boreal caribou and moose movement patterns and potential movement corridors. The presence of the full-length highway from end to end (i.e., 281 km of new constructed highway in addition to the existing segments to be incorporated) and associated permanent borrow sites and quarries with their respective access roads will represent a semi-permeable year-round barrier. Compared to the current presence of the MVWR ROW, the completed Project will increase the size of the barrier (i.e., the ROW will increase from 20 to 60 m) and duration of use (i.e., change from current winter use only to year-round use). Use of the constructed highway by all-season traffic, with an estimated 50 vehicles per day (see Chapter 5), is likely to reduce barrier

permeability. Traffic is anticipated to comprise local and commercial traffic between communities, tourists, and industrial traffic (see Chapter 5).

10.4.3.3.2.1 Boreal Caribou

The completed highway, use of the highway, and operation of permanent borrow sites and quarries with their respective access roads can result in the alteration of boreal caribou movement patterns and potential movement corridors. These alterations may be caused by the presence of the highway (i.e., establishing a year-round semi-permeable physical barrier) and through sensory disturbance resulting from use of the highway and human presence. Based on radio collar information, boreal caribou have been using areas close to the MVWR ROW (Caribou and Moose TDR, Figure 1.1 [see Appendix 10A; EDI, 2023]). Locations were recorded near the MVWR ROW (i.e., within the Caribou and Moose LAA) during all seasons (i.e., calving, spring dispersal, summer, fall, and winter). Crossings may have occurred during these times, but it is unknown if the MVWR was a barrier to their movements. Most of the PDA will follow the MVWR ROW, which will be widened from 20 m to 60 m, potentially increasing a possible barrier effect.

Traffic on the completed highway, once constructed, is expected to be approximately 50 vehicles per day year-round (Detailed Project Description; see Chapter 5), which may reduce permeability compared to the currently occurring winter traffic only.

While alteration of boreal caribou movement patterns and potential movement corridors may occur within the Caribou and Moose LAA during the operations and maintenance phase, it is not expected that project-related changes in their movement will result in a measurable change in their distribution and/or abundance in the Caribou and Moose LAA. Mitigation measures identified in Table 10.7 are expected to reduce the potential for the residual effect of change in movement on boreal caribou during the operations and maintenance phase.

10.4.3.3.2.2 Moose

The completed highway, permanent borrow sources and quarries with their respective access roads, and public use of the highway can result in the alteration of moose movement patterns and potential movement corridors. These alterations may be caused by the presence of the highway (i.e., establishing a year-round physical barrier) and through sensory disturbance resulting from use of the highway and human presence. Based on available survey and other observation data, moose may have been using and crossing the MVWR ROW for the past decades (Caribou and Moose TDR, Figure 3.3 [see Appendix 10A; EDI, 2023]). Moose surveys (between 1984 and 2020) and incidental or random observations (e.g., during environmental monitoring or other surveys between 1999 and 2016) have provided evidence of moose using the MVWR ROW and adjacent areas (i.e., the LAA) (Caribou and Moose TDR [see Appendix 10A; EDI, 2023]). Observations from moose surveys were made between November and March of any given year and were overlapping with the use of the MVWR by the public (typically between late December and late March to early April; see Chapter 5). Incidental and random observations were recorded year-round, including during the use of the MVWR by the public in winter. These observations suggest the MVWR may not

have acted as a barrier to moose movements. Most of the PDA will follow the MVWR ROW, which will be widened from 20 m to 60 m, potentially increasing a possible barrier effect.

Traffic on the highway, once constructed, is expected to be approximately 50 vehicles per day year-round (see Chapter 5), which may reduce permeability compared to the currently occurring winter traffic only.

While alteration of moose movement patterns and potential movement corridors are expected to occur within the Caribou and Moose LAA during the operations and maintenance phase, it is not expected that project-related changes in their movement will result in a measurable change in their distribution and/or abundance in the Caribou and Moose LAA. Mitigation measures identified in Table 10.7 are expected to reduce the potential for the residual effect of change in movement on moose during the operations and maintenance phase.

10.4.3.3.2.3 *Summary of Residual Effect Characteristics for Change in Movement during Operations and Maintenance*

Following the implementation of mitigation measures described in Table 10.7, residual effects of change in movement on boreal caribou and moose during operations and maintenance are characterized by the following:

- **Direction is adverse:** Operations and maintenance activities may alter boreal caribou and moose movement patterns and potential movement corridors.
- **Likelihood is possible:** Operations and maintenance activities may alter boreal caribou and moose movement patterns and potential movement corridors.
- **Magnitude is low:** Based on the current use of the MVWR ROW and adjacent areas by boreal caribou and moose, it is not expected that project-related changes in their movement will result in a measurable change in their distribution and/or abundance in the Caribou and Moose LAA.
- **Geographic extent is the Caribou and Moose LAA:** Project-related changes in caribou and moose movement are expected to extend into the Caribou and Moose LAA.
- **Timing is high sensitivity:** Operations and maintenance of the Project is expected to occur year-round, including during sensitive periods for boreal caribou and moose. As described in Table 10.3, the combined sensitive periods for boreal caribou and moose are March 16 to April 5 and May 1 to July 15.
- **Duration is long-term:** Project-related changes in caribou and moose movement are expected to persist throughout the life of the Project (i.e., > 20 years).
- **Frequency is continuous:** The effects of change in movement are expected to occur throughout the operations and maintenance phase.
- **Change is irreversible:** The Project will be operated indeterminately, and the physical barrier of the all-season highway and associated public traffic are expected to persist throughout the life of the Project.

10.4.3.3 Summary of Residual Effects Characteristics for Change in Movement

Table 10.13 summarizes the residual effects characteristics rating for change in boreal caribou and moose movement during the life of the Project (i.e., the construction and the operations and maintenance phases).

Table 10.13 Residual Effects on Caribou and Moose Movement

Valued Component	Residual Effects Characterization*								
	Project Phase	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Boreal Caribou and Moose	C	A	P	L	Caribou and Moose LAA	HS	LT	C	I
	O	A	P	L	Caribou and Moose LAA	HS	LT	C	I

KEY

*See Table 10.3 for detailed definitions

Project Phase

C: Construction

O: Operations and maintenance

Direction:

A: Adverse

N: Neutral

Likelihood:

U: Unlikely

P: Possible

CE: Certain

Magnitude:

No: Negligible

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

10.4.4 Change in Mortality Risk

10.4.4.1 Effect Pathways

Construction and operations and maintenance of the Project could increase mortality risk or the number of boreal caribou and moose fatalities through direct or indirect pathways. Direct mortality pathways include collisions during construction with project-related vehicles and mobile equipment (e.g., used for grading, compaction, and dust control) and with vehicles driven by public users of the completed highway. Indirect mortality pathways include increased harvest pressure via improved hunter access, and increased predation via facilitated predation (when linear features facilitate predator movements); see Section 10.4.4.1.2 (indirect mortality pathways) or apparent competition (when habitat changes create conditions supporting higher densities of alternative prey species; see Section 10.4.4.1.2 (indirect mortality pathways)). Overall, direct and indirect mortality pathways resulting from project activities may affect the abundance of boreal caribou and/or moose within the LAA, as described in the following section.

10.4.4.1.1 Direct Mortality Pathways

Boreal caribou and moose may cross the highway or access roads associated with the Project during daily or seasonal movements, potentially exposing them to an increased risk of mortality via wildlife-vehicle collisions (Rea and Rea, 2005; EDI, 2015; ECCC, 2020). Some individuals may use roads with limited traffic (e.g., access roads) as travel corridors, particularly during winter, which may result in wildlife-vehicle collisions (Oberge, 2001; Rea and Rea, 2005; Berger, 2007; Muhly et al., 2011; Leblond et al., 2013; Ewacha, 2016; Dickie et al., 2020). Wildlife (e.g., moose) may also be attracted to ROWs with altered vegetation and brush growing back (for foraging on early seral stage vegetation) after being cleared initially for construction, which may expose them to the risk of wildlife-vehicle collisions (Oberge, 2001; Rea and Rea, 2005; Leblond et al., 2013; EDI, 2015; Ewacha, 2016; ECCC, 2020). Moose may be attracted to project roads due to the use, if any, of road salt or other sodium chloride-based de-icing chemicals in winter, increasing mortality risk from vehicle collisions (Dussault et al., 2006).

10.4.4.1.2 Indirect Mortality Pathways

Linear features, such as roads and trails, may improve hunter access to previously inaccessible areas, which may result in mortality of boreal caribou and moose via increased harvest pressure (Boer, 1990; Beazley et al., 2004; Schindler et al., 2006; Ewacha, 2016; ECCC, 2020). Similarly, facilitated predation may occur when linear features such as compacted roads and trails with light, infrequent traffic facilitate predator movements into areas occupied by prey species (Oberge, 2001; Dickie et al., 2017, 2020; ECCC, 2020). However, traffic on roads and trails can deter predators using linear features. If predators (e.g., wolves and bears) use these linear features to move more quickly and consequently hunt more efficiently within their ranges, this facilitation of movement may result in increased predation on and subsequent mortality of boreal caribou and moose (Oberge, 2001; Beazley et al., 2004; Schindler et al., 2006; Ewacha, 2016; Dickie et al., 2017, 2020; Mumma and Gillingham, 2019; ECCC, 2020).

Dehcho First Nations have expressed concerns regarding over-harvesting by recreational harvesters (Dehcho First Nations, 2011). Over harvesting by Indigenous hunters is not a concern as traditional harvesting has declined over the last few decades, but there has been a slow increase in Indigenous hunters entering accessible habitat areas in the Dehcho Region during the fall and winter months (Dehcho First Nations, 2011). Dehcho First Nations indicate that the number of animals harvested by recreational hunters is not known (Dehcho First Nations, 2011).

Dehcho First Nations reported concerns about boreal caribou habitat becoming more widely known, which would result in caribou being targeted by non-Indigenous harvesters (Dehcho First Nations, 2011). Apparent competition can occur when natural or anthropogenic disturbances initiate habitat changes on the landscape (e.g., mature forests are changed to early successional forests) that may create conditions supporting higher densities of alternative prey species (e.g., deer) (Bergerud and Elliot, 1986; Oberg, 2001; Fortin et al., 2017; Mumma and Gillingham, 2019; Dickie et al., 2020; ECCC, 2020; Fryxell et al., 2020). This increase in alternative prey species, in turn, supports increased predator populations (e.g., wolves and bears), which may also prey on other species (such as boreal caribou) when they are encountered (Bergerud and Elliot, 1986; Oberg, 2001; Fortin et al., 2017; Mumma and Gillingham, 2019; Dickie et al., 2020; ECCC, 2020; Fryxell et al., 2020). Unnaturally high predation rates resulting from apparent competition have been identified as a primary threat for several populations of boreal caribou (ECCC, 2020; Fryxell et al., 2020).

10.4.4.1.3 Construction

Direct mortality of boreal caribou and moose may occur within the PDA during site preparation and construction activities that involve the movement of vehicles and mobile equipment, including mobilization of equipment, materials, and fuel, resupply, and demobilization; site preparation of the ROW, access, and workspaces; material haul; and embankment and quarry access road construction (including road cuts) (Table 10.6).

Indirect mortality of boreal caribou and moose may occur within the LAA during site preparation and construction activities that may facilitate increased harvest pressure (via improved hunter access) or increased predation (via facilitated predation or apparent competition), including site preparation of the ROW, access, and workspaces; and embankment and quarry access road construction (including road cuts) (Table 10.6). During construction, the MVWR will continue to be accessible for public use during winter (see Chapter 5).

10.4.4.1.4 Operations and Maintenance

Direct mortality of boreal caribou and moose may occur within the PDA during operations and maintenance activities that involve the movement of vehicles and mobile equipment, including material haul and stockpiling; water withdrawal for dust control; and presence of the highway and associated public traffic (Table 10.6).

Operations and maintenance of the Project are expected to result in a continuation of an increase in indirect mortality of boreal caribou or moose within the LAA via increased harvest pressure based on year-round improved access. However, due to the expected traffic on the highway, the effects of indirect mortality on boreal caribou and moose via increased predation are not expected to increase further from the level possibly occurring during the construction phase; however, this effect may persist throughout the life of the Project.

10.4.4.2 Mitigation

As discussed in Chapter 5, project routing and design have integrated the existing MVWR ROW to the extent practicable, which will reduce potential project interactions with change in mortality risk. A project-specific WMMP, SCP, and TMP will be implemented. Monitoring of wildlife-vehicle collisions, harvest monitoring programs (described in Section 10.8), standard industry practices and mitigation measures will also be implemented and are summarized in Table 10.7. Key mitigation measures to avoid or reduce changes in mortality risk include:

- Project personnel will be prohibited from hunting wildlife while housed in work camps for the Project.
- Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP.
- Wildlife monitors will assess for the presence of wildlife in or near the PDA during project activities and mitigation will occur in accordance with the approved WMMP.
- The Project will use previously disturbed areas for project activities and project infrastructure and workspaces, to the extent practical.
- Clearing will be limited to areas required for construction and safe operations.
- Construction and quarry development activities will be reduced, where possible and spatial overlap is expected, during sensitive periods for wildlife in accordance with the WMMP.
- Pre-construction surveys will be completed to identify possible wildlife habitat features along the ROW (like mineral licks) and potential crossing locations.

10.4.4.3 Residual Effects

10.4.4.3.1 Construction

10.4.4.3.1.1 Boreal Caribou

10.4.4.3.1.1.1 Direct Mortality

Site preparation and construction activities within the PDA may result in direct mortality of boreal caribou via vehicle collisions. This may occur when animals cross the PDA during daily or seasonal movements.

The GNWT maintains an informal database for wildlife-vehicle collisions on highways across the NWT (except for the Sahtu and Beaufort Delta regions). The database was initially created to record vehicle collisions with wood bison but has been expanded to include other wildlife species (Armstrong, 2021, pers. comm.). Between 2009 and 2016, five vehicle collisions with boreal and/or barren-ground caribou were recorded on Highways #1 and #7 in the Dehcho and South Slave regions, with no information on the collision location (Armstrong, 2021, pers. comm.), which equates to less than one caribou-vehicle collision per year. This supports the assessment that vehicle collisions are not considered a major threat to boreal caribou (ECCC, 2020). Currently, there are no data on wildlife-vehicle collisions along the existing MVWR (Armstrong, 2021, pers. comm.).

Highways #1 and #7 in the NWT are all-season highways. Highway #1 spans the Dehcho and South Slave regions and Highway #7 is located entirely within the Dehcho Region (NWT Parks, 2021; GNWT, 2020c). Based on traffic data collected between 2011 and 2020, the average annual daily traffic volume for Highways #1 and #7 ranged from 130 to 190 vehicles per day (with a mean value of 166 vehicles per day) and 30 to 80 vehicles per day (mean of 64 vehicles per day), respectively (GNWT, 2020d). The posted maximum speed limit on Highways #1 and #7 is 80-100 km/h.

Where the all-season Highway #1 ends at Wrigley (in the Dehcho Region), the existing MVWR extends north into the Sahtu Region (NWT Parks, 2021). The existing MVWR is only operational during winter (i.e., between the end of December and the end of March/early April; see Chapter 5) with varying speed limits (of 50 km/h or less) depending on the time of year, load, and location. Based on traffic data collected along the existing MVWR between 2005 and 2021, the average daily traffic volume ranged from 14 to 164 vehicles per day (mean of 54 vehicles per day; GNWT, 2020c).

The daily traffic volume estimates for the existing MVWR are within the range of the daily traffic volume estimates for Highways #1 and #7, which suggests that the risk of wildlife-vehicle collisions along the existing MVWR is likely comparable to the risk of caribou-vehicle collisions along Highways #1 and #7 (i.e., less than one caribou-vehicle collision per year). However, the risk of caribou-vehicle collisions along the existing MVWR is assumed to be lower, considering that the MVWR is only operational during winter and speed limits are lower. These conclusions are supported by available TK and TLRU information for caribou-vehicle collisions in the Dehcho and Sahtu regions. Contrary to that reported by Armstrong (2021, personal communication above), there were no known incidences of boreal caribou being struck by vehicles in the Dehcho Region

(up to November 2010), even though there are several all-season and winter roads in the region with regular boreal caribou sightings along these roads (Dehcho First Nations, 2011). Similarly, vehicle collisions with boreal caribou have not been reported in the Sahtu Region (McDonald, 2010).

As described in Chapter 5, it is anticipated that the Project will be constructed in three segments over a period of up to 20 years, with actual construction time amounting to approximately 10 years in total due to gaps in construction between segments to allow for permitting and procurement. Project equipment and materials will be mobilized before the construction of each segment via barge and/or truck, with approximately 500 trucks potentially required during each mobilization. Some mobilization via truck would occur during winter (i.e., December to April) by winter road. During the construction of each segment, resupply of bulk items and other supplies will occur via barge and/or truck, with 50 to 100 trucks potentially required annually. Based on truck transport estimates for mobilization and resupply, approximately 200 to 250 trucks may be required per year (i.e., less than one truck per day).

In addition to mobilization and resupply transport, construction is anticipated to occur year-round, which would involve localized movement of project-related vehicles and mobile equipment within the PDA. Equipment, scrap materials, and wastes will also be demobilized progressively toward the end of each construction segment (by barge and/or truck); however, the number of demobilization transports has not been estimated. Public use of the MVWR will continue during project construction, thus adding additional vehicle traffic (see Chapter 5).

While traffic volumes are expected to increase within the PDA during the construction phase, it is anticipated that any change in mortality risk for boreal caribou due to increased wildlife-vehicle collision risk will remain within the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for direct boreal caribou mortality, thereby reducing the residual effect of change in mortality risk during the construction phase. The residual effect of change in mortality risk via direct mortality pathways is unlikely to alter the population viability or persistence of boreal caribou within the Caribou and Moose LAA.

10.4.4.3.1.1.2 Indirect Mortality

Portions of the Caribou and Moose LAA that may have been previously inaccessible, or only accessible during winter through the existing MVWR, may become accessible year-round as construction of the Project advances (as per the staged construction schedule; Section 10.1.4.2). These access improvements may change indirect mortality risk on boreal caribou within the Caribou and Moose LAA, including increased harvest pressure via improved hunter access and increased predation via facilitated predation. Similarly, habitat changes resulting from clearing new ROW sections and widening existing sections of MVWR ROW may change the indirect mortality risk on boreal caribou within the Caribou and Moose LAA through increased predation via apparent competition.

Indigenous hunters harvest boreal caribou within the Dehcho and Sahtu regions. In 2005, subsistence harvest (i.e., harvest by Indigenous hunters and General Hunting Licence holders) in the Pehdzéh Kì N’deh area of the Dehcho Region was estimated at 50 caribou¹ for the preceding year (IMG-Golder Corporation, 2006). Boreal caribou are also lawfully harvested by resident hunters in the NWT via a regulated harvest (non-resident hunters cannot harvest boreal caribou in the NWT). Based on a summary of the resident hunter harvest of woodland caribou (boreal and mountain ecotypes) in the NWT between 1983/1984 and 2018/2019 (ENR, 2020d), the GNWT-ECC estimated 19 boreal caribou were harvested on average each year in the NWT (ENR, 2021, pers. comm.). While overall boreal caribou harvest to date in the NWT is understood to be low, there are concerns about the potential of local overharvesting, particularly in the vicinity of communities, roads, and waterbodies that may facilitate access into boreal caribou habitat (ECCC, 2020; SARC, 2022).

Based on traditional observations and community harvesting levels, it is believed that boreal caribou populations are generally stable within the Dehcho and Sahtu regions (McDonald, 2010; Dehcho First Nations, 2011). However, studies in southern NWT areas suggest an overall long-term decline in boreal caribou in the Dehcho Region (SARC, 2022). Increased wildfire disturbance and/or high levels of anthropogenic pressure (including harvest) can cause local population declines, particularly for boreal caribou (McDonald, 2010; Dehcho First Nations, 2011).

Access is expected to improve, and habitat changes are expected to occur within the Caribou and Moose LAA during the construction phase. However, the GNWT and the co-management boards will continue to manage harvesting. The responsibility for wildlife management, including harvest management, is shared between governments, users, and renewable resources board set up under land claim agreements, such as the SRRB. Therefore, it is anticipated that any change in mortality risk on boreal caribou due to increased harvest pressure or predation risk will remain within current harvest limits or the natural range of variability.

Mitigation measures identified in Table 10.7 are expected to reduce the potential for indirect boreal caribou mortality, thereby reducing the residual effect of change in mortality risk during the construction phase. The residual effect of change in mortality risk via indirect pathways is not expected to alter the population viability or persistence of boreal caribou within the Caribou and Moose LAA.

¹ The number of caribou harvested included both boreal and barren-ground caribou with no breakdown provided.

10.4.4.3.1.2 *Moose*

10.4.4.3.1.2.1 *Direct Mortality*

Site preparation and construction activities within the PDA may result in direct mortality of moose via vehicle collisions. This may occur when individuals cross the PDA during daily or seasonal movements or are attracted to project infrastructure if de-icing or dust control chemicals are used.

To document wildlife-vehicle collisions, the GNWT maintains an informal database for highways in the NWT (except the Sahtu and Beaufort Delta regions). Between 2011 and 2019, seven vehicle collisions with moose were recorded on Highways #1 and #7 in the Dehcho Region (Armstrong, 2021, pers. comm), which equates to less than one moose-vehicle collision per year. Currently, there are no data on wildlife-vehicle collisions along the existing MVWR (Armstrong, 2021, pers. comm.).

Highways #1 and #7 in the NWT are all-season highways, with Highway #1 spanning the Dehcho and South Slave regions and Highway #7 located entirely within the Dehcho Region (NWT Parks, 2021; GNWT, 2020c). Based on traffic data collected between 2011 and 2020, the average annual daily traffic volume for Highways #1 and #7 averaged 166 vehicles per day and 64 vehicles per day, respectively (GNWT, 2020d). The maximum posted speed limit on Highways #1 and #7 is 80-100 km/h.

The existing MVWR is only operational during winter (i.e., between late December to late March/early April; see Chapter 5) with varying speed limits (of up to 50 km/h) depending on the time of year, load, and location. Based on traffic data collected along the existing MVWR between 2005 and 2021, the average daily traffic volume is approximately 54 vehicles per day (GNWT, 2020c), which is within the range of the daily traffic volume estimates for Highways #1 and #7, suggesting that the risk of moose-vehicle collisions along the existing MVWR is likely similar to Highways #1 and #7 (i.e., less than one moose-vehicle collision per year). The risk of moose-vehicle collisions along the existing MVWR may be even lower, considering the MVWR is only operational during winter and has a lower speed limit. Information from TK and TLRU regarding vehicle collisions with moose are not available for the Dehcho or Sahtu regions.

Based on truck transport estimates for mobilization and resupply, approximately 200 to 250 trucks may be required per year (i.e., less than one truck per day; see Chapter 5). In addition to mobilization and resupply transport, construction on site is anticipated to occur year-round, involving localized movement of project-related vehicles and mobile equipment within the PDA. It is also expected that public use of the MVWR will continue during project construction, thus adding additional vehicle traffic (see Chapter 5).

Moose attraction to areas of the ROW, where altered vegetation communities may be growing back after initial clearing for construction purposes, potentially may lead to increased risk of vehicle collision, but is expected to be eliminated or reduced through regular vegetation control measures (Table 10.7).

Moose attraction to project roads treated with de-icing or dust suppressing products during construction is not expected because salt or other sodium chloride-based chemicals will not be used for project construction during winter. During project construction, only water will be used for compaction and dust control, except as provided for in the GNWT Guideline for Dust Suppression (see Chapter 5).

While traffic volumes are expected to increase within the PDA during the construction phase, it is anticipated that any change in mortality risk on moose due to increased wildlife-vehicle collision risk will remain within the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for direct mortality, thereby reducing the residual effect of change in mortality risk during the construction phase. The residual effect of change in mortality risk via direct pathways is not expected to alter the population viability or persistence of moose within the Caribou and Moose LAA.

10.4.4.3.1.2.2 Indirect Mortality

Portions of the Caribou and Moose LAA that may have been previously inaccessible, or only accessible during winter through the existing MVWR, may become accessible year-round as project construction advances (as per the staged construction schedule; Section 10.1.4.2). These improvements to access may result in a change in indirect mortality risk on moose within the Caribou and Moose LAA, including increased harvest pressure via improved hunter access and increased predation via facilitated predation. Similarly, habitat changes resulting from clearing new ROW sections and widening existing MVWR ROW sections may change the indirect mortality risk on moose within the Caribou and Moose LAA through increased predation via apparent competition.

Moose are harvested by Indigenous hunters within the Dehcho and Sahtu regions, with harvest numbers varying from year to year. In 2005, subsistence harvest (i.e., harvest by Indigenous hunters and General Hunting Licence holders) in the Pehdzéh Kì N’deh area of the Dehcho Region was estimated at 75 moose for the preceding year (IMG-Golder Corporation, 2006). Studies using estimated minimum harvest numbers showed that annual moose harvest in the Mackenzie Valley is believed to be moderate (averaging approximately 6% of the studied populations—approximately 30 moose per year in an area west of Norman Wells) due to low human occupation and limited access (Stenhouse et al., 1995; Veitch et al., 1995; Swallow et al., 2003) and appears to be within sustainable limits (Veitch et al., 1995). However, moose harvest can be higher locally where access is available (e.g., near communities, roads, and waterbodies; Brackett et al., 1985; Treseder and Graf, 1985; GNWT, 2022c).

Based on traditional observations and community harvesting levels, it is believed that the moose populations are generally stable within the Dehcho and Sahtu regions (McDonald, 2010; Dehcho First Nations, 2011). People from all Sahtu communities have observed an increase in wolf population numbers, believed to be a result of a decrease in wolf trapping activities (McDonald, 2010); however, Sahtu communities also observed an increase in the abundance of moose.

Access is expected to improve and habitat changes are expected to occur within the Caribou and Moose LAA during the construction phase; however, since harvesting will continue to be managed by the GNWT and the co-management boards, it is anticipated that any change in indirect mortality risk on moose due to increased harvest pressure will remain within current harvest limits or the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for indirect mortality, thereby reducing the residual effect of change in mortality risk during the construction phase. The residual effect of change in mortality risk via indirect pathways is not expected to alter the population viability or persistence of moose within the Caribou and Moose LAA.

10.4.4.3.1.3 Residual Effect Characterization

Following the implementation of mitigation measures described in Table 10.7, residual effects for change in mortality risk on boreal caribou and moose during the construction phase are characterized by the following:

- **Direction is adverse:** Construction activities may increase the mortality risk via direct and indirect pathways for boreal caribou and moose.
- **Likelihood is possible:** Construction activities may increase the mortality risk via direct and indirect pathways for boreal caribou and moose.
- **Magnitude is low:** A measurable change in the abundance of boreal caribou and moose within the Caribou and Moose LAA is unlikely. Mitigation measures are expected to reduce the potential for direct and indirect mortality, thereby reducing the residual effect of change in mortality risk during the construction phase. A residual effect may occur but is not expected to alter the population viability or persistence of boreal caribou or moose within the Caribou and Moose LAA.
- **Geographic extent is the Caribou and Moose LAA:** Direct mortality of caribou and moose is expected to be restricted to the PDA, while indirect mortality pathways are likely to extend into the Caribou and Moose LAA.
- **Timing is high sensitivity:** Vegetation clearing is expected to occur in the winter but construction will likely occur throughout the year, including during sensitive periods for boreal caribou and moose. As described in Table 10.3, the combined sensitive periods for boreal caribou and moose are March 16 to April 5 and May 1 to July 15.
- **Duration is long-term:** Direct and indirect pathways of mortality are expected to be present during the construction phase (i.e., up to 20 years) and may continue through the operations and maintenance phase (i.e., > 20 years).
- **Frequency is irregular event:** Construction activities may result in direct and/or indirect mortality of boreal caribou and moose, but potential mortalities are expected to occur at no set schedule (i.e., they are expected to be isolated and infrequent events) following the implementation of mitigation measures.
- **Change is irreversible:** Direct and indirect mortality risk is expected to persist throughout the life of the Project.

10.4.4.3.2 Operations and Maintenance

10.4.4.3.2.1 Boreal Caribou

10.4.4.3.2.1.1 Direct Mortality

As discussed in Section 10.4.4.1, the presence of the highway and four permanent borrow sources and quarries with permanent year-round access within the PDA may result in direct mortality of boreal caribou via collisions with vehicles using the completed highway. This effect is influenced by both traffic volume and speed and may occur when animals cross the highway during daily or seasonal movements. An increase in both traffic volume and speed on the completed highway (compared to the existing MVWR) may be mitigated by the widening of the ROW and trimming of dense brush within the ROW, which will improve the visibility of wildlife and reduce the potential for collisions (Table 10.7).

As described in Chapter 5, once operational, the expected traffic volume on the highway is approximately 50 vehicles per day, year-round, for an indeterminate time. The posted speed limit for highway travel will be 80 km/h. While the expected daily traffic volume is similar to the average daily traffic volume for the current MVWR, the MVWR is only operational during winter and the speed limit is lower. The expected daily traffic volume and speed limit for the highway are within range of the daily traffic volume estimates and speed limits for all-season Highways #1 and #7, which suggests that the risk of wildlife-vehicle collisions due to the Project will likely be similar to the risk of wildlife-vehicle collisions along those highways (i.e., less than one caribou-vehicle collision per year). Currently, available TK and TLRU information for caribou-vehicle collisions in the Dehcho and Sahtu regions concludes that there are no known incidences of boreal caribou being struck by vehicles in the Dehcho Region, even though there are several existing all-season and winter roads in the region, with regular boreal caribou sightings along these roads (Dehcho First Nations, 2011). Similarly, vehicle collisions with boreal caribou have not been reported in the Sahtu Region (McDonald, 2010).

While annual traffic volumes will increase on the completed highway during the operations and maintenance phase as compared to the current MVWR, it is anticipated that any change in mortality risk on boreal caribou due to increased wildlife-vehicle collisions will remain within the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for direct mortality, thereby reducing the residual effect of change in mortality risk during the operations and maintenance phase. The residual effect of change in mortality risk via direct pathways is not expected to alter the population viability or persistence of boreal caribou within the Caribou and Moose LAA.

10.4.4.3.2.1.2 Indirect Mortality

As described in Chapter 5, the Project will provide year-round access to the Caribou and Moose LAA. Portions of the Caribou and Moose LAA that may have been previously inaccessible, or only accessible during winter by the existing MVWR, may become accessible year-round once construction is completed and the highway is operational. These improvements to access may

continue to result in increases in indirect mortality risk on boreal caribou within the Caribou and Moose LAA through increased harvest pressure. However, due to the expected traffic, which is likely to deter predators, the effects of indirect mortality on boreal caribou via increased predation (through facilitated predation) are not expected to increase further but may persist throughout the life of the Project.

Boreal caribou are harvested by Indigenous hunters within the Dehcho and Sahtu regions. In 2005, subsistence harvest in the Pehdzéh Kì N’deh area of the Dehcho Region was estimated at 50 caribou (boreal and barren-ground caribou) for the preceding year (IMG-Golder Corporation, 2006). Based on a summary of the resident hunter harvest between 1983 and 2019, the GNWT-ECC estimated that 19 boreal caribou were harvested annually in the NWT (ENR, 2020, pers. comm.). While overall boreal caribou harvest to date in the NWT is low, there are concerns about the potential of local overharvesting, particularly in the vicinity of communities, roads, and waterbodies that may facilitate access to boreal caribou habitat (ECCC, 2020; SARC, 2022). Based on traditional observations and community harvesting levels, it is believed that boreal caribou populations are generally stable within the Dehcho and Sahtu regions (McDonald, 2010; Dehcho First Nations, 2011). However, studies in southern NWT areas suggest an overall long-term decline in boreal caribou in the Dehcho Region (SARC, 2022). Increased wildfire disturbance and/or high levels of anthropogenic pressure (including harvest) are known to cause local population declines for boreal caribou (McDonald, 2010; Dehcho First Nations, 2011).

Access to the Caribou and Moose LAA is expected to improve and habitat changes are expected to occur within the Caribou and Moose LAA during the construction phase. These changes are anticipated to continue through the operations and maintenance phase. Harvest will continue to be managed by the GNWT and the co-management boards and, therefore, it is anticipated that any change in indirect mortality risk on boreal caribou due to increased harvest pressure or predation risk will remain within allowable harvest limits or the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for indirect mortality, thereby reducing the residual effect of change in mortality risk during the operations and maintenance phase. The residual effect of change in mortality risk via indirect pathways is not expected to alter the population viability or persistence of boreal caribou within the Caribou and Moose LAA.

10.4.4.3.2.2 *Moose*

10.4.4.3.2.2.1 *Direct Mortality*

As discussed in Section 10.4.4.1, the presence of the highway and four permanent borrow sources and quarries with permanent year-round access within the PDA may result in direct mortality of moose via collisions with vehicles using the completed highway. This effect is influenced by both traffic volume and speed and may occur when animals cross the highway during daily or seasonal movements. Mortality risk associated with an increase in annual traffic volume and speed on the new highway (compared to the existing MVWR) may be reduced by the widening of the ROW and regular vegetation management by trimming of dense brush along the highway ROW, which will improve the visibility of wildlife and reduce the potential for collisions.

As described in Chapter 5, once operational, the annual average daily traffic volume on the highway is anticipated to be approximately 50 vehicles per day, year-round, for an indeterminate time. The posted speed limit for highway travel will be 80 km/h. While the expected daily traffic volume for the new highway is similar to the average daily traffic volume for the current MVWR, the MVWR is only operational during winter and the speed limit is lower (refer to details under the Construction sub-heading). The expected daily traffic volume and speed limit for the Project are within range of the daily traffic volume estimates and speed limits for all-season Highways #1 and #7, which suggests that the risk of wildlife-vehicle collisions along the Project will likely be similar to the risk of wildlife-vehicle collisions along Highways #1 and #7 (i.e., less than one moose-vehicle collision per year).

Moose attraction to areas of the ROW where altered vegetation communities may be growing back after initial clearing for construction purposes and subsequent increased risk of vehicle collision is expected to be eliminated or reduced through regular vegetation control measures (Table 10.7).

While annual traffic volumes will increase on the completed highway during the operations and maintenance phase, it is anticipated that change in mortality risk on moose due to increased wildlife-vehicle collision risk will remain within the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for direct mortality, thereby reducing the residual effect of change in mortality risk during the operations and maintenance phase. The residual effect of change in mortality risk via direct pathways is not expected to alter the population viability or persistence of moose within the Caribou and Moose LAA.

10.4.4.3.2.2 Indirect Mortality

As described in Chapter 5, the Project will create and maintain year-round access to the Caribou and Moose LAA. Portions of the Caribou and Moose LAA that may have been previously inaccessible, or only accessible during winter through the existing MVWR, may become accessible year-round once construction is completed and the highway is operational. These improvements to access may continue to result in a change in indirect mortality risk on moose within the Caribou and Moose LAA, including increased harvest pressure via improved hunter access and increased predation via facilitated predation. Similarly, habitat changes that resulted from clearing new sections of ROW and widening existing sections of MVWR ROW during the construction phase may continue to result in a change in indirect mortality risk on moose within the Caribou and Moose LAA through increased predation via apparent competition.

Moose subsistence harvest in the Pehdzéh Kì N’deh area of the Dehcho Region was estimated at 75 moose for the 2004/2005 season (IMG-Golder Corporation, 2006). With approximately 30 moose per year, the annual moose harvest in the Mackenzie Valley is believed to be moderate (averaging approximately 6% of the studied populations), believed to be due to low human occupation and limited access (Stenhouse et al., 1995; Veitch et al., 1995; Swallow et al., 2003), and appears to be within sustainable limits (Veitch et al., 1995). However, moose harvest can be higher locally where access is available (e.g., near communities, roads, and waterbodies; Brackett et al., 1985; Treseder and Graf, 1985; GNWT, 2022c).

Based on traditional observations and community harvesting levels, it is believed that the moose populations are generally stable within the Dehcho and Sahtu regions (McDonald, 2010; Dehcho First Nations, 2011).

Access is expected to improve, and habitat changes are expected to occur within the Caribou and Moose LAA during the construction phase, and these changes are anticipated to continue through the operations and maintenance phase. Harvest will continue to be managed by the GNWT and the co-management boards and, therefore, it is anticipated that any change in mortality risk on moose due to increased harvest pressure or predation risk will remain within current harvest limits or the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for interactions between moose and potential pathways of indirect mortality, thereby reducing the residual effect of change in mortality risk during the operations and maintenance phase. The residual effect of change in mortality risk via indirect pathways is not expected to alter the population viability or persistence of moose within the Caribou and Moose LAA.

10.4.4.3.2.3 *Residual Effect Characterization*

Following the implementation of mitigation measures described in Table 10.7, residual effects for change in mortality risk on boreal caribou and moose during operations and maintenance are characterized by the following:

- **Direction is adverse:** Operations and maintenance activities may increase the mortality risk via direct and indirect pathways for boreal caribou and moose.
- **Likelihood is possible:** Operations and maintenance activities may increase the mortality risk via direct and indirect pathways for boreal caribou and moose.
- **Magnitude is low:** A measurable change in the abundance of boreal caribou and moose within the Caribou and Moose LAA is not anticipated. Mitigation measures are expected to reduce the potential for direct and indirect mortality, thereby reducing the residual effect of change in mortality risk during the operations and maintenance phase. A residual effect may occur but is not expected to alter the population viability or persistence of boreal caribou or moose within the Caribou and Moose LAA.
- **Geographic extent is the Caribou and Moose LAA:** Direct mortality of caribou and moose is expected to be restricted to the PDA, while indirect mortality pathways will extend into the Caribou and Moose LAA.
- **Timing is high sensitivity:** Use of the Highway will continue year-round, including during sensitive periods for boreal caribou and moose. As described in Table 10.3, the combined sensitive periods for boreal caribou and moose are March 16 to April 5 and May 1 to July 15.
- **Duration is long-term:** Direct and indirect mortality pathways are expected to be present during the operations and maintenance phase (i.e., > 20 years).

- **Frequency is irregular event:** Operations and maintenance activities may result in direct and indirect mortality of boreal caribou and moose, but potential mortalities are expected to occur at no set schedule (i.e., they are expected to be isolated and infrequent events) following the implementation of mitigation measures.
- **Change is irreversible:** Direct and indirect mortality risk is expected to persist throughout the life of the Project.

10.4.4.3.3 Summary of Residual Effects Characteristics for Change in Mortality Risk

Table 10.14 summarizes the residual effects characteristics rating for change in boreal caribou and moose mortality risk during the life of the Project (i.e., the construction and operations and maintenance phases).

Table 10.14 Characterization of Residual Effects on Mortality Risk

Valued Component	Residual Effects Characterization*								
	Project Phase	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Boreal Caribou and Moose	C	A	P	L	Caribou and Moose LAA	HS	LT	IR	I
	O	A	P	L	Caribou and Moose LAA	HS	LT	IR	I

KEY

*See Table 10.3 for detailed definitions

Project Phase

C: Construction

O: Operations and maintenance

Direction:

A: Adverse

N: Neutral

Likelihood:

U: Unlikely

P: Possible

CE: Certain

Magnitude:

No: Negligible

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

N/A: Not applicable

10.4.5 Change in Health

10.4.5.1 Effect Pathways

Construction and operations and maintenance of the Project could expose boreal caribou and moose to potential contaminants or emissions that may affect their health, including changes in energetics and physical condition because of project-related sensory disturbance, increased predation, and increased hunting pressure.

Wildlife health can be measured through various parameters, including the absence of disease, the presence of contaminants, productivity, the viability of their population, or the ability to cope with stress and change. For this assessment, the exposure pathways for boreal caribou and moose were identified as:

- Exposure to contaminants or emissions that may affect their health.
- Sensory disturbance, increased predation, and increased hunting pressure that may result in changes in energetics and physical condition (Table 10.2).

Exposure to contaminants or emissions includes direct contact with or ingestion of soil, vegetation, or water that may contain contaminants. Deposition of rock and dust may release contaminants into the surrounding terrestrial and aquatic environment during material extraction (e.g., blasting, stockpiling), crushing, transport, and road construction activities.

Boreal caribou and moose health may be affected by consuming contaminated vegetation. For example, lichen bioaccumulates atmospheric pollutants (e.g., stemming from emission), which could be passed to caribou foraging on lichen (Naeth and Wilkinson, 2008). While the concentration of pollutants necessary to produce negative effects on lichen and caribou is poorly understood (Naeth and Wilkinson, 2008), the effects of natural resource development throughout the circumpolar North, with the associated introduction of pollution into the atmosphere, may result in the loss of lichen and their reduced productivity (Klein and Vlasova, 1991), which may negatively affect caribou.

Disturbance to caribou through sensory stressors resulting from industrial development or infrastructure projects may reduce the effectiveness of adjacent habitats, affect movement patterns, and/or increase overall energy expenditures (through changes in the animals’ activities) near the sources of sensory disturbance (Gunn et al., 2011). Caribou may be displaced by industrial development or infrastructure projects, resulting in the temporary avoidance of areas near the source of disturbance. Changes in energy expenditure (e.g., through increased movements) may affect the physical condition of individual animals (including the presence of parasites and diseases), calf survival, and population viability. Effects from anthropogenic disturbance or displacement associated with industrial development and infrastructure projects have the potential to add to effects from existing natural environmental variability, such as changes in climate and weather patterns, and influence the resilience of caribou populations to cope with additional stress factors, such as predation and hunting pressure (Gunn et al., 2011).

Effects on boreal caribou and moose health are closely linked to changes in movement (Section 10.4.3) and change in mortality risk (Section 10.4.4).

10.4.5.1.1 Construction

Boreal caribou and moose health may be affected in the PDA and Caribou and Moose LAA during construction activities through the described exposure pathways. Activities include mobilization of equipment, materials, and fuel, resupply, and demobilization; site preparation of ROW, access, and workspaces; borrow source and quarry development and operations, including blasting, crushing, sorting, and stockpiling; embankment and quarry access road construction, including road cuts; and road base, compaction, and surfacing (Table 10.6). The transport, hauling, and storage of hazardous material has the potential to interact with boreal caribou and moose habitat through accidental spills, which is addressed in Chapter 25.

10.4.5.1.2 Operations and Maintenance

Similar to the construction phase, boreal caribou and moose health may be affected in the PDA and Caribou and Moose LAA during operations and maintenance activities through borrow source and quarry operations (including blasting, crushing, sorting, and stockpiling) and the presence and use of the highway (Table 10.6). Deposition of dust is likely to persist through operations and maintenance with the presence of the highway and associated public traffic as the primary pathways for dust to enter the terrestrial and aquatic environments.

10.4.5.2 Mitigation

As discussed in Chapter 5, project routing and design have integrated the existing MVWR ROW to the extent practicable, which will reduce potential project interactions with changes in health. In addition to a project-specific WMMP, Waste Management Plan, SCP, and Traffic Management Plan that will be implemented during construction and operations and maintenance phases, standard industry practices and mitigation measures will also be implemented and are summarized in Table 10.7. Key mitigation measures to avoid or reduce changes in wildlife health include:

- Spill contingency measures will be implemented, in accordance with the SCP.
- Fuel handling and refueling will be in accordance with an Operating Procedure to be included in the SCP.
- Only material with low ARD/ML potential will be used for the Project.
- Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m from the high-water mark and in a manner to prevent any deleterious substances from entering the water.
- Machinery will not be left in any waterbody.
- Water only will be used for dust suppression, except as provided for in the GNWT Guideline for Dust Suppression.

- Incinerators will be operated in accordance with manufacturer’s specifications and emissions will meet Canadian Council of Ministers of the Environment Canada Wide Standards for Dioxins & Furans and Mercury.
- Equipment, wastes, and contaminated soils will be removed once construction is completed.

10.4.5.3 Residual Effects

10.4.5.3.1 Construction

10.4.5.3.1.1 Boreal Caribou

As described in the Caribou and Moose TDR (see Appendix 10A; EDI, 2022), based on past studies, boreal caribou in the Dehcho Region appear in good condition with a low prevalence of parasites and disease antibodies, which are known to typically occur in other Canadian regions (Johnson et al., 2010; Larter et al., 2019). Serum samples from caribou captured in the Dehcho Region showed some exposure (i.e., 15.7%) to the pathogenic bacterium *Erysipelothrix rhusiopathiae*, which can adversely affect caribou survival and reproduction (Schwantje et al., 2016; Larter et al., 2019). Prevalence of the bacterium appears lower in the Dehcho Region than in other Canadian caribou ranges. Winter ticks (*Dermacentor albipictus*) are uncommon in the NWT and were documented on some captured boreal caribou from the Dehcho Region between 2015 and 2018 but not in 2019 (Larter et al., 2019). The TK from the Dehcho Region concurs with the findings that boreal caribou appear to be in good health in the Dehcho Region, with no reported incidents of unusual internal parasites or evidence of disease, and animals were found to be fat when harvested in the fall and winter (Dehcho First Nations, 2011). Baseline information on contaminant levels (e.g., metals, organochlorines) in NWT boreal caribou is currently unavailable.

The Project can change caribou health through exposure to contaminants and sensory disturbance stemming from construction activities, traffic, and human presence. The potential for contaminants originating from project emissions during the construction phase, including dust, is anticipated to be too low to affect vegetation in the Caribou and Moose LAA (see Chapter 18). If the vegetation is not affected, then it is unlikely to affect boreal caribou health. Sedimentation and runoff from project activities and accidental spills of hazardous materials may release contaminants into the environment but are not considered to expose boreal caribou in the Caribou and Moose LAA due to the localized and infrequent nature of these potential events, for which established and effective mitigations exist. Sensory disturbance may result in increased stress in boreal caribou and, with that, increased susceptibility to parasites and diseases and/or altered energetics. Based on radio collar information, boreal caribou have been recorded near the current MVWR ROW during all seasons (i.e., calving, spring dispersal, summer, fall, and winter) over the past years, including during the operating season between December and April (Caribou and Moose TDR, Figure 1.1 [see Appendix 10A; EDI, 2023]), indicating that boreal caribou in the Dehcho and Sahtu regions are tolerating the exposure to the effects of seasonal traffic.

Construction of the Project in the PDA will be completed in sections and effects associated with contaminant exposure (if any) and sensory disturbance are expected to be localized and short-term in any given location. The conceptual schedule (see Chapter 5) assumes that the Project will be constructed in three segments and each segment may take up to five years to construct.

While exposure to potential contaminants and sensory disturbance may occur within the Caribou and Moose LAA during the construction phase, it is anticipated that change in boreal caribou health will remain within the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for interactions between boreal caribou and potential exposure pathways, thereby reducing the residual effect of change in health during the construction phase. As such, the residual effect is not expected to alter the population viability or persistence of boreal caribou within the Caribou and Moose LAA.

10.4.5.3.1.2 Moose

Starting in 2003, baseline information on the condition of resident moose in the Dehcho Region was collected through aerial surveys and analysis of fecal, bone, and tissue samples from harvested animals (Larter, 2009). Results showed a low presence of disease and parasites, winter ticks or papillomas were absent, and the levels of cadmium found in the kidneys of harvested moose were considered low. In summary, low occurrence of diseases and parasites, low levels of cadmium in organ tissue, and fat indices indicated that moose were in good body condition (Larter, 2009). Between 2005 and 2016, Larter et al. (2018a) analyzed additional tissues collected from moose harvested in the Dehcho Region, confirming that most of the moose were in good or excellent body condition, with cadmium and mercury concentrations within the limits of moose in other regions (Larter et al., 2018a). Elevated cadmium levels have been identified in moose tissues from the southern Mackenzie Mountains (outside and west of the Caribo and Moose LAA) compared to those harvested in the Mackenzie Valley (Larter et al., 2018b). The main source of cadmium in the NWT is from natural erosion and weathering processes through which plants can absorb the element and pass it on in the food chain. Cadmium has documented adverse health effects on terrestrial wildlife, and the GNWT issued a bulletin recommending that Dehcho residents should limit the consumption of liver and kidneys from moose harvested in the southern Mackenzie Mountains due to high cadmium levels (GNWT, 2017). There are no known moose health studies from the Sahtu region.

The Project has the potential to result in a change of moose health through exposure to contaminants and sensory disturbance stemming from construction activities, traffic, and human presence. Potential contaminants originating from project emissions during the construction phase, including dust deposition, are anticipated to be too low to affect vegetation in the LAA (see Chapter 18), and are therefore not anticipated to affect moose health. Sedimentation and runoff from project activities, as well as accidental spills of hazardous materials, may release contaminants into the environment but are not considered to expose moose in the Caribou and Moose LAA due to the localized nature of these potential events. Sensory disturbance may result in increased stress in moose and increased vulnerability to parasites and diseases. Based on the available survey and other observation data, moose have been using the MVWR ROW and adjacent areas in the Caribou and Moose LAA for the past decades (Caribou and Moose TDR, Figure 3.3 [see Appendix 10A; EDI, 2023]). Observations from moose surveys were made between November

and March of any given year and were overlapping with the use of the MVWR by the public (typically between late December and late March to early April; see Chapter 5). Incidental and random observations were recorded year-round, including during the use of the MVWR by the public in winter. These observations indicate that moose in the Dehcho and Sahtu regions are tolerating the exposure to seasonal traffic.

Construction of the Project in the PDA will be completed in sections and effects associated with contaminant exposure (if any) and sensory disturbance are expected to be localized and short-term in any given location. The conceptual schedule (see Chapter 5) assumes that the Project will be constructed in three segments, and each segment may take up to five years to construct.

While exposure to potential contaminants and sensory disturbance may occur within the Caribou and Moose LAA during the construction phase, it is anticipated that change in moose health will remain within the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for interactions between moose and potential exposure pathways, thereby reducing the residual effect of change in health during the construction phase. As such, the residual effect on health is not expected to alter the population viability or persistence of moose within the Caribou and Moose LAA.

10.4.5.3.1.3 *Summary of Residual Effect Characteristics for Change in Health during Construction*

Following the implementation of mitigation measures described in Table 10.7, residual effects for change in health on boreal caribou and moose during construction are characterized by the following:

- **Direction is adverse:** Construction activities may alter boreal caribou and moose health.
- **Likelihood is possible:** Construction activities may alter boreal caribou and moose health.
- **Magnitude is low:** Based on the current use of the MVWR ROW and adjacent areas by boreal caribou and moose, and their observed overall good health (where information is available), project-related changes to health are not expected to result in a measurable change in their population viability or persistence the Caribou and Moose LAA.
- **Geographic extent is the Caribou and Moose LAA:** Project-related changes in boreal caribou and moose health are expected to extend across the Caribou and Moose LAA.
- **Timing is high sensitivity:** Construction will occur throughout the year, including during sensitive periods for boreal caribou and moose. As described in Table 10.3, the combined sensitive periods for boreal caribou and moose are March 16 to April 5 and May 1 to July 15.
- **Duration is long-term:** Potential exposure to contaminants and sensory disturbance may be reduced following the construction phase (i.e., up to 20 years), but the effects are expected to persist throughout operations and maintenance (i.e., greater than 20 years).

- **Frequency is continuous:** The effects of change in health are expected to occur throughout the construction phase (and beyond).
- **Change is irreversible:** Potential effects of change in health through exposure to contaminants and sensory disturbance may be reduced following the construction phase, but the all-season highway and associated traffic are expected to persist throughout the life of the Project.

10.4.5.3.2 Operations and Maintenance

10.4.5.3.2.1 Boreal Caribou

As described for the construction phase, based on past studies, boreal caribou in the Dehcho Region appear to be in good condition, with a low prevalence to parasites and disease antibodies typically known to occur in other Canadian regions (Johnson et al., 2010; Larter et al., 2019; Dehcho First Nations, 2011) and a relatively low exposure to the pathogenic bacterium, *E. rhusiopathiae* (Schwantje et al., 2016; Larter et al., 2019). Winter ticks were documented on some captured boreal caribou from the Dehcho Region (Larter et al., 2019). Baseline information on contaminant levels (e.g., metals, organochlorines) in NWT boreal caribou is currently not available.

The Project has the potential to result in a change of boreal caribou health through the exposure to contaminants and sensory disturbance stemming from the presence of the highway and through sensory disturbance resulting from permanent borrow and quarry source operations. Potential contaminants originating from project emissions during the operations and maintenance phase, including dust deposition, are likely to be too low to affect vegetation in the Caribou and Moose LAA (see Chapter 18) and are therefore not anticipated to affect boreal caribou health. Sensory disturbance may result in increased stress in boreal caribou and, with that, increased susceptibility to parasites and diseases and/or altered energetics. Boreal caribou have been recorded near the current MVWR ROW during all seasons, including during the operating season between December and April (Caribou and Moose TDR, Figure 1.1 [see Appendix 10A; EDI, 2023]), indicating that boreal caribou in the Dehcho and Sahtu regions are tolerating the exposure to the effects of seasonal traffic.

Traffic on the highway, once constructed, is expected to be approximately 50 vehicles per day year-round (see Chapter 5), which may increase emissions and sensory disturbance compared to the currently occurring winter traffic only. Project emissions stemming from public use of the highway during the operations and maintenance phase, including dust deposition, are anticipated to be too low to affect vegetation in the Caribou and Moose LAA and are not anticipated to affect boreal caribou health.

While exposure to potential contaminants and sensory disturbance may occur within the Caribou and Moose LAA during the operations and maintenance phase, it is anticipated that change in boreal caribou health will remain within the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for interactions between boreal caribou and potential exposure pathways, thereby reducing the residual effect of change in health

during the operations and maintenance phase. The residual effect is not expected to alter the population viability or persistence of caribou within the Caribou and Moose LAA.

10.4.5.3.2.2 *Moose*

Studies in the Dehcho Region showed that moose were healthy and in good condition with a low presence of disease and parasites (Larter, 2009). Cadmium and mercury concentrations were recorded to be within the limits of those reported for moose in other regions (Larter et al., 2018a) with only moose tissues from the southern Mackenzie Mountains (outside and west of the Caribou and Moose LAA) showing elevated cadmium levels (Larter et al., 2018b).

The Project has the potential to result in a change of moose health through the exposure to potential contaminants and sensory disturbance stemming from the presence of the highway and through sensory disturbance resulting from associated traffic and permanent borrow and quarry source operations. Project emissions during the operations and maintenance phase, including dust deposition, are anticipated to be too low to affect vegetation in the Caribou and Moose LAA and are therefore not anticipated to affect moose health. Sensory disturbance may result in increased stress in moose and, with that, increased susceptibility to parasites and diseases. Moose have been recorded to use the current MVWR ROW, including during the operating season between December and April (Caribou and Moose TDR, Figure 1.1 [see Appendix 10A; EDI, 2022]), indicating that moose in the Dehcho and Sahtu regions are tolerating the exposure to the effects of seasonal traffic.

Traffic on the highway, once constructed, is expected to be approximately 50 vehicles per day year-round (see Chapter 5), which may result in increased emissions and sensory disturbance compared to the currently occurring winter traffic only. Project emissions during the operations and maintenance phase, including dust deposition, are anticipated to be too low to affect vegetation in the LAA and are therefore not anticipated to affect moose health.

While exposure to potential contaminants and sensory disturbance may occur within the Caribou and Moose LAA during the operations and maintenance phase, it is anticipated that a change in moose health will remain within the natural range of variability. Mitigation measures identified in Table 10.7 are expected to reduce the potential for interactions between moose and potential exposure pathways, thereby reducing the residual effect of change in health during the operations and maintenance phase. As such, the residual effect is not expected to alter the population viability or persistence of moose within the Caribou and Moose LAA.

10.4.5.3.2.3 *Summary of Residual Effects Characteristics for Change in Health during Operations and Maintenance*

Following the implementation of mitigation measures described in Table 10.7, residual effects for change in health on boreal caribou and moose during operations and maintenance are characterized by the following:

- **Direction is adverse:** Operations and maintenance activities may alter boreal caribou and moose health.
- **Likelihood is possible:** Operations and maintenance activities may alter boreal caribou and moose health.
- **Magnitude is low:** Based on the current use of the MVWR ROW and adjacent areas by boreal caribou and moose and their observed overall good health (where information is available), it is not expected that project-related changes in their health will result in a measurable change in their population viability or persistence in the Caribou and Moose LAA.
- **Geographic extent is the Caribou and Moose LAA:** Project-related changes in boreal caribou and moose health are expected to extend across the Caribou and Moose LAA.
- **Timing is high sensitivity:** The Project will be operated indeterminately, including during sensitive periods for boreal caribou and moose. As described in Table 10.3, the combined sensitive periods for boreal caribou and moose are March 16 to April 5 and May 1 to July 15.
- **Duration is long-term:** Potential exposure to contaminants and sensory disturbance stemming from the all-season highway and associated traffic are expected to persist throughout operations and maintenance (i.e., > 20 years).
- **Frequency is continuous:** The effects of change in health are expected to occur throughout the operations and maintenance phase.
- **Change is irreversible:** The Project will be operated indeterminately, and a change in health through exposure to contaminants and sensory disturbance stemming from the all-season highway and associated traffic may persist throughout the life of the Project.

10.4.5.3.3 *Summary of Residual Effects Characteristics for Change in Health*

Table 10.15 summarizes the residual effects characteristics rating for change in boreal caribou and moose health during the life of the Project (i.e., the construction and the operations and maintenance phases).

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Table 10.15 Residual Effects on Caribou and Moose Health

Valued Component	Residual Effects Characterization*								
	Project Phase	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Boreal Caribou and Moose	C	A	P	L	Caribou and Moose LAA	HS	LT	C	I
	O	A	P	L	Caribou and Moose LAA	HS	LT	C	I

KEY

*See Table 10.3 for detailed definitions

Project Phase

C: Construction

O: Operations and maintenance

Direction:

A: Adverse

N: Neutral

Likelihood:

U: Unlikely

P: Possible

CE: Certain

Magnitude:

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

10.4.6 Summary of Residual Effects

Table 10.16 provides a summary of the residual effects on boreal caribou and moose during the life of the Project (i.e., the construction and the operations and maintenance phases): change in habitat, change in movement, change in mortality risk, and change in health.

With the implementation of the mitigation measures, the Project is anticipated to meet the SLUP conformity requirement related to fish and wildlife, and consideration of engagement input and incorporation of Traditional Knowledge.

The design of the Project and mitigation measures for protection of caribou and moose will respect the values of the Bear Rock CZ, Mio Lake CZ, Norman Range SMZ, K'ąąłq Tué (Willow Lake Wetlands) SMZ, and the Deh Cho (Mackenzie River) SMZ as important habitats for caribou and moose.

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Table 10.16 Residual Effects on Caribou and Moose

Residual Effect	Residual Effects Characterization*								
	Project Phase	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	C	A	CE	L	LAA ¹	HS	LT	C	I
	O	A	CE	L	LAA ¹	HS	LT	C	I
Change in Movement	C	A	P	L	LAA ¹	HS	LT	C	I
	O	A	P	L	LAA ¹	HS	LT	C	I
Change in Mortality Risk	C	A	P	L	LAA ¹	HS	LT	IR	I
	O	A	P	L	LAA ¹	HS	LT	IR	I
Change in Health	C	A	P	L	LAA ¹	HS	LT	C	I
	O	A	P	L	LAA ¹	HS	LT	C	I

KEY

*See Table 10.3 for detailed definitions

Project Phase

C: Construction

O: Operations and maintenance

Direction:

A: Adverse

N: Neutral

Likelihood:

U: Unlikely

P: Possible

CE: Certain

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA¹: Caribou and Moose LAA

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

10.5 Assessment of Cumulative Effects on Caribou and Moose

Adverse residual effects described in Section 10.4 can interact cumulatively with residual effects on caribou and moose from other past, present, and reasonably foreseeable projects and physical activities if they overlap spatially (i.e., in the Caribou and Moose LAA) and temporally. As described in Section 10.1.4.1, the LAA for caribou and moose (i.e., the Caribou and Moose LAA) was extended to the boundaries of the RAA to assess residual project effects on boreal caribou and moose, accounting for the likelihood of some residual effects to extend beyond the boundaries of the general LAA and the fact that caribou and moose populations use larger areas than outlined by the general LAA. The species-specific Caribou and Moose LAA, identical to the boundaries of the RAA, was also used in the assessment of cumulative effects on boreal caribou and moose, consistent with the cumulative effects assessment of other VCs.

The effects of past and current projects contribute to existing conditions (Section 10.2), which formed the basis for the assessment of project effects. Therefore, cumulative effects are described as those resulting from residual project effects contributing to the effects of reasonably foreseeable projects and physical activities. These projects and activities are identified and the Project’s contribution to the cumulative effects is then described qualitatively.

Future projects that are reasonably foreseeable are those that: (a) have obtained the necessary authorizations to proceed or are in the process of obtaining the required authorization; or (b), have been publicly announced with the intention to seek the necessary authorizations to proceed.

Two conditions should be met to initiate an assessment of cumulative effects on caribou and moose:

- A project-related adverse residual effect on caribou and moose is identified.
- The adverse residual effect of the Project overlaps spatially and temporally with the effect of other projects or physical activities on caribou and moose.

If either condition is not met, further assessment of cumulative effects is not warranted because the Project is not considered to interact cumulatively with other projects or activities. Barren-ground caribou habitat, movement, mortality, and health are not assumed to be currently affected by the Project as the current range of the Bluenose-East Herd does not overlap with the Caribou and Moose LAA (Figure 10.3). However, the Project may contribute cumulatively to reasonably foreseeable projects and physical activities in the Caribou and Moose LAA and affect barren-ground caribou in proximity to the Caribou and Moose LAA (e.g., through change in mortality via increased harvester access). Therefore, following the conservative approach of this effects assessment, and to address uncertainties about barren-ground caribou future range, follow-up monitoring for the Bluenose-East herd was considered in Sections 10.7 and 10.8, respectively.

10.5.1 Residual Effects Likely to Interact Cumulatively

The project and physical activity inclusion list (Table 10.17) identifies known past, present, and reasonably foreseeable projects and physical activities that could overlap spatially and temporally with the residual effects. Chapter 4 presents the names, proponents, use or activity, descriptions, status, and location of these projects and activities.

Table 10.17 Interactions with the Potential to Contribute to Cumulative Effects

	Residual Effects			
	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Health
Other Projects and Physical Activities with Potential for Cumulative Effects				
Past and Present Physical Activities (Base Case)				
<i>Geotechnical (projects in Hamlet of Tulita)</i>	-	-	-	-
<i>Oil, Gas & Seismic*</i>				
Tulita 2D Seismic Program	✓	✓	✓	-
EL 466 Drilling Program	✓	✓	✓	-
Windy Island Drilling Program	✓	✓	✓	-
Summit Creek Drilling Program	✓	✓	✓	-
Slater River Project	✓	✓	✓	-
Little Bear Staging Area	✓	✓	✓	-
<i>Infrastructure</i>				
Mackenzie Valley Winter Road, including bridges and bridge-sized culverts	✓	✓	✓	✓
Deline Winter Road	✓	✓	✓	✓
Highway #1	✓	✓	✓	✓
Canyon Creek All Season Access Road	✓	✓	✓	✓
Norman Wells Pipeline	✓	✓	✓	✓
Mackenzie Valley Fibre Link	✓	✓	✓	✓
<i>Quarries and Borrow Sources</i>				
HRN Quarry	✓	✓	✓	✓
Little Bear River Quarry	✓	✓	✓	✓
<i>Mining & Exploration</i>				
Wrigley Zinc Property Drilling Program	✓	✓	✓	✓
<i>Municipal Operations (including water, waste, power, and community development)</i>				
Wrigley Municipal Activities	✓	✓	-	-
Tulita Municipal Activities	✓	✓	-	-

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	Residual Effects			
	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Health
Other Projects and Physical Activities with Potential for Cumulative Effects				
Norman Wells Municipal Activities	✓	✓	-	-
Prohibition Creek Access Road	✓	✓	✓	✓
Project-related Physical Activities (Project Case)				
Mackenzie Valley Highway Project	✓	✓	✓	✓
Reasonably Foreseeable Physical Activities (Reasonably Foreseeable Case)				
Quarries				
Dhu-1 Quarry	✓	✓	✓	-
Infrastructure				
Great Bear River Bridge	✓	✓	✓	-
Oil and Gas				
Enbridge Maintenance Camp	✓	✓	✓	-

Notes:

- ✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with project residual effects.
- = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
- * = Includes support activities such as production, exploration, remediation, drilling, wells, associated infrastructure, facilities, camp, and staging areas.

10.5.2 Change in Habitat

10.5.2.1 Cumulative Effects Pathways

Residual effects for change in habitat resulting from past, present, and reasonably foreseeable projects and physical activities follow similar pathways as those expected to result from the Project (Section 10.4.2.1). Project-related effects are predicted to contribute cumulatively to a change in direct habitat loss and indirect habitat alteration during the construction and operations and maintenance phases. Habitat may be directly lost through vegetation clearing and indirect habitat alteration may occur through sensory disturbance, edge effects, and fragmentation generated during construction and operations and maintenance of the Project (Section 10.4.2.1).

Past and present projects and physical developments that may have contributed to cumulative effects of habitat loss in the Caribou and Moose LAA are oil and gas activities, mining and exploration activities, the Norman Wells Pipeline, the MVWR, Highway #1, other all-season and

winter roads, quarries and borrow sources, the Mackenzie Valley Fibre Link, and municipal operations. Reasonably foreseeable projects and developments include the proposed Dhu-1 Quarry and the Great Bear River Bridge that are planned to be developed within the Caribou and Moose LAA.

10.5.2.2 Mitigation for Cumulative Effects

Mitigation measures described in Section 10.4.2.2 and the listed management and monitoring plans will be implemented to reduce the contribution to cumulative effects of change in habitat on boreal caribou and moose. This includes adherence to the project-specific WMMP and other management and monitoring plans used to protect and monitor the environment during project construction and operations and maintenance, including the Spill Contingency Plan and Traffic Management Plan.

No additional mitigation measures are required to reduce the Project’s contribution to cumulative effects of change in habitat on boreal caribou and moose. The Project will use previously disturbed areas for project activities and project infrastructure and workspaces, to the extent practical. Reasonably foreseeable projects and physical activities are assumed to be required to implement similar mitigation measures to those described in Section 10.4.5.2 to reduce their contributions to cumulative effects.

10.5.2.3 Cumulative Effects

10.5.2.3.1 Direct Habitat Loss and Indirect Habitat Alteration

10.5.2.3.1.1 Boreal Caribou

The potential direct and indirect effects on boreal caribou habitat were assessed using a disturbance-based approach described in the framework to identify critical habitat for boreal caribou (EC 2011), the federal recovery strategy (ECCC 2020), and regional-specific disturbance limits derived by the GNWT (GNWT 2019). Environment and Climate Change Canada developed a relationship that expresses the probability of a boreal caribou population being stable or increasing at varying levels of total range disturbance (EC 2011, ECCC, 2020). Disturbed habitats are areas that have burned within the past 40 years or are within 500 m of an anthropogenic footprint. This analysis indicated that boreal caribou require at least 65% undisturbed habitat within their range to maintain sustained or positive population growth. The NWT boreal caribou population (NT1) was classified as self-sustaining by ECCC based on the habitat conditions at that time and the current understanding that boreal caribou in the NWT consists of one single population occupying a continuous range (ECCC, 2020). To account for variation within the extensive NT1 range, the GNWT (2019) accounted for regions with naturally high levels of wildfire and varied maximum total disturbance limits between 30 to 40%, with an overall maximum in NT1 of 35%.

The habitat disturbance assessment was completed using three spatial scales: the Caribou and Moose LAA, the Caribou Range Planning Regions (Sahtu and Southern NT1), and the NT1 range. A GIS-based calculation (NWT Species and Habitat Viewer, 2023) was used for calculating the disturbance metrics. The disturbance-based approach included fires ≤40 years old (1982–2021)

and anthropogenic disturbances (2015), plus a 500 m buffer. The Project footprint (PDA) (including a 500 m buffer) was added to the existing fire and human disturbance footprints (NWT Species and Habitat Viewer, 2023) to assess the Project's contribution to existing disturbance. The 500 m buffer will not account for all indirect changes (based on the literature review provided above) in boreal caribou habitat and is only intended to indicate anthropogenic habitat disturbance.

Accounting for fires ≤ 40 years old (404,222 ha) and existing anthropogenic disturbances plus a 500 m buffer (206,982 ha), there is a combined existing disturbance of 528,167 ha (52.3%) in the Caribou and Moose LAA. The cumulative habitat disturbance in the Caribou and Moose LAA exceeds the 35% threshold identified by ECCC (2011, 2020) and the 40% limit identified for the Southern NWT Planning Region (GNWT 2019). Although the Project contributes a small proportion of the loss of selected habitat (Section 10.4.2.3), that effect occurs in a landscape with a pre-existing high disturbance level. Regardless, the NWT Species and Habitat Viewer (2023) results note that *“The results of queries for areas of interest that are smaller than the NT1 range should not be relied upon to make inferences about whether boreal caribou populations are self-sustaining or non in the specific area of interest”*.

There is 3,014,899 ha (20.2%) of disturbed habitat in the Sahtu Range Planning Region, and 6,374,525 ha (39.3%) of disturbed habitat in the Southern NT1 Range Planning Region. The broadest NT1 region has 12,380,071 ha (27.9%) of disturbed habitat (Table 10.18).

The total disturbance for the NT1 range calculated by the NWT Species and Habitat Viewer (2023) (Table 10.17) is different than that reported by GNWT (2019). The difference in disturbance area may be explained in part by the different years the disturbance calculations were completed (e.g., fires are only considered to be a disturbance if they occurred in the past 40 years and some older fires may not have been accounted for any longer in the 2023 calculations).

The current disturbance in the Southern NWT Planning Region (39.3%) is mainly caused by wildfires but does include disturbance from several existing highways, roads and seismic lines (NT Species and Habitat Viewer 2023). The disturbance level is above ECCC’s recommended 35% disturbance threshold within the range of a boreal caribou population (ECCC, 2020). However, given that it is a region with naturally high wildfire levels, it is just below the GNWT’s (2019) recommended 40% combined disturbance level. While fire disturbances and seismic lines will regenerate with time, the highways and roads will continue to affect caribou habitat.

The Project will contribute incrementally to indirect habitat alteration considering reasonably foreseeable projects and physical activities (Table 10.17). Although additive, the reasonably foreseeable projects are comparatively small regarding their contributions to sensory disturbance. It is assumed that these localized quarry, road, and bridge projects will use best practices and proven techniques and implement effective mitigation measures.

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Table 10.18 Existing Disturbance and Project Contribution in NT1 Boreal Caribou Range, Affected Range Planning Regions, and the Caribou and Moose LAA

Boundary Name	Boundary area (ha)	Before Project				Project	After Project					
		Human Disturbance Area (ha) ¹	Human Disturbance Area Percentage (%)	Total Disturbance Area (ha) ²	Total Disturbance Area Percentage (%)	MVH Disturbance Area (ha) ³	Human Disturbance Area (ha) ¹	Human Disturbance Area as Percentage (%)	New Total Disturbance Area (ha) ⁴	Total Disturbance Area (ha) ²	Total Disturbance Area as Percentage (%)	Percent Change from Project (%)
NT1 Range	44,292,049	4,047,137	9.14	12,380,071	27.95	3,197	4,050,335	9.15	1,574	12,381,645	27.96	0.004
Range Planning Region: Sahtu	14,901,479	1,035,137	6.95	3,014,899	20.23	2,532	1,037,668	6.96	932	3,015,831	20.24	0.006
Range Planning Region: Southern NWT	16,241,765	2,618,135	16.12	6,374,525	39.25	666	2,618,800	16.12	642	6,375,167	39.25	0.004
Caribou and Moose LAA*	1,010,686	206,983	20.48	528,167	52.26	3,197	210,180	20.80	1,574	529,741	52.41	0.156

Notes:

Results were generated by the NWT Species and Habitat Viewer (accessed 8/9/2023)

¹ Human disturbance layer circa2015

² Total Disturbance represents the combined (dissolved) footprint of 500 m buffered Human Disturbance Footprint and the Forty-year Fire Footprint (1981–2021)

³ This number represents the area of the new 500 m buffered disturbance contributed by the project footprint after accounting for any overlaps with the existing 500 m buffered Human Disturbance Footprint layer (Human Disturbance version: 2015)

⁴ Total New Disturbance Area represents the area of new 500 m buffered disturbance contributed by the project footprint, after accounting for any overlaps with the combined 500 m buffered Human Disturbance Footprint (2015) and Forty-year (1981–2021) Fire Footprint

* The Caribou and Moose LAA area is clipped to the NT1 Range (there is a small amount of the Caribou and Moose LAA that extends outside of the NT1 Range)

The Project contributes minimally to cumulative changes in indirect boreal caribou habitat resulting from reasonably foreseeable projects and activities, following project-specific mitigation measures. The Project is expected to increase the existing total disturbance area by 0.004% (NT1 range), 0.006% (Sahtu Range Planning Region), 0.004% (Southern NWT Range Planning Region) and 0.156% in the Caribou and Moose LAA. Regardless, the Caribou and Moose LAA and the Southern NT1 Range Planning Region have a (or near to) pre-existing high magnitude habitat effect. The level of disturbance exceeds the ecological threshold (65% (ECCC) or 60% [Southern NWT Planning Region, GNWT 201] undisturbed habitat) that is required to maintain a self-sustaining population of boreal caribou (EC 2011, ECCC 2020). However, based on those disturbance metrics, the boreal caribou population is expected to persist in the broader NT1 range.

10.5.2.3.1.2 Moose

Approximately 2,315.2 ha of suitable moose habitat will be lost from Project construction. This direct loss is a 0.2% decrease in suitable moose habitat within the Caribou and Moose LAA compared to existing baseline conditions. Of this change, 1,507.3 ha (0.2%) of affected moose habitat is in the Sahtu Region, and 807.9 ha (0.2%) of habitat loss is expected in the Dehcho Region (Section 10.4.2.3).

However, this estimate is conservative because the existing MVWR and other past and current disturbances in the PDA have contributed to an existing anthropogenic disturbance of 47.8% of the PDA (i.e., 1,104.9 ha). Therefore, the effect of direct habitat loss on boreal caribou (i.e., 0.03%) and moose (i.e., 0.2%) includes effects already accounted for from past and current projects and activities.

It is expected that the Project will contribute incrementally to direct habitat loss considering reasonably foreseeable projects and physical activities (Table 10.17). Although additive, the reasonably foreseeable projects are comparatively small regarding their contribution to vegetation clearing. It is assumed that these localized quarry, road, and bridge projects will use best practices and proven techniques and implement effective mitigation measures.

In conclusion, the Project makes small contributions to cumulative changes in direct boreal caribou and moose habitat loss resulting from reasonably foreseeable projects and activities following project-specific mitigation measures.

10.5.3 Change in Movement

10.5.3.1 Cumulative Effects Pathways

Residual effects for change in boreal caribou and moose movement resulting from past, present, and reasonably foreseeable projects and physical activities follow similar pathways to those resulting from the Project (Section 10.4.3.1). Therefore, project-related residual effects may contribute to cumulative changes in boreal caribou and moose movement patterns or potential movement corridors. The effect pathway is associated chiefly with creating physical and sensory barriers through development, reducing the likelihood of caribou or moose crossings, and altering

movement within and between parts of their range and selected habitat types. The greatest potential for causing a change to boreal caribou movement patterns is the construction of infrastructure that could act as a barrier (e.g., roads) and the use of infrastructure that could reduce the likelihood of caribou moving across the feature (e.g., traffic).

Past and present projects and physical developments that may have contributed to cumulative effects on boreal caribou and moose movement in the Caribou and Moose LAA (e.g., the creation of linear infrastructure acting as semi-permeable barriers) are oil and gas activities, mining and exploration activities, the Norman Wells Pipeline, the MVWR and other winter roads, Highway #1 and other all-season roads, and quarries and borrow sources. Reasonably foreseeable projects and developments with the potential to act cumulatively with the project effects are the Dhu-1 Quarry and the Great Bear River Bridge proposed within the boundaries of the Caribou and Moose LAA.

10.5.3.2 Mitigation for Cumulative Effects

Mitigation measures described in Section 10.4.2.2 and the listed management and monitoring plans will be implemented to reduce the contribution to cumulative effects of change in movement on boreal caribou and moose. This includes adherence to the project-specific WMMP and other management and monitoring plans used to protect and monitor the environment during project construction and operations and maintenance, including the:

- Follow-up and Compliance Monitoring Plan
- Traffic Management Plan

No additional mitigation measures are required to reduce the Project’s contribution to cumulative effects of change in movement on boreal caribou and moose. Reasonably foreseeable projects and physical activities are assumed to be required to implement similar mitigation measures to those described in Section 10.4.5.2 to reduce their contributions to cumulative effects.

10.5.3.3 Cumulative Effects

The Project is expected to result in an alteration of boreal caribou and moose movement patterns and potential movement corridors within the Caribou and Moose LAA, but it is unlikely that these changes will result in a measurable change in their distribution and/or abundance in the Caribou and Moose LAA (Section 10.4.3.3). The project-related adverse effects may interact cumulatively with past, present, or reasonably foreseeable projects or physical activities. However, considering that past and present projects and developments are used in project construction to the extent possible, and given the small scale of the reasonably foreseeable projects and physical developments, the Project is not considered to add cumulatively to measurable changes in boreal caribou and moose movement in the Caribou and Moose LAA, following the implementation of project-specific mitigation measures.

10.5.4 Change in Mortality Risk

10.5.4.1 Cumulative Effects Pathways

Residual effects resulting from past, present, and reasonably foreseeable projects and physical developments follow similar pathways to those resulting from the Project (Section 10.4.4.1). Therefore, project-related residual effects may contribute to cumulative changes in boreal caribou, barren-ground caribou (if the range changes), moose mortality risk, and the number of caribou and moose fatalities through direct or indirect pathways. Direct mortality pathways include collisions with vehicles, and indirect mortality pathways include increased harvest pressure via improved hunter access and increased predation via facilitated predation or apparent competition (Section 10.4.4.1).

Past and present projects and physical developments that have contributed to cumulative effects on boreal caribou, barren-ground caribou, and moose mortality risk in the Caribou and Moose LAA (e.g., through vehicle collisions, increased harvest pressure and predation) are oil and gas activities, mining and exploration activities, the Norman Wells Pipeline, the MVWR and other winter roads, Highway #1 and other all-season roads, and quarries and borrow sources. Reasonably foreseeable projects and developments with the potential to act cumulatively with the project effects are the Dhu-1 Quarry and the Great Bear River Bridge proposed within the boundaries of the Caribou and Moose LAA.

10.5.4.2 Mitigation for Cumulative Effects

Mitigation measures described in Section 10.4.4.2 and the listed management and monitoring plans will be implemented to reduce the contribution to cumulative effects of change in mortality risk on boreal caribou, barren-ground caribou, and moose. This includes adherence to the project-specific WMMP and other management and monitoring plans used to protect and monitor the environment during project construction and operations and maintenance, including the:

- Implementation of monitoring of vehicle collisions resulting in wildlife fatalities (Section 10.8)
- Implementation of harvest monitoring programs (Section 10.8)
- Traffic Management Plan (including speed limits, warning signage at wildlife crossing locations)

No additional mitigation measures are required to reduce the contribution to cumulative effects of change in mortality risk on boreal and barren-ground caribou and moose. Wildlife harvest will continue to be managed under the existing management regimes and updated as necessary to address harvest issues. Reasonably foreseeable projects and physical activities are assumed to be required to implement similar mitigation measures to those described in Section 10.4.5.2 to reduce their contributions to cumulative effects.

10.5.4.3 Cumulative Effects

The Project is expected to result in changes in indirect and direct caribou and moose mortality within the Caribou and Moose LAA (Section 10.4.4.3). While annual traffic volumes will increase on the completed highway, it is anticipated that the change in mortality risk on boreal caribou and moose due to increased wildlife-vehicle collision risk will not alter the population viability or persistence of boreal caribou and moose within the Caribou and Moose LAA. Similarly, access across the Caribou and Moose LAA is expected to improve and may result in increased harvest pressure. Harvest will continue to be managed by the GNWT and the co-management boards and, therefore, it is anticipated that any change in mortality risk will not alter the population viability or persistence of boreal caribou and moose within the Caribou and Moose LAA.

The project-related adverse effects may interact cumulatively with past, present, or reasonably foreseeable projects or physical activities. However, considering that past and present projects and developments are contributing to current mortality risks, and given the small scale of the reasonably foreseeable projects and physical developments, the Project is not considered to add cumulatively to measurable changes in boreal caribou and moose mortality risk in the Caribou and Moose LAA, following the implementation of project-specific mitigation measures.

10.5.5 Change in Health

10.5.5.1 Cumulative Effects Pathways

Residual effects resulting from past, present, and reasonably foreseeable projects and physical developments follow similar pathways to those resulting from the Project (Section 10.4.4.1). Therefore, project-related residual effects may contribute to cumulative changes in boreal caribou and moose health. The Project could expose boreal caribou and moose to potential contaminants or emissions that may affect their health, including changes in energetics and physical condition as a result of project-related sensory disturbance, increased predation and increased hunting pressure. Changes in air and water quality can result in changes in the quality of vegetation consumed by boreal caribou and moose. However, the cumulative effects assessments for air quality (see Chapter 12) and water and sediment quality (see Chapter 16) concluded that there is no potential for cumulative effects on air or surface water and sediment quality; therefore, this exposure pathway is excluded from the cumulative effects assessment for change in health. The assessment is focused on sensory disturbance, increased predation, and increased hunting pressure that may result in changes in energetics and physical condition of boreal caribou and moose.

Disturbance to boreal caribou and moose through sensory stressors resulting from industrial development or infrastructure projects may reduce the effectiveness of adjacent habitats, affect movement patterns, and/or increase overall energy expenditures (through changes in the animals’ activities) near the sources of sensory disturbance. Animals may be displaced by development or infrastructure projects, resulting in the temporary avoidance of areas near the source of disturbance. Changes in energy expenditure (e.g., through increased movements) may affect the physical condition of individual animals (including the presence of parasites and diseases), calf survival, and population viability (Section 10.4.5.1). Effects from anthropogenic disturbance or

displacement associated with development and infrastructure projects have the potential to add to effects from existing natural environmental variability, such as changes in climate and weather patterns, and influence the resilience of populations to cope with additional stress factors, such as predation and hunting pressure.

Past and present projects and physical developments that may have contributed to cumulative effects on boreal caribou and moose health in the Caribou and Moose LAA are oil and gas activities, mining and exploration activities, the Norman Wells Pipeline, the MVWR and other winter roads, Highway #1 and other all-season roads, and quarries and borrow sources. The Great Bear River Bridge has the potential to act cumulatively with the project effects within the boundaries of the Caribou and Moose LAA.

10.5.5.2 Mitigation for Cumulative Effects

Mitigation measures described in Section 10.4.5.2 and the listed management and monitoring plans will be implemented to reduce the contribution to cumulative effects of change in health on boreal caribou and moose. This includes adherence to the project-specific WMMP and other management and monitoring plans used to protect and monitor the environment during project construction and operations and maintenance, including the:

- Spill Contingency Plan
- Traffic Management Plan (including speed limits, warning signage at wildlife crossing locations)

No additional mitigation measures are required to reduce the Project’s contribution to cumulative effects of change in health on boreal caribou and moose. The Project will use previously disturbed areas for project activities and project infrastructure and workspaces, to the extent practical. Reasonably foreseeable projects and physical activities are assumed to be required to implement similar mitigation measures to those described in Section 10.4.5.2 to reduce their contributions to cumulative effects.

10.5.5.3 Cumulative Effects

The Project is expected to result in changes in boreal caribou and moose health within the Caribou and Moose LAA (Section 10.4.5.3). While exposure to potential contaminants and sensory disturbance may occur within the Caribou and Moose LAA as a result of the Project, it is anticipated that a change in boreal caribou and moose health will remain within the natural range of variability and the residual effect is not expected to alter the population viability or persistence of boreal caribou and moose within the Caribou and Moose LAA.

The project-related adverse effects may interact cumulatively with past, present, or reasonably foreseeable projects or physical activities. However, considering that past and present projects and developments are contributing to current health conditions, and given the small scale of the reasonably foreseeable projects and physical developments, the Project is not considered to add cumulatively to measurable changes in boreal caribou and moose health in the Caribou and Moose LAA, following the implementation of project-specific mitigation measures.

10.5.6 Summary of Cumulative Effects

Table 10.19 summarizes cumulative effects on boreal caribou and moose expected to result from the Project contributing to other past, present, and reasonably foreseeable projects and physical activities. The cumulative effect of change in mortality risk includes considerations of barren-ground caribou of the Bluenose-East Herd.

Table 10.19 Summary of Cumulative Effects

Cumulative Effect	Cumulative Effects Characterization							
	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	A	CE	H	Caribou and Moose LAA	HS	LT	C	I
Project contribution to the cumulative effect	<p>The magnitude for change in Habitat is High because the Project exists in a region (the Caribou and Moose LAA) already exceeding habitat disturbance thresholds for caribou.</p> <p>The Project will result in direct habitat loss and indirect habitat alteration for boreal caribou and moose. This habitat change will occur in an area that is already subject to anthropogenic disturbances resulting from past and present projects and physical activities, including the existing MVWR and borrow sources/quarries.</p> <p>It is further expected that the Project will contribute incrementally to direct habitat loss and indirect habitat alteration considering reasonably foreseeable projects and physical activities. These localized quarry, road, and bridge projects are expected to use best practices and proven techniques and to implement effective mitigation measures.</p> <p>The Project exists in an area (the Caribou and Moose LAA and the Southern NT Range Planning Region) with a pre-existing significant habitat disturbance that cannot sustain a caribou population. However, the Project falls within the broader NT1 population range with current conditions allowing for a sustained boreal caribou population to exist. The Project will contribute to cumulative habitat loss.</p>							
Change in Movement	A	P	L	Caribou and Moose LAA	HS	LT	C	I
Project contribution to the cumulative effect	<p>The Project is expected to alter boreal caribou and moose movement patterns and potential movement corridors within the Caribou and Moose LAA through physical barrier effects and reduced barrier permeability. It is unlikely that these changes will result in a measurable change in their distribution and/or abundance in the Caribou and Moose LAA. The Project is not expected to contribute to cumulative effects causing changes in boreal caribou and moose movement in the Caribou and Moose LAA, following project-specific mitigation measures.</p>							

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Cumulative Effect	Cumulative Effects Characterization							
	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Mortality Risk	A	P	L	Caribou and Moose LAA	HS	LT	IR	I
Project contribution to the cumulative effect	<p>The Project is expected to result in changes in indirect and direct caribou and moose mortality risk within the Caribou and Moose LAA through increased wildlife-vehicle collision risks, increased harvest pressure, and increased predation. It is unlikely that these changes will result in a measurable change in direct and indirect mortality risk in the Caribou and Moose LAA.</p> <p>The Project is not expected to contribute to cumulative effects causing changes in boreal caribou, barren-ground caribou, and moose mortality in the Caribou and Moose LAA, following project-specific mitigation measures.</p>							
Change in Health	A	P	L	Caribou and Moose LAA	HS	LT	C	I
Project contribution to the cumulative effect	<p>The Project is expected to result in changes in boreal caribou and moose health within the Caribou and Moose LAA through exposure to potential contaminants and sensory disturbance within the Caribou and Moose LAA. It is unlikely that these changes will result in a measurable change in boreal caribou and moose health in the Caribou and Moose LAA.</p> <p>The Project is not expected to contribute to cumulative effects causing changes in boreal caribou and moose health in the Caribou and Moose LAA, following project-specific mitigation measures.</p>							

KEY

*See Table 10.3 for detailed definitions

Direction:

A: Adverse
N: Neutral

Likelihood:

U: Unlikely
P: Possible
CE: Certain

Magnitude:

L: Low
M: Moderate
H: High

Geographic Extent:

PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Timing

NS: No sensitivity
MS: Moderate sensitivity
HS: High sensitivity

Duration:

ST: Short-term
MT: Medium-term
LT: Long-term

Frequency:

S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:

R: Reversible
I: Irreversible

10.6 Determination of Significance

10.6.1 Significance of Residual Effects

10.6.1.1 Change in Habitat

Based on the description of the residual effect in Section 10.4.2.3 and the residual effects characteristics rating in Table 10.3, the residual effect of change in boreal caribou and moose habitat, following the application of avoidance and mitigation measures, is not expected to threaten the long-term persistence or viability of boreal caribou and moose populations in the Caribou and Moose LAA. The residual effect of the Project on moose due to change in habitat is predicted to be not significant. However, based on the habitat disturbance assessment completed for boreal caribou (Section 10.5.2), the amount of existing disturbance in the Caribou and Moose LAA (52.3%) already exceeds the 35% disturbance threshold defined in the federal recovery strategy (ECCC 2020) and the 40% for the Southern NWT Range Planning Region defined by the GNWT (2019). The Project is predicted to result in the direct (94.3 ha) loss and indirect effect (1,466 ha) of selected caribou habitat in the Caribou and Moose LAA. Although this represents a relatively small percentage (0.15%) of the Caribou and Moose LAA, the Project will further contribute to the exceedance of a conservation-based threshold. Therefore, the residual effect of the Project on boreal caribou from a change in habitat is predicted to be significant.

10.6.1.2 Change in Movement

Based on the description of the residual effect in Section 10.4.3.3 and the residual effects characteristics rating in Table 10.13, the residual effect of change in boreal caribou and moose movement, following the application of avoidance and mitigation measures, is not expected to threaten the long-term persistence or viability of boreal caribou and moose populations in the Caribou and Moose LAA. Therefore, the residual effect of change in movement on boreal caribou and moose is assessed as not significant.

10.6.1.3 Change in Mortality Risk

Based on the description of the residual effect in Section 10.4.3.3 and the residual effects characteristics rating in Table 10.14, the residual effect of change in boreal caribou and moose mortality risk, following the application of avoidance and mitigation measures, is not expected to threaten the long-term persistence or viability of boreal caribou and moose populations in the Caribou and Moose LAA. Therefore, the residual effect of change in mortality risk on boreal caribou and moose is assessed as not significant.

10.6.1.4 Change in Health

Based on the description of the residual effect in Section 10.4.5.3 and the residual effects characteristics rating in Table 10.15, the residual effect of change in boreal caribou and moose health, following the application of avoidance and mitigation measures, is not expected to threaten the long-term persistence or viability of boreal caribou and moose populations in the Caribou and Moose LAA. Therefore, the residual effect of change in health on boreal caribou and moose is assessed as not significant.

10.6.2 Significance of Cumulative Effects

10.6.2.1 Change in Habitat

Although the Project will contribute to residual cumulative effects on moose habitat in the Caribou and Moose LAA, past, present and future activities combined with the Project are not expected to threaten the viability of moose populations in the Caribou and Moose LAA. With the implementation of mitigation measures, cumulative effects on moose habitat are predicted to be not significant.

However, based on the habitat disturbance assessment completed for boreal caribou, (Section 10.5.2), the amount of existing disturbance (52.2%) in the Caribou and Moose LAA already exceeds the 35% disturbance threshold defined in the federal recovery strategy (ECCC 2020). The Project is predicted to result in the direct (94.3 ha) and indirect loss (1,466 ha) of caribou habitat in the Caribou and Moose LAA. Although this represents a relatively small percentage (0.15%) of the Caribou and Moose LAA, the Project will contribute to an existing cumulative effect and the exceedance of a conservation-based threshold. Therefore, residual cumulative effects on change in habitat for boreal caribou is predicted to be significant.

It is important to recognize, however, the relative contribution of the Project to existing cumulative effects varies with spatial scale. For example, there is 3,114,409 ha (20.9%) of disturbed habitat in the Sahtu Range Planning Region, and 7,584,904 ha (46.7%) of disturbed habitat in the Southern NT1 Range Planning Region. The broadest NT1 region has 13,730,535 ha (31.0%) of disturbed habitat (Table 10.18). Based on these levels of existing disturbance, the Project would not result in a significant residual cumulative effect in the Sahtu Planning Region or the NT1 range because the Project does not contribute to an exceedance of a conservation-based threshold or threaten the long-term persistence or viability of boreal caribou. However, similar to the Caribou and Moose LAA, the Southern NT1 Range already exceeds (46.7%) the 35% disturbance threshold; and therefore, the Project’s relatively small contribution (0.004 %) to an existing residual cumulative effect in the Southern NT1 range would further contribute to an exceedance of a conservation-based threshold; and therefore, residual cumulative effects on caribou is predicted to be significant but not expected to threaten the long-term persistence or viability of boreal caribou.

10.6.2.2 Change in Movement

The Project is predicted to result in an alteration of movement patterns and movement corridors of boreal caribou and moose in the Caribou and Moose LAA, but is not expected to contribute to cumulative effects causing measurable changes in boreal caribou and moose movement in the Caribou and Moose LAA, following the implementation of project-specific mitigation measures (Section 10.5.3.3). Therefore, the Project is not expected to contribute cumulatively to effects from other past, present, and reasonably foreseeable projects and physical developments and threaten the long-term persistence or viability of boreal caribou and moose populations in the Caribou and Moose LAA. In conclusion, the cumulative effect of change in movement on boreal caribou and moose is assessed as not significant.

10.6.2.3 Change in Mortality Risk

The Project is predicted to result in changes in direct and indirect mortality risk for boreal caribou and moose in the Caribou and Moose LAA, but is not expected to contribute to cumulative effects causing measurable changes in boreal caribou and moose mortality risk in the Caribou and Moose LAA, following the implementation of project-specific mitigation measures (Section 10.5.4.3). Therefore, the Project is not expected to contribute cumulatively to effects from other past, present, and reasonably foreseeable projects and physical developments and threaten the long-term persistence or viability of boreal caribou and moose populations in the Caribou and Moose LAA. In conclusion, the cumulative effect of change in mortality risk on boreal caribou and moose is assessed as not significant.

10.6.2.4 Change in Health

While the Project is predicted to result in changes in health of boreal caribou and moose habitat in the Caribou and Moose LAA, the Project is not expected to contribute to cumulative effects causing measurable changes in boreal caribou and moose health in the Caribou and Moose LAA, following the implementation of project-specific mitigation measures (Section 10.5.5.3). Therefore, the Project is not expected to contribute cumulatively to effects from other past, present, and reasonably foreseeable projects and physical developments and threaten the long-term persistence or viability of boreal caribou and moose populations in the Caribou and Moose LAA. In conclusion, the cumulative effect of change in health on boreal caribou and moose is assessed as not significant.

10.6.3 Project Contribution to Cumulative Effects

The Project is expected to interact cumulatively with other past, present, and reasonably foreseeable projects and physical developments that will contribute to additional direct and indirect loss of boreal caribou and moose habitat but is not expected to contribute to measurable changes in movement, mortality risk and health of boreal caribou and moose in the Caribou and Moose LAA.

10.7 Prediction Confidence

The level of confidence in the above significance determination is considered moderate, based on:

- The quantity and quality of data available for caribou and moose in the Caribou and Moose LAA (also addressed in Section 10.7.2):
 - Some of the information included in this assessment dates back a decade or more with limited or no comparable surveys completed since then.
 - The information included in this assessment was not always available for both the Sahtu and Dehcho regions.
 - Some information used to assess effects may be based on minimum accounts, and, therefore, some uncertainty remains in the assessment results.
- The conservative approach taken in the assessment:
 - Direct habitat loss was overestimated because 47.8% (i.e., 1,104.9 ha) of the PDA is currently subject to existing anthropogenic disturbances, but this area is included in the calculation of new habitat loss.
 - To reduce uncertainty, the assessment conservatively identified the requirement for a variety of follow-up and monitoring programs (Section 10.8).
- Professional judgement and experience with similar projects
- Effectiveness of mitigation measures, which reflect best industry practices and those used on similar highways projects in the NWT (e.g., Tłıchǫ Highway)

10.7.1 Assumptions

The assessment conclusions are based on the following assumptions:

- The effects assessment uses a habitat-based approach, focusing on selected boreal caribou and moose habitats affected by the Project relative to the availability of those habitats in the Caribou and Moose LAA. This is a conservative approach because it assumes that animals are present if appropriate habitats are available. This is not always the case (e.g., if a habitat was recently affected by fire or habitat use has changed for other reasons). Additionally, values of direct habitat loss are a conservative estimate because 47.8% (i.e., 1,104.9 ha) of the PDA is currently subject to existing anthropogenic disturbances, including the existing MVWR and borrow sources/quarries. These areas may provide reduced suitability as boreal caribou and moose habitat, but are still included in the assessment.
- Without field verification, the habitat data and models used in the assessment are assumed to reflect field conditions.
- Some of the survey data used in the assessment are dated (e.g., > 20 years old). In the absence of more current data, the current conditions were generally assumed to reflect the conditions during those surveys and that the information is still relevant to this assessment.

- A 500 m buffer was added to the PDA to measure indirect effects on caribou habitat. That 500 m buffer followed the Environment Canada (2011) approach. As concluded by EC, that buffer around anthropogenic disturbance is assumed to encompass the combined effects of increased predation and avoidance on caribou population trends.
- It was assumed that the road embankment is not a physical barrier to movement.

10.7.2 Gaps and Uncertainties

The following key gaps and uncertainties were recognized during the preparation of this effects assessment:

- The temporal scope of the Project is currently estimated to be 20 years; uncertainties in accounting for environmental changes that may occur or other developments that may be constructed during that timeframe are addressed through monitoring programs (Section 10.8).
- The assessment was based on current habitat conditions. However, there is uncertainty about habitat change throughout the project’s life, particularly as influenced by climate-driven variables. Using boreal caribou habitat as an example, Stewart et al. (2023) created 90-year habitat and demography projections for five boreal caribou monitoring areas in the NWT, one of which at least partially overlaps the southern extent of the Caribou and Moose LAA (Dehcho North monitoring area). Their results suggested that habitat suitability might increase in central and southwest regions of the NWT portion of the Taiga Plains ecozone but decrease in southern and northwestern regions. The primary habitat change is the conversion of coniferous to deciduous forests. The authors did not anticipate a simultaneous change in boreal caribou population growth despite the habitat change. The findings of that paper are directly relevant to considering the uncertainty about future conditions in the Project area and that there are likely to be substantial changes in habitat conditions in the Caribou and Moose LAA and the broader region, regardless of the Project-related effects.
- Predicted RSF values and the predictive RSF maps can change annually as fires age and areas become suitable again. There are also areas predicted to be “not selected” that boreal caribou are obviously using based on collar locations, which speaks to the fact that the RSF model predictions have uncertainty associated with them, which is not reflected in predictive maps. The RSF model also likely overestimates the avoidance of the existing MVWR (and hence predicts low RSF values adjacent to it) because the RSF model did not distinguish between winter versus all-season roads. Most of the collar data that went into the model is from caribou in areas adjacent to all-season roads, so the RSF model treats the MVWR like an all-season road. This means the RSF model currently might underpredict suitable habitat near the MVWR, unless the underlying land cover types mainly drive the predictive values.

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- Boreal caribou have been recorded near the current MVWR ROW during all seasons, indicating that boreal caribou in the Dehcho and Sahtu regions are tolerating the exposure to the effects of seasonal traffic. It is unknown if boreal caribou cross the MVWR ROW or if the current road acts as a barrier to movement. However, as noted in Section 10.4.1.2, there is a concurrent study investigating collared boreal caribou response to the MVWR. That analysis and results will be available during this Project’s review and is intended to refine understanding of caribou movement patterns in the Caribou and Moose LAA.
- Although literature and other knowledge summarizes the influence of potential indirect effects of the project on adjacent remaining habitat (i.e., Zone of Influence), the findings are not consistent, and there is nothing specific to the caribou and moose response to disturbance in the Caribou and Moose LAA. ECCC’s 500 m radius buffer around anthropogenic disturbance (ECCC, 2011) is assumed to encompass the combined effects of increased predation and avoidance on caribou population trends.
- It is unclear exactly how habitat use by moose and caribou will vary in habitat adjacent the PDA (i.e., within the Zone of Influence) from undisturbed habitat use.
- Wildlife-vehicle collision data used in this effects assessment were only available for some regions of the NWT, were not associated with specific locations, and no data were collected in the past for the MVWR. Therefore, no area-specific information was included in the assessment.
- The available wildlife-vehicle collision information for caribou and moose used in this effects assessment is assumed to under-report actual collisions. Therefore, uncertainties about the actual extent of fatal wildlife-vehicle collisions remain.
- Based on available information, existing harvest levels were calculated for a wider area in the NWT and were not specific to the Caribou and Moose LAA. In addition, Indigenous harvest information for caribou and moose was not available and was not considered in this assessment.
- The GNWT will work with SRRB and other resource managers to address uncertainty regarding the effects of improved access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization.
- It is expected that there will be a time lag associated with the implementation of enhancements into existing harvest management programs to effectively respond to increased harvest pressures on caribou and moose (e.g., new staff would need to be hired, monitoring and enforcement protocols would need to be developed and applied).
- It is unknown to what extent poaching is currently adding or may contribute in the future to caribou and moose mortality (i.e., with year-round access).
- The number and location of mineral licks within the Caribou and Moose LAA is unknown.
- Gaps in moose movement, population, and habitat use. Data are over 20 years old and there has been little to no assessment with comparable surveys in the interim.
- There are data gaps in current harvest and potential increases in harvest.

10.8 Follow-up Monitoring, and Management

Follow-up programs are designed and implemented to address any uncertainties identified during the assessment process. Ongoing management initiatives will also incorporate potential project and cumulative effects concerns. Monitoring programs are designed to meet regulatory requirements (e.g., permit or license conditions) and/or demonstrate compliance with environmental commitments made in the DAR. Existing monitoring programs can/will receive support early on to expand and modify them to address questions/provide more information about species near the Project. The programs will require long-term financial and staffing and resource commitment to obtain and analyze results.

The WMMP (included in Volume 5) will guide all mitigation, monitoring and management activities related to wildlife. The objectives of the WMMP are to:

- Describe the mitigation measures that will be implemented to avoid and/or reduce potential Project effects on wildlife and wildlife habitat
- Describe the monitoring programs that will be implemented to quantify and evaluate the effectiveness of mitigation measures and to confirm the assessment predictions
- Describe the adaptive management approach and action levels that will be used to adjust mitigation measures where necessary to meet management goals

The monitoring plans specific to caribou and moose are briefly described below.

- The WMMP will be designed to determine if the highway is resulting in a pattern or level of harvest mortality for moose and caribou that would suggest a conservation concern or need for additional harvest management actions.
- The database for wildlife-vehicle collisions, implemented and maintained by the GNWT-ECC, will be extended to include the MVWR ROW and completed sections of the highway during and after construction. Collision locations will be added to the information to determine the necessity of appropriate signage to alert drivers of crossing locations and identification of other possible measures.
- The ongoing collection of annual large game harvest success for all non-Indigenous hunters will be continued.
- Wildlife health will continue to be monitored through local initiatives and collection of specimens from hunters. The Project’s management plans (see Volume 5) include mitigation measures stipulated for construction and operations and maintenance activities. As part of an adaptive management plan for follow-up and monitoring, these mitigation measures will be regularly reviewed and updated by the GNWT to verify and enhance their effectiveness. If an unexpected deterioration of the environment is observed as part of follow-up and/or monitoring, intervention mechanisms will include an adaptive management process.
- The adaptive management process will support the project-specific mitigation measures by monitoring and (if required) adapting the mitigation measures to ensure they are effective.

- Following the terms and conditions of permit approvals and the approved WMMP, monitoring programs will be implemented to evaluate if mitigation measures are applied and operate as planned.
- The GNWT is open to further discussions with the Indigenous Guardians Program to explore how best implement it for the Project.

10.8.1 Boreal Caribou

The GNWT commits to exploring options to further avoid or minimize the project’s small contribution to cumulative direct and indirect habitat loss of boreal caribou habitat, and to explore options to offset any remaining residual effects that cannot be avoided or minimized. The GNWT will evaluate the approach to offsetting proposed for the Tłı̄ch̄o Highway (GNWT 2021c) and will seek input on offsetting options for the Project during and following the environmental assessment process. Proposed offset measures for the Project may be incorporated into future drafts of the Wildlife Management and Monitoring Plan for the project.

Other monitoring proposed specific to boreal caribou, includes the below:

- Previously collected baseline data from collared boreal caribou will be analyzed to obtain more accurate movement information in the vicinity of the MVWR. Analyses are expected to reveal if caribou are crossing the MVWR from which seasonal and/or spatial patterns may become apparent (considering that the current MVWR is only used during winter).
- The boreal caribou collar program, currently conducted by the GNWT-ECC, will continue to collect ongoing information on distribution, movements, and mortality, subject to periodic assessments and adjustments. Existing and newly collected data will be analyzed to obtain movement information to assist in determining adverse effects of the Project.

10.8.2 Moose

Survey programs, currently conducted by the GNWT-ECC, will continue to collect ongoing information on distribution, abundance, and population trends of moose, subject to periodic assessments and adjustments.

10.8.3 Barren-ground Caribou

Barren-ground caribou and wildlife management in the Northwest Territories (NWT) and Nunavut (NU) is highly collaborative, with Indigenous governments, co-management boards, communities and the federal and territorial governments all sharing responsibilities. For a wide-ranging migratory caribou herd like the Bluenose-East herd (BNE) that has its calving grounds and much of the summer range in Nunavut (NU) and the rest of its range in the NWT, collaborative processes in both territories are central to management decision-making. In the wake of a large decline in the herd from 2010 to 2018, several actions have been taken through these processes.

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Overall management guidance for the BNE herd is provided in the Taking Care of Caribou Plan, developed collaboratively in 2014 by the Advisory Committee for Cooperation on Wildlife Management (ACCWM), made up of co-management boards in NWT and NU (<https://accwm.com/>). The ACCWM meets annually in the fall and reviews all new information on the BNE herd to develop an action plan that is updated annually. Individual member boards retain their decision-making abilities but seek agreement on the status designation of each herd.

In NU, the Nunavut Wildlife Management Board (NWMB) and the Government of Nunavut (GN) have key roles in managing the BNE herd. In addition, the community of Kugluktuk has had a long history of harvesting and managing this herd. In 2016, the Kugluktuk Angoniatit Association developed a community-based management plan for the herd that includes harvest limits and is used as key guidance for this herd in NU.

In the NWT, the BNE herd range overlaps the Sahtú Settlement Area and Wek’èezhì or the Ṯcẖo land claim area and a small portion of the Inuvialuit Settlement Region (ISR). The Sahtú Renewable Resources Board (SRRB) and the Wek’èezhì Renewable Resources Board (WRRB) have key responsibilities for wildlife management in these land claim areas, along with the Ṯcẖo Government (TG) and the Government of the Northwest Territories (GNWT). Ṯcẖo harvesters have been one of the main Indigenous groups harvesting the BNE herd. In addition, the Sahtú community of Dèḻne has had a long history of harvesting and managing this herd. The Dèḻne Renewable Resources Council developed a community-based plan for managing the BNE herd in 2016 (updated in 2021) that is used as key guidance for this herd in the Sahtú Settlement Area.

The decline of the BNE herd 2010–2018 from about 120,000 caribou to about 19,300 in 2018 resulted in several management proposals and formal hearings under the WRRB (2010, 2016, 2019) and SRRB (2016) in the NWT and in NU under the NWMB. Key outcomes of these hearings have been a suite of management actions to support the herd’s recovery. Harvest limits for BNE are in place in the Sahtú, currently at 30 bulls/year under the Dèḻne plan; a total Allowable Harvest (TAH) of 193 bulls/year under a WRRB determination; and 170 caribou with 1:1 sex ratio recommended by the NWMB in NU and administered by the Kugluktuk Angoniatit Association plan.

Additionally, a wolf management program was developed to increase wolf harvest on the ranges of the BNE and Bathurst herds in the North Slave region of the NWT. This program was first approved by the WRRB in 2020 as a pilot project and then in 2021 after public review and input for an additional four years (to 2024). The focus of the wolf management program is support for the traditional economy through ground-based wolf harvest on the winter ranges of the two herds and an extensive research and monitoring program. Wolves taken under this program in the high incentive area totaled 432 over the program’s first four years: 85 wolves in 2019-2020, 135 wolves in 2020-2021, 69 wolves in 2021–2022, and 143 wolves in 2022–2023. Increased research into wolf movements, abundance, and ecology, including GPS satellite collars on wolves, has also been carried out. The wolf management program is not currently being applied in the Sahtú region. There are also incentives for NU wolf hunters across the territory.

While harvest management and wolf management have been two key actions taken in recent years to promote recovery of the BNE herd, the overall management plan for the herd (the Taking Care of Caribou plan of 2014), the Dèlne plan for the herd, the Kugluktuk Angoniatit Association plan for the herd, and a series of recommendation reports over several years by the WRRB, have all emphasized the need for a comprehensive, holistic approach to managing the BNE herd. This includes conserving key habitats and carefully managing land use in the NWT and NU. From a cumulative effects perspective, decisions that may affect the herd in one part of its range have potential implications for governments, co-management boards and communities across the entire range of the herd.

Barren-ground caribou surveys, currently conducted by the GNWT-ECC and other organizations, will continue to monitor the distribution, abundance, and population trends of the Bluenose-East herd, subject to periodic assessments and adjustments. Results from these surveys can be used to assess potential future overlap of their range with the Project.

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11.0 ASSESSMENT OF POTENTIAL EFFECTS ON CULTURE AND TRADITIONAL LAND USE, INCLUDING HARVESTING

Culture and traditional land use, including harvesting, has been identified as a Valued Component (VC) based on the potential for the Mackenzie Valley Highway Project (the Project) to affect traditional activities, sites, and resources important to Indigenous Governments¹, Indigenous Organizations², and certain other affected parties³. Priority is placed on the assessment of effects on harvesting as an element of the key line of inquiry (KLOI) Caribou, Moose, and Harvesting in the Terms of Reference (ToR) (Mackenzie Valley Environmental Impact Review Board [MVEIRB], 2015 [Public Registry {PR}#66]). Ongoing engagement conducted by the Government of the Northwest Territories (GNWT) and feedback provided during the MVEIRB’s scoping phase confirm that areas potentially affected by the Project continue to be highly valued by Indigenous Governments, Indigenous Organizations and certain other affected parties³ for cultural and traditional uses, including:

- Hunting (moose, caribou)
- Wildlife harvesting and trapping
- Fishing
- Plant gathering
- Use of trails and travelways, including navigation
- Use of habitation areas (e.g., cabins, campsites, temporary shelters)
- Use of cultural and spiritual sites and areas
- Heritage sites (including known archaeological sites)

An overview of engagement activities is summarized in Chapter 2 (Consultation and Engagement) and Chapter 3 (Traditional Knowledge).

This assessment assumes that culture and traditional land use depends on the health and abundance of traditionally harvested species and continued availability of and access to traditional use sites and areas. A review of information obtained through the engagement program for the Project, through project-specific reports and traditional land and resource use (TLRU) studies

¹ Indigenous Governments include governments that have negotiated, or are in the process of negotiating, Lands and Resources and/or Self-Government Agreements (Land Claims) with the GNWT and the Government of Canada.

² Indigenous Organizations include organizations that do not meet the definition of an Indigenous Government that have been elected as the sole representative of the collective Aboriginal and/or Treaty rights of its Indigenous membership.

³ Affected parties include all entities who may be affected by the Project, including, but not limited to, community governments or designated authorities, land corporations, renewable resource boards and councils, co-management boards, Indigenous Governments and Indigenous Organizations, landowners, local residents, and the public.

(GNWT, 2011; Dessau, 2012 [PR#13]; NWRRC, 2023; TRRC, 2022), publicly available literature, and the analysis of relevant environmental impact studies, concludes that the Project has the potential to affect traditional activities, sites, and resources relied upon by Indigenous peoples.

The assessment of effects on culture and traditional land use, including harvesting, is informed by predicted residual effects on socio-economic valued components (see Chapter 9), and air quality (see Chapter 12), noise (see Chapter 13), water quantity (see Chapter 15), water and sediment quality (see Chapter 16), vegetation (see Chapter 18), fish and fish habitat (see Chapter 17), wildlife and wildlife habitat (see Chapter 19), bird and bird habitat (see Chapter 20), caribou and moose (see Chapter 10), and heritage resources (see Chapter 22).

The assessment of potential effects on the Culture and Traditional Land Use, including Harvesting VC concludes that with the application of mitigation measures, residual effects from the Project on culture and traditional land use, including harvesting will be adverse. Residual effects and cumulative effects will not result in a long-term loss of availability of cultural and traditional use resources, or access to lands, cultural use sites, and areas relied on for cultural use practices, such that cultural and traditional use is critically reduced or eliminated within the RAA and therefore will not be significant.

11.1 Scope of Assessment

11.1.1 Regulatory and Policy Setting

The assessment of potential effects of the Project on culture and traditional land use takes into consideration information regarding traditional land use, including harvesting in the Sahtu Region and Dehcho Region (around Wrigley [Pehdzéh Kì N’deh], hereafter referred to as Wrigley), (see Culture and Traditional Land Use Technical Data Report [TDR]; Appendix 11A [K’alo-Stantec, 2022a]).

The Sahtu Renewable Resources Board (ʔehdzo Got’ìneḡ Gots’é Nákedì; SRRB) is one of three co-management boards in the Sahtu Region (others are Sahtu Land and Water Board and Sahtú Land Use Planning Board [SLUPB]) established by the Sahtu Dene and Métis Comprehensive Land Claim Agreement (SDMCLCA). The SRRB uses both TK and western science in its role as a resource manager responsible for wildlife and wildlife harvesting in the Sahtu Region. Under S. 13.9 of the SDMCLCA, each Sahtu Region community within the Sahtu Settlement Area, hereafter referred to as the Sahtu Region, has a designated Renewable Resource Council (RRC), whose roles include managing, in a manner consistent with legislation and policies of the SRRB, the local exercise of participants harvesting rights, and encouraging and promoting local involvement in conservation, harvest studies, research, and wildlife management in the community. Renewable resource councils provide comments relevant to their mandate for preliminary screenings and environmental assessments, including providing local Indigenous knowledge in an advisory capacity to the SRRB for the management of wildlife and forests (SLUPB, 2022).

Through the SDMCLCA, Sahtu Dene and Métis have title to 41,437 square kilometres (km²) of Sahtu Settlement Lands.

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In addition to the principles noted in Section 11.1.1, the following objectives of the SDMCLCA apply to land use in the Sahtu Region:

1. To recognize and encourage the way of life of the Sahtu Dene and Métis, which is based on the cultural and economic relationship between them and the land (1.1.1.c);
2. To encourage the self-sufficiency of the Sahtu Dene and Métis and to enhance their ability to participate fully in all aspects of the economy (1.1.1.d);
3. To integrate planning and management of wildlife and wildlife habitat with the planning and management of all types of land and water use in order to protect wildlife and wildlife habitat (13.1.1.f); and
4. To protect and conserve wildlife and the environment of the settlement area for present and future generations (13.1.1.g).

Further information on the appropriation of Sahtu Settlement Lands for the Project is provided in Chapter 6.

A modern treaty (land claim) has not yet been finalized with any Indigenous Government in the Dehcho Region. There is no approved land use plan in effect in the Dehcho Region.

11.1.1.1 Sahtu Land Use Plan

Specific to the areas to which the Sahtu Land Use Plan (SLUP) applies, the Project must meet the 13 general conformity requirements (CR) of the SLUP (SLUPB, 2023). Conformity requirement #2 requires that *“The proposed activities must be designed and carried out with due regard for community concerns and incorporate relevant traditional knowledge.”*

Additionally, CR #14 requires that the Project be designed and carried out in a manner that protects, respects, or takes into account the values of the Conservation Zones (CZ) and Special Management Zones (SMZ) potentially affected by the Project as directed in the SLUP’s Zone Descriptions (SLUPB, 2023), including the following:

- Petinizah (Bear Rock) CZ (Zone #32)
- Mio Lake CZ (Zone #36)
- Norman Range SMZ (Zone #50)
- K’aałq Tué (Willow Lake Wetlands) SMZ (Zone #62)
- Deh Cho (Mackenzie River) SMZ (Zone #63)

11.1.2 Influence of Engagement

The GNWT has engaged with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resource councils. Detailed information regarding these engagement activities is presented in Chapter 2 (Consultation and Engagement) and Chapter 3 (Traditional Knowledge), as well as in this chapter. The GNWT has recently initiated Consultation with Indigenous Governments and Indigenous Organizations.

During project-specific community engagement activities delivered between 2010-2012 and 2021-2023, participants shared information, expressed concerns, and provided project-specific concerns and comments related to culture and traditional land use, including harvesting, hunting, and trapping. This feedback has been integrated throughout the assessment of potential effects on cultural and traditional use, with a priority placed on the assessment of effects on harvesting.

In particular, the following information obtained through engagement has been integrated into the assessment of effects on cultural and traditional use:

- Traditionally harvested wildlife, as well as wildlife harvesting, hunting, and trapping areas were identified in the vicinity of the Project⁴. This information has been incorporated into Section 11.2.3, Section 11.4.2, Section 11.4.3, Section 11.5.2 and Section 11.5.3. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on wildlife and wildlife harvesting in Section 11.4.2.2.
- Concern was expressed about increased human encounters with boreal caribou near Tulita along the Mackenzie Valley Winter Road (MVWR) and around lack of range and protection plans for caribou and moose⁵. This information has been incorporated into Section 11.4.2 and Section 11.5.2. In addition to the implementation of the Wildlife Management and Monitoring Plan (WMMP) to manage effects to caribou and moose, the GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on wildlife and wildlife harvesting in Section 11.4.2.2. and Section 11.4.3.2.
- Concern about a potential increase in non-resident hunters’ access to wildlife game within the Regional Assessment Area (RAA)⁶. This information has been incorporated into Section 11.2.3, Section 11.4.2, Section 11.4.3, Section 11.4.4, Section 11.5.2 and Section 11.5.3. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on wildlife and wildlife harvesting in Section 11.4.2.2.

⁴ 5658 NWT Ltd. and GNWT, 2011; Auld and Kershaw, 2005; Dessau, 2012 (PR#13); Dehcho First Nations, 2011; DCLUP, 2006; IMG-Golder Corporation, 2006; McDonald, 2011; NWRRC, 2023; SLUPB, 2023, 2022; SRRB, 2021b, 2007; TRRC, 2022

⁵ Indigenous engagement – April to July 2022.

⁶ Dessau, 2012 (PR#13); NWRRC, 2023; TRRC, 2022; April to July 2022 Engagement; November 2022 to February 2023 Engagement.

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- Potential changes in wildlife health during construction and operations and maintenance, including effects on wildlife from sensory disturbance (noise, ground disturbance), traffic fatalities and contamination exposure (i.e., spills). This information has been incorporated into Section 11.2.3, Section 11.4.2, and Section 11.5.2. The GNWT has proposed mitigation measures that may avoid or reduce the effects on wildlife and wildlife harvesting from sensory disturbance in Section 11.4.2.2.
- Potential effects on wildlife and wildlife habitat from changes to important wildlife habitat, including calving areas, migration routes and habitat⁷. This information has been incorporated into Section 11.2.3, Section 11.4.2, Section 11.4.3, Section 11.4.4 and Section 11.5.2. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on wildlife and wildlife habitat in Section 11.4.2.2.
- Traditionally harvested plants, and harvesting locations were identified in the vicinity of the Project⁸. This information has been incorporated into Section 11.2.3, Section 11.4.2, Section 11.4.3, and Section 11.5.2. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on traditionally harvested plants in Section 11.4.2.2.
- Concern about the introduction of invasive species during construction and operations and maintenance. This information has been incorporated into Section 11.2.3, Section 11.4.2, and Section 11.5.2. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on traditionally harvested plants in Section 11.4.2.2.
- Potential effects on fish and fish habitat from changes to important fish habitat, including spawning areas and migration routes areas in the assessment areas (including effects of erosion and sedimentation, ground disturbance and climate change on water quality)⁹. This information has been incorporated into Section 11.2.3, Section 11.2.5, Section 11.4.2, and Section 11.5.2. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on fish, fish habitat and traditional fishing in Section 11.4.2.2.
- Traditionally harvested fish, and fishing locations were identified in the vicinity of the Project¹⁰. This information has been incorporated into Section 11.2.3, Section 11.2.4, Section 11.4.2, Section 11.4.3, and Section 11.5.2. The GNWT has proposed mitigation measures that may avoid or reduce effect on traditional land and resource use from changes to traditionally harvested fish and access to fishing locations in Section 11.4.2.2 and Section 11.4.3.2.

⁷ Dehcho First Nations, 2011; IMG-Golder Corporation, 2006; NWRRC, 2023; August to April 2021 Engagement; April to July 2022 Engagement; November to December 2022 Engagement; November 2022 to February 2023 Engagement; TRRC, 2022.

⁸ Dehcho First Nations, 2022; EBA, 2006; IMG-Golder, 2006; NWRRC, 2023; SLUPB, 2022; TRRC, 2022

⁹ 5658 NWT Ltd. And GNWT, 2011 (PR#16); Dessau, 2012 (PR#13); DLUPC, 2006; EBA 2006; Golder, 2015; NWRRC, 2023; SRRB, 2021; SLUPB, 2013; TRRC, 2013,2022; November to December 2022 Engagement; April to July 2022 Engagement; November to December 2022 Engagement.

¹⁰ Auld and Kershaw, 2005; DLUPC, 2006; IMG-Golder, 2015; NWRRC, 2023; SRRB, 2021b; SLUPB, 2022; TRRC, 2022

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- Drinking water resources have been identified relative to the Project¹¹. This information has been incorporated into Section 11.2.3, Section 11.4.2, and Section 11.5.2. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on drinking water in Section 11.4.2.2.
- Concern was expressed regarding decreasing water levels in water bodies important for fish, wildlife, drinking water, and water navigation¹². This information has been incorporated into Section 11.2.3, Section 11.4.2, and Section 11.5.2. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on water quantity in Section 11.4.2.2.
- Concerns were raised about potential project effects on water quality and quantity, including potential effects from water withdrawals (from or near important water bodies) contamination, patterns of surface water flow and potential groundwater changes, increased sediment from vegetation clearing along waterbodies and effects of blasting, runoff and thawing permafrost (erosion, flooding, scouring, reduced land subsistence)¹³. This information has been incorporated into Section 11.2.3, Section 11.4.2, and Section 11.5.2. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on water quality in Section 11.4.2.2.
- Important trails and travel routes were identified relative to the Project¹⁴. This information has been incorporated into Section 11.2.4, Section 11.4.3, and Section 11.5.3. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on the use of trails and travel routes in Section 11.4.3.2.
- Concern about changes to burial grounds, and other historic or meaningful locations, such as Bear Rock (Petinızah), known burial sites, and cabins¹⁵. This information has been incorporated into Section 11.2.5, Section 11.4.4, and Section 11.5.4. The GNWT has proposed mitigation measures that may avoid or reduce the effects of the Project on the use of trails and travel routes in Section 11.4.3.2. In addition, GNWT will develop and implement a Heritage and Sites Protection Plan (HSPP).

¹¹ Golder, 2015; NWRRC, 2023; TRRC, 2022

¹² Golder, 2015.

¹³ Dessau, 2012 (PR#13); Golder, 2015; NWRRC, 2023; TRRC, 2022

¹⁴ 5658 NWT Ltd. And GNWT, 2011 (PR#16); GNWT, 2018; Golder, 2015; IMG-Golder Corporation, 2006; NWRRC, 2023; SLUPB, 2023; TRRC, 2022

¹⁵ NWRRC, 2023; TRRC, 2022; August 2021 Engagement; April to July 2022 Engagement; November to December 2022 Engagement; November 2022 to February 2023 Engagement

11.1.2.1 Project-Specific Traditional Land and Resource Use Studies

The GNWT-INF provided capacity funding for the TRRC, the NWRRC and Pehdzéh Kì First Nation to complete project-specific TLRU studies for the Project. Each of the three TLRU studies supported by the GNWT-INF were designed to provide relevant TK and TLRU information to be included in the DAR for the Project. The TRRC and NWRRC completed their confidential TLRU studies prior to the submission of the DAR and information validated by TRRC and NWRRC was incorporated. As additional project-specific TLRU studies become available, they will be reviewed against the results of the DAR to determine whether new project effects have been brought forward or whether additional mitigation measures may be warranted.

11.1.3 Potential Effects, Pathways and Measurable Parameters

This section provides context for how potential effects of the Project on cultural and traditional land use were identified, how the Project may interact with cultural and traditional land use (pathways), and what parameters will be used to measure changes to cultural and traditional land use. The MVEIRB’s working definition of culture is “...a way of life, a system of knowledge, beliefs, values and behaviours passed down to each generation” (MVEIRB, 2009).

For the purposes of this assessment, culture and traditional land use will be referred to as ‘cultural use’ and is understood to encompass various traditional activities, practices, sites, areas, and resources, including:

- Hunting
- Trapping
- Fishing
- Plant gathering
- Use of trails and travelways, including navigation
- Use of habitation areas (e.g., cabins, campsites, temporary shelters)
- Use of cultural and spiritual sites and areas

Cultural use also accounts for the conditions of use, seasonal cycles, inter-generational knowledge transmission, landforms and named places, and other factors that provide context, setting, or understanding for the practice of cultural use activities.

Cultural use must be understood in the context of past and future use. Past cultural use information and information based on Indigenous peoples’ living memory situates contemporary activities and long-term observations of existing conditions. Future use pertains to the opportunities for generations of descendants of the Indigenous Governments, and Indigenous Organizations to continue to practice cultural traditions in a modern form. Framing traditional activities and practices in this way serves to acknowledge that cultural use—while having continuity with historic practices, traditions, or customs—is dynamic and changing. Conceived of

in this way, cultural use situates long-standing cultural practices in a contemporary context. The Project can affect cultural use through:

- Change in availability of resources for cultural use, affecting the ability to exercise cultural use activities (e.g., hunting, trapping, fishing, and plant gathering)
- Change in access to resources or areas for cultural use
- Change in sites or areas for cultural use through the disruption or alteration of a traditional use site or location (e.g., habitation areas, trails and travelways, and cultural or spiritual practices sites and areas)

Characterizing the effects of the Project on cultural use employs parameters that can be used to evaluate each type of predicted effect. Ideally, these parameters are measurable and quantifiable (e.g., availability of habitat for harvested species). However, some effects on cultural use lack defined parameters to measure effects and are therefore evaluated qualitatively based on comments received from Indigenous Governments, Indigenous Organizations, and renewable resource councils, past project experience, and professional judgment. Potential effects, effects pathways, and measurable parameters used to characterize and assess effects on cultural use are provided in Table 11.1.

Table 11.1 Potential Effects, Effects Pathways and Measurable Parameters for Culture and Traditional Land Use, Including Harvesting

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in availability of resources for cultural and traditional land use	<ul style="list-style-type: none"> • Vegetation clearing associated with construction could result in a direct loss or loss of habitat for species of traditional importance, including plants and animals relied on for traditional hunting, trapping, or plant harvesting • Sensory disturbance has the potential to affect the availability of habitat or distribution of species of traditional importance • Loss or alteration of habitat resulting from disturbance to watercourses • Change to the distribution, diversity, and abundance of traditionally harvested species • Indirect effects on the experience of Indigenous peoples, which adversely alter the perceived value of availability of traditional resources for cultural use 	<ul style="list-style-type: none"> • Change in availability of habitat (hectares [ha]) for traditionally used plant or animal species • Change in availability of habitat for harvested fish species • Qualitative evaluation of change in hunting and fishing pressure as a result of the Project • Identification of change in quality or quantity of resources from participating Indigenous Governments and Indigenous Organizations • Change in availability of harvested resources

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11.0 Assessment of Potential Effects on Culture and Traditional Land Use, Including Harvesting

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Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in access to resources or areas for cultural and traditional land use	<ul style="list-style-type: none"> • Project activities could result in the restriction or alteration of access (including trails and travelways) to lands and resources used for traditional and cultural purposes. • Indirect effects on the experience of Indigenous peoples, which adversely alter the perceived value of access to traditional resources for current use or current use sites and areas. 	<ul style="list-style-type: none"> • Disruption of trails and travelways • Areas subject to permanent or temporary access restrictions • Area (ha) of altered land use management • Time required to access different traditional and cultural use locations
Change in access to resources or areas for cultural and traditional land use (cont'd)	<ul style="list-style-type: none"> • Indirect effects of highways and access roads increasing access to harvesting areas 	<ul style="list-style-type: none"> • Identification of change in access or avoidance behaviors from participating Indigenous Governments and Indigenous Organizations • Quality of access roads, and harvesting locations
Change in sites or areas for cultural and traditional land use	<ul style="list-style-type: none"> • Construction works and activities could result in a loss or alteration of identified harvesting sites, habitation areas, and cultural and sacred sites. • Indirect effects on the experience of Indigenous peoples, which adversely alter the perceived value of current use sites or areas • Indirect effects of highways and access roads increasing access to harvesting areas 	<ul style="list-style-type: none"> • Number of or area (ha) of identified sites and areas affected • Identification of change in sites or areas from participating Indigenous Governments and Indigenous Organizations • Identification of change in use of sites or areas from participating Indigenous Governments and Indigenous Organizations

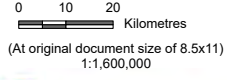
11.1.4 Boundaries

11.1.4.1 Spatial Boundaries

The spatial boundaries for cultural use were established in consideration of potential effects on traditional use in the Local Assessment Area (LAA) and RAA, where data was obtained to allow for an understanding of the environment in support of the effects assessment and the cumulative effects assessment. The spatial boundaries for the assessment of the potential effects of the Project on cultural use are presented in Figure 11.1.



- Proposed Mackenzie Valley Highway Project
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Proposed Great Bear River Bridge
- Community
- Local Assessment Area
- Regional Assessment Area
- Northwest Territories Highway
- Winter Road
- District Boundary
- Region Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 8/10/2023
 TR by LN on 8/10/2023

Client/Project: 144903025-0138 REVA

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No.
11.1

Culture and Traditional Land Use Assessment Areas

Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics. n.d. Inventory of Landscape Change Map Viewer, GNWT, Centre for Geomatics. n.d. Open Data, MVLWB. n.d. Public Registry, Sahtu Land and Water Board. n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd. 2015-2016
 3. Background: World Topographic Map; Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery date: 2021

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

The spatial boundaries defined for cultural use follow the spatial boundaries described for the wildlife and wildlife habitat assessment (see Chapter 19) because there are demonstrable links between cultural use activities and the potential effects pathways described in the assessment of potential effects on wildlife and wildlife habitat (e.g., traditional hunting and change in wildlife health). The spatial boundaries for cultural use also align with spatial boundaries for wildlife and wildlife habitat because this is understood to represent the greatest extent of direct and indirect environmental effects of the Project. The spatial boundaries for cultural use also encompass the spatial boundaries for the assessment of potential effects on fish and fish habitat (Chapter 17), vegetation and wetlands (Chapter 18), water and sediment quality (Chapter 16), air quality (Chapter 12), and noise (Chapter 13), and therefore the extent of potential effects on these VC’s are also captured within the cultural use spatial boundaries.

While the cultural use spatial boundaries align with those of the Wildlife and Wildlife Habitat VC and encompass those of the Fish and Fish Habitat VC, the assessment of effects on cultural use is not limited to the effects on resources; the assessment also considers information about cultural importance and experiential values, where that information has been provided by Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils.

The spatial boundaries for the assessment of effects on cultural use are as follows:

- **Project Development Area (PDA):** The area of direct project disturbance within which works and activities will occur (footprint). This includes a new two-lane gravel highway, 60 metres (m) wide highway right-of-way (ROW), laydown and staging areas, maintenance yards, construction camps, and quarry/borrow sites with access roads on a 30 m ROW.
- **Local Assessment Area (LAA):** Aligns with that for wildlife and wildlife habitat and is the area within approximately 1 kilometre (km) of the preliminary highway alignment and access roads, extended to 2 km around quarry and borrow source extents. The size of the LAA is based on measurable effects on traditionally harvested species, while also considering recommended setback distances for wildlife and wildlife habitat features.
- **Regional Assessment Area (RAA):** Aligns with that for wildlife and wildlife habitat and is the area within approximately 15 km of the PDA that is used to capture a wide range of wildlife species and wildlife habitats that could potentially be affected cumulatively by the Project and other past, present, and reasonably foreseeable projects.

Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, may identify spatial boundaries in relation to their traditional lands that may vary considerably. Due to the location of the Project, this DAR is focused on the effects within the Sahtu Region and Dehcho Region and the Indigenous Governments, Indigenous Organizations, and renewable resources councils within these regions. The cultural use boundaries used for this DAR generally align with those of wildlife and wildlife habitat (see Chapter 19) boundaries.

11.1.4.2 Temporal Boundaries

Temporal boundaries for the assessment of potential effects of the Project are described in Section 5.4.1.

- **Construction phase:** The Project will take approximately 10 years to construct, over a timeframe of up to 20 years. The schedule (see Figure 5.3) used for this assessment is conceptual and reflects a phased approach to construction, as construction is not likely to be continuous. The conceptual schedule assumes the Project will be constructed in three consecutive segments: Wrigley north to the Dehcho–Sahtu border (102 km); Tulita south to the Dehcho–Sahtu border (134 km); and Tulita north to the Prohibition Creek Access Road ([PCAR]; 45 km).
- **Operations and maintenance phase:** The operations and maintenance phase of the Project will likely commence in a similarly staged approach once construction of a particular segment has been completed. The operations and maintenance phase is considered indeterminate as the Project will not be decommissioned.

The temporal boundary for cultural use also considers current and future use of lands and resources by Indigenous Governments, and Indigenous Organizations during Project construction and operations and maintenance. Current use was defined as extending back one generation; therefore, information regarding existing conditions, with associated temporal details, encompasses 1997 to present and into the reasonably foreseeable future. The one generation timeframe for considering effects of a change in the environment on cultural use reflects the fact that knowledge about traditional practices or locales may be lost or may not be passed on if it goes unused for a generation. Future use pertains to the opportunities for generations of descendants to practice traditional activities (in modern form) and maintain cultural use practices and values. Traditional Knowledge (TK) information considered in the DAR has been obtained from published TK source materials dating back to 1997; TK information from other sources may date back farther. It is acknowledged that Indigenous peoples have knowledge and experience of the project area that goes back generations and where secondary sources or TLRU studies include observations about events, activities, practices, or traditional resources that occur prior to 1997, this information has been included for context.

11.1.5 Residual Effects Characterization

Cultural use is dependent on many factors, including healthy and accessible lands and resources (including animal and plant species), and sites such as trails, sacred areas, campsites, and harvesting areas. The assessment of residual effects considers change in the distribution, diversity, and abundance of traditionally used resources, and access to harvesting and cultural use sites and areas. Table 11.2 provides a description of the terms used to characterize residual effects.

Table 11.2 Characterization of Residual Effects on Culture and Traditional Land Use, including Harvesting

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	<p>Adverse: A residual effect that moves measurable parameters of cultural use in a negative direction relative to baseline.</p> <p>Neutral: No net change in measurable parameters for cultural relative to baseline.</p>
Likelihood	The probability that the residual effect will occur	<p>Unlikely: The residual effect is almost certainly not to occur.</p> <p>Possible: The residual effect could occur.</p> <p>Certain: The residual effect will certainly occur.</p>
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	<p>Low: Effect will increase the effort necessary to conduct cultural use activity but will not reduce the ability to conduct cultural use activity.</p> <p>Moderate: Effect will reduce the ability to conduct cultural use activity.</p> <p>High: Effect will greatly reduce or eliminate the ability to conduct cultural use activity.</p>
Geographic Extent	The geographic area in which a residual effect occurs	<p>PDA: Residual effects are restricted to the PDA.</p> <p>LAA: Residual effects extend into the LAA.</p> <p>RAA: Residual effects interact with those of other projects in the RAA.</p>
Timing	Considers when the residual effect is expected to occur, where relevant to the VC.	<p>Time of day: Residual effect is greater during the daytime or nighttime.</p> <p>Seasonality: Residual effect is greater in one season than another (e.g., spring/summer vs. fall/winter).</p> <p>Not applicable: The residual effect of construction, operation, or maintenance activities will have the same effect on the VC, regardless of timing.</p>
Duration	The time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	<p>Short-term: The residual effect is restricted to no more than the duration of one construction segment, or 3 to 4 years.</p> <p>Medium-term: The residual effect lasts through project construction (up to 20 years).</p> <p>Long-term: The residual effect extends beyond construction and through project operation (for more than 20 years).</p>

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Frequency	Identifies how often the residual effect occurs and how often during the project or in a specific phase	<p>Single event: The residual effect occurs once.</p> <p>Multiple irregular event: Occurs at no set schedule</p> <p>Multiple regular event: Occurs at regular intervals</p> <p>Continuous: Occurs continuously</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	<p>Reversible: The residual effect is likely to be reversed after activity completion and reclamation.</p> <p>Irreversible: The residual effect is unlikely to be reversed.</p>

11.1.6 Significance Definition

Evaluating the significance of potential effects is a subjective and value-dependent judgement of importance requiring consideration of the proposed development altering or decreasing the value, quality, and quantity of VCs beyond a certain threshold. Evaluation includes involvement of affected Indigenous Governments’, Indigenous Organizations’, and specific other affected parties’ (such as renewable resources councils) perspectives and knowledge on the significance of the effect, drawing on traditional and local knowledge, research studies, comparable baseline studies, community-based affects assessment, standards, and guidelines (MVEIRB, 2007). However, the lack of laws, policies, management plans, or standard industry practice regarding thresholds for effects on cultural and traditional use makes choosing and applying significance thresholds challenging. The subjective nature of describing and understanding the importance of effects on cultural and traditional use means that selected thresholds might not evenly apply across Indigenous Governments’ and Indigenous Organizations’ circumstances. Indigenous Governments and Indigenous Organizations themselves may have differing views on the meaning of significance that reflect oral history traditions and holistic understandings of natural phenomena.

Given these considerations, a significant adverse effect on cultural use is defined as a long-term loss of availability of cultural and traditional use resources, or access to lands, cultural use sites, and areas relied on for cultural use practices, such that cultural and traditional use is critically reduced or eliminated within the RAA. Cultural use activities and practices may experience significant adverse effects even where a conclusion of no significant effect is made with respect to biological resources (such as wildlife or vegetation) or physical sites (such as registered historical resources or trap lines) in the RAA.

11.1.7 Conservative Approach

This assessment conservatively assumes that cultural use activities have the potential to occur within the RAA, even if Indigenous Governments, Indigenous Organizations, and renewable resources councils did not specifically identify cultural use activities or site-specific uses as occurring there. In assessing potential effects on current use, this assessment uses a conservative approach that recognises that a lack of cultural use information for a specific area or activity does not necessarily represent a lack of cultural use for that location or activity, especially where no project-specific TLRU information is available. The assessment also assumes that traditionally used species identified as being present in the RAA could be hunted, trapped, fished, or gathered by Indigenous Governments and Indigenous Organizations.

The conclusions in this section are derived in part from the conclusions of biophysical assessments. The assessments of wildlife and wildlife habitat, vegetation and wetlands, and fish and fish habitat can inform an assessment of cultural use harvesting activities, while assessments of other biophysical elements, such as air quality, noise, hydrology, and surface water quality, can provide information regarding changes in the environment that may affect conditions for cultural use. However, biophysical effects may not fully align with effects on cultural use, nor do the mitigation measures for biophysical effects necessarily mitigate the effects on cultural use. This is considered when cross-referencing sections of the assessment.

Publicly available cultural use information is also used to provide context regarding existing conditions, issues and concerns, and environmental observations that may affect conditions for cultural use. This includes material collected during previous engagement on the Project, some of which dates to 2011, while other reports date earlier. As explained in Section 11.1.4.2, temporal boundaries for cultural use are defined as extending back from the present time to within the last 25 years (or one generation). In keeping with conservative assumptions, this material has been referenced to assist in understanding the extent and nature of cultural use activities and practices undertaken by Indigenous Governments and Indigenous Organizations as well as identifying potential issues and concerns that have been brought forward on other projects that may be applicable to the Project (e.g., concerns that construction could have effects on air quality and noise, which may change the distribution and abundance of traditionally harvested species).

11.2 Existing Conditions for Culture and Traditional Land Use, Including Harvesting

11.2.1 Methods

A literature review of publicly available information regarding access to traditional resources or areas for cultural use was completed to address the ToR (MVEIRB, 2015 [PR#66]). The review included relevant literature and TK and traditional use information in the Dehcho and Sahtu regions. Results are used to characterize the existing conditions for selected VCs (i.e., harvesting, harvesting areas, access trails, cultural and spiritual use areas, heritage resources, habitation) within the LAA and RAA, and are organized by Sahtu and Dehcho regions in this report.

More information about traditional land use and associated VCs in the Dehcho and Sahtu regions can be found in the MVH Project Extension: Technical Data Report (TDR) for Cultural and Traditional Land Use (Appendix 11A, K’alo-Stantec, 2022a). The TDR presents a summary that categorizes applicable TK and traditional land use information within relevant VCs that are discussed through this DAR. Traditional land use includes TK about the activities, practices and places, locations, and areas related to use of traditional resources, including travel to engage in harvesting practices, or places of habitation and settlement such as cabins or campsites, sacred areas, burials, and ceremonial sites (discussed in Section 11.2.5 Cultural and Heritage Use Sites or Areas).

The description of existing conditions for cultural use relies on information regarding Indigenous TLRU provided from the project-specific engagement program, project-specific TLRU reports, and a review of publicly available literature containing information about cultural use by affected Indigenous Governments and Indigenous Organizations. In addition, government databases and certain Indigenous Governments’ and Indigenous Organizations’ websites were reviewed to obtain current information about their location, demographics, and governance structures. As mentioned in Section 11.1.1, RRCs designated under the SDMCLCA are responsible to provide comments relevant to their mandate for preliminary screenings and environmental assessments (SLUPB, 2022). The Project lies within the jurisdiction of NWRRC and TRRC. As such, TLRU and TK provided by NWRRC and TRRC have been prioritized; however, project-specific feedback obtained through engagement has been included for all participating Indigenous Governments, Indigenous Organizations, and other affected parties to provide regional context.

The GNWT acknowledges that TK is the intellectual property of Indigenous Governments, Indigenous Organizations, and knowledge holders; the GNWT is committed to protecting the confidentiality of TK information and respects the terms of use for each of the documents reviewed. Confidential TK studies or those stipulating one-time use were excluded from the review of publicly available documents. The GNWT is confident that the information obtained through the publicly available sources is valid and reliable and adequate for purposes of this assessment but acknowledges gaps and uncertainties (see Section 11.7.1.1).

Confidential TLRU have been completed by TRRC and NWRRC study prior to the submission of the DAR. Information validated by TRRC and NWRRC has been incorporated into this document. It is anticipated that Pehdzéh Kì First Nation will provide a project-specific TLRU study discussing traditional land use, harvested species, and continued availability of and access to traditional sites and areas of interest to Pehdzéh Kì First Nation; this may include concerns about potential project effects and mitigation recommendations for TLRU resources and accessibility for incorporation into the DAR. Upon receipt of the TLRU study from Pehdzéh Kì First Nation, TK information will be incorporated into the DAR as appropriate.

11.2.2 Indigenous Government and Indigenous Organization History and Context

Indigenous Governments are defined as governments that have negotiated, or are in the process of negotiating, Lands and Resources and/or Self-Government Agreements (Land Claims) with the GNWT and the Government of Canada.

Indigenous Organizations are defined as organizations that do not meet the definition of an Indigenous Government that have been elected as the sole representative of the collective Aboriginal and/or Treaty rights of its Indigenous membership.

11.2.2.1 Dehcho Region

The Project will traverse a portion of the Dehcho Region. The Dehcho Land Use Planning Committee (DLUPC) describes a territory rich in culture and resources, with residents in the region working to maintain lands and resources to meet the social, cultural, economic, and environmental needs of current and future generations (DLUPC, 2006). The Dehcho Region borders British Columbia and Yukon Territory. Within the Dehcho Region, Pehdzéh Kì First Nation is located within the project LAA. Pehdzéh Kì First Nation is seasonally connected to other Nations within the Sahtu Region by the MVWR and all-season by highway to the nearest full-service in Hay River (Kátł’odeh) (IMG Golder, 2006).

11.2.2.2 Sahtu Region

The Project will traverse a portion of the Sahtu Region, home to Sahtu Dene and Métis (SLUPB, 2022). Traditional Sahtu Dene have maintained cultural integrity in the Sahtu Region for thousands of years and have always followed the seasons and movement of wildlife and use the land for hunting, trapping, fishing, gathering, spiritual renewal, and healing (SLUPB, 2023, 2022). Sahtu Métis moved into the region during the early 19th century and are descendants of Sahtu Dene and Euro-Canadians (SLUPB, 2022). The history of the Sahtu Métis began in the early fur trade era, in which Métis of the Sahtu played crucial roles as both interpreters and ambassadors to both cultures, which helped foster and drive the local economy (SLUPB, 2022).

There are many places throughout the Sahtu Region recognized as cultural and historical features important to both Dene and Métis for TLRU, including spiritual ties to Bear Rock (Petınızah) (SLUPB, 2022; TRRC, 2022; NWRRC, 2023). The spiritual site of Bear Rock (Petınızah), which rises 400 m above the community of Tulita to the north, is the home to Yamoria, Dene lawmaker (GNWT, 2021f). Tulita Dene Band has expressed interest in protecting this site (see Section 11.4.4).

Different Sahtu cultural groups reside in different Sahtu Districts (SLUPB, 2022). *Shúhtaot’ıę* (Mountain People) reside in the Tulita District in the communities of Norman Wells and Tulita within the project LAA (SLUPB, 2022). Dene of Tulita are known as skillful boat makers; the boats are designed to travel inland along rivers (SRRB, n.d.). Mountain People and Mountain Dene traditionally lived nomadically in the alpine tundra, where fast moving rivers and forested river valleys provide the resources required for survival on the land (Hamlet of Tulita, 2022).

Shúhtaot’ıę (Mountain People) traditionally met seasonally in Tulita; however, wide dispersion of Dene people has occurred since the 19th century (Hamlet of Tulita, 2022). At present, most of Tulita Dene Band members reside in Tulita (Hamlet of Tulita, 2022).

For Sahtu Dene, connection to land is more than the resources it provides (SLUPB, 2023, 2022). Dene Elders¹⁶ do not view the land and people as separate but connected by tradition and culture through shared experiences on the land, careful observation, and through oral history (SLUPB, 2022). Spiritual and ethical values, traditional law, and codes of behaviour are learned on the land, and embedded in powerful stories and legends of cultural heroes associated with the landscape as a way of understanding wildlife and the natural environment (Sahtú Heritage Places and Sites Joint Working Group [SHPSJWG], 2000; SLUPB, 2022). Traditional ecological knowledge, as a body of knowledge including local micro-climates, ice and snow, river currents, plants, and animal movements, have maintained Dene and Métis survival through all seasons and harsh climates of the region (SLUPB, 2022).

Sahtu Dene describe TK as a deeper form of knowledge; developed and evolving over many generations, TK embodies environmental stewardship and instills a worldview embodied in valuing the ethical practices of everyday Dene life (SLUPB, 2022). Dene Elders are the primary teachers and keepers of oral TK, shared on the land and through associated stories specific to place and location (SLUPB, 2022). Powerful stories and important cultural heroes are a symbolic representation of the deep connection Dene have with the landscape, bound by place names, narratives, and the TK they embody (5658 NWT Ltd and GNWT, 2011 [PR#16]; SLUPB, 2023; SHPSJWG, 2000). Stories are meant to demonstrate important cultural rules that govern human relationships with the environment and wildlife to instill social norms, which help sustain life and maintain Sahtu Dene and Métis identity (SLUPB, 2022).

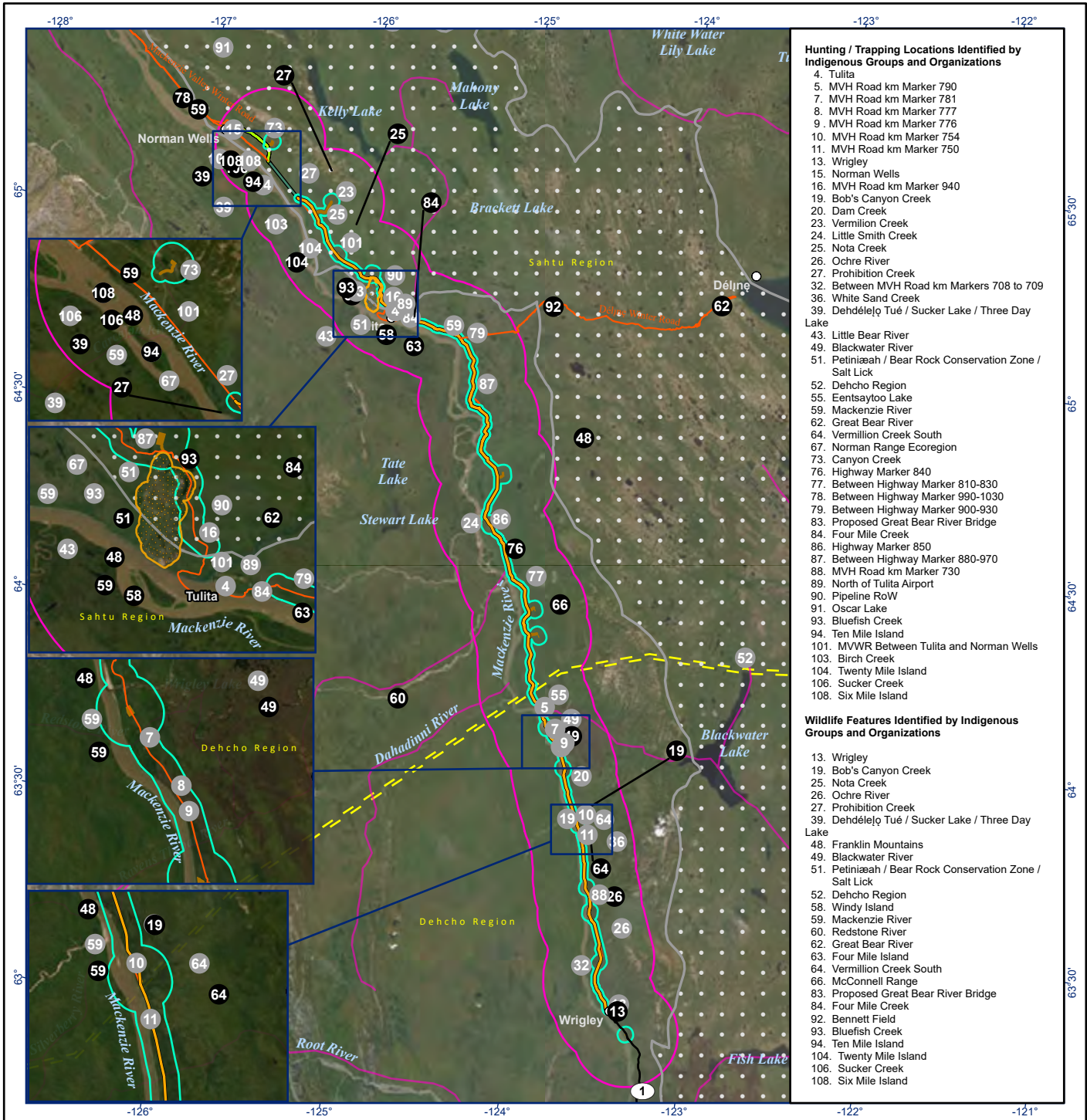
¹⁶ Elder(s) is used to follow the original usage identified in the literature review and project-specific TLRU studies.

11.2.3 Availability of Traditional Resources for Cultural Use

Information on the availability of traditional resources for cultural use was collected through a literature review of publicly available documents, project-specific TLRU studies, and information provided by Indigenous Governments, Indigenous Organizations, and renewable resources councils in the Dehcho and Sahtu regions, during the project-specific engagement program (see Section 11.1.5). Results are used to characterize the existing conditions for selected VCs (i.e., wildlife and wildlife habitat, including caribou, moose, furbearers, and other wildlife; fish and fish habitat; water; and plants) within the LAA and RAA associated with their availability for cultural use.

11.2.3.1 Wildlife

Dehcho First Nations and Sahtu Dene and Métis reported harvesting wildlife for sustenance to be essential for diet and survival and explained it is a way of life and part of their cultural identity (DLUPC, 2006; IMG-Golder Corporation, 2006; SLUPB, 2022). The protection of Indigenous culture and traditional land use (including hunting, fishing, trapping, gathering, and occupancy) is highly important to land users in the Dehcho and Sahtu regions. Pehdzéh Kì First Nation, Dehcho First Nations, and Sahtu Dene and Métis have reported numerous important wildlife habitat areas and specific harvesting and trapping locations (Figure 11.2). Wildlife species (including birds) of interest identified by Indigenous Governments, Indigenous Organizations, and certain other affected parties engaged on the Project, through a review of publicly available literature and project-specific TLRU studies, are listed in Table 11.3.



- Hunting / Trapping Locations Identified by Indigenous Groups and Organizations**
4. Tulita
 5. MVH Road km Marker 790
 7. MVH Road km Marker 781
 8. MVH Road km Marker 777
 9. MVH Road km Marker 776
 10. MVH Road km Marker 754
 11. MVH Road km Marker 750
 13. Wrigley
 15. Norman Wells
 16. MVH Road km Marker 940
 19. Bob's Canyon Creek
 20. Dam Creek
 23. Vermilion Creek
 24. Little Smith Creek
 25. Nota Creek
 26. Ochre River
 27. Prohibition Creek
 32. Between MVH Road km Markers 708 to 709
 36. White Sand Creek
 39. Dehdélelǰ Tué / Sucker Lake / Three Day Lake
 43. Little Bear River
 49. Blackwater River
 51. Petiniāah / Bear Rock Conservation Zone / Salt Lick
 52. Dehcho Region
 55. Eentsaytoo Lake
 59. Mackenzie River
 62. Great Bear River
 64. Vermillion Creek South
 67. Norman Range Ecoregion
 73. Canyon Creek
 76. Highway Marker 840
 77. Between Highway Marker 810-830
 78. Between Highway Marker 990-1030
 79. Between Highway Marker 900-930
 83. Proposed Great Bear River Bridge
 84. Four Mile Creek
 86. Highway Marker 850
 87. Between Highway Marker 880-970
 88. MVH Road km Marker 730
 89. North of Tulita Airport
 90. Pipeline RoW
 91. Oscar Lake
 93. Bluefish Creek
 94. Ten Mile Island
 101. MVWR Between Tulita and Norman Wells
 103. Birch Creek
 104. Twenty Mile Island
 106. Sucker Creek
 108. Six Mile Island
- Wildlife Features Identified by Indigenous Groups and Organizations**
13. Wrigley
 19. Bob's Canyon Creek
 25. Nota Creek
 26. Ochre River
 27. Prohibition Creek
 39. Dehdélelǰ Tué / Sucker Lake / Three Day Lake
 48. Franklin Mountains
 49. Blackwater River
 51. Petiniāah / Bear Rock Conservation Zone / Salt Lick
 52. Dehcho Region
 58. Windy Island
 59. Mackenzie River
 60. Redstone River
 62. Great Bear River
 63. Four Mile Island
 64. Vermillion Creek South
 66. McConnell Range
 83. Proposed Great Bear River Bridge
 84. Four Mile Creek
 92. Bennett Field
 93. Bluefish Creek
 94. Ten Mile Island
 104. Twenty Mile Island
 106. Sucker Creek
 108. Six Mile Island



- Traditional Land Use**
- Hunting / Trapping
 - Wildlife
 - Proposed Mackenzie Valley Highway Project
 - Canyon Creek All Season Access Road (Constructed)
 - Prohibition Creek Access Road (In Construction)
 - Proposed Great Bear River Bridge
 - Proposed Borrow Source / Quarry and Access
 - Local Assessment Area
 - Regional Assessment Area
 - Community
 - Northwest Territories Highway
 - Winter Road
 - Petiniāah (Bear Rock) Conservation Zone
 - Norman Range Ecoregion
 - Region Boundary

0 10 20 Kilometres
(At original document size of 8.5x11) 1:1,700,000

Project Location
Wrigley to Norman Wells, NWT

Client/Project
144903025-0131 REV C

Government of the Northwest Territories
Mackenzie Valley Highway Project

Figure No.
11.2

Title
Wildlife Harvesting, Hunting and Trapping Locations and Important Wildlife Features in the Regional Assessment Area

Notes

1. This map is associated with Chapter 11 Section 11.2.3, Tables 11.5, 11.6 and 11.7
2. Coordinate System: NAD 1983 Northwest Territories Lambert
3. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics, n.d. Inventory of Landscape Change Map Viewer, GNWT, Centre for Geomatics, n.d. Open Data, MVLWB, n.d. Public Registry, Sahtu Land and Water Board, n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd., 2015-2016, 5658 NWT Ltd. and GNWT 2011; Dehcho First Nations 2011; Dessau 2012; Golder 2015; SLUPB 2013; IMG-Golder Corporation 2006; McDonald 2010; Project Engagement Workshops (see Appendix); TRRC 2022; SLUPB 2013; NWRRCC 2023
4. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
World Imagery: Earthstar Geographics
World Hillshade: Esri, USGS. Imagery date: 2021

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

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Table 11.3 Culturally Important Wildlife Species

Common Name	Latin Name	Identified By
American widgeon	<i>Anas americana</i>	SRRB
Arctic fox	<i>Alopex lagopus</i>	SRRB; NWRRC
Arctic hare	<i>Lepus arcticus</i>	SRRB; TRRC
Arctic ground squirrel	<i>Spermophilus parryii</i>	SRRB
Arctic Loon	<i>Gavia arctica</i>	SRRB
Barren-ground caribou	<i>Rangifer tarandus groenlandicus</i>	Dehcho First Nations; Pehdzéh Kì First Nation; Sahtu Dene and Métis; TRRC
Barrows goldeneye	<i>Bucephala islandica</i>	SRRB
Beaver	<i>Castor canadensis</i>	Dehcho First Nations; Pehdzéh Kì First Nation; Wrigley Community; SRRB; TRRC; NWRRC
Black bear	<i>Ursus americanus</i>	Dehcho First Nations; Pehdzéh Kì First Nation; SRRB; NWRRC
Black scoter	<i>Melanitta nigra</i>	SRRB
Blue-winged teal	<i>Anas disors</i>	SRRB
Boreal woodland caribou	<i>Rangifer tarandus caribou</i>	Dehcho First Nations; Pehdzéh Kì First Nation; Sahtu Dene and Métis; TRRC; NWRRC
Brant goose	<i>Branta bernicla</i>	SRRB
Bufflehead	<i>Bucephala</i>	SRRB
Canada goose	<i>Branta canadensis</i>	SRRB; NWRRC
Canvasback	<i>Aythya valisineria</i>	SRRB
Common goldeneye	<i>Bucephala clangula</i>	SRRB
Common loon	<i>Gavia immer</i>	SRRB
Common merganser	<i>Mergys merganser</i>	SRRB
Cougar	<i>Felis concolor</i>	SRRB
Coyote	<i>Canis latrans</i>	SRRB
Dall sheep	<i>Ovis dalli</i>	SRRB
Duck	Various	Dehcho First Nations; Pehdzéh Kì First Nation; Wrigley Community; TRRC; NWRRC
Ermine (weasel)	<i>Mustela erminea</i>	Pehdzéh Kì First Nation; SRRB
Fisher	<i>Martes pennanti</i>	Pehdzéh Kì First Nation; SRRB
Goose	Various	Dehcho First Nations; Pehdzéh Kì First Nation; Wrigley Community; NWRRC

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Common Name	Latin Name	Identified By
Greater scaup	<i>Aythya marlia</i>	SRRB
Greater white-fronted goose	<i>Anser albifrans</i>	SRRB
Green-winged teal	<i>Anas crecca</i>	SRRB
Grizzly bear	<i>Ursus arctos</i>	Dehcho First Nations; Pehdzéh Kì First Nation; SRRB
Grouse/Ptarmigan (e.g., willow ptarmigan/chicken)	Various (e.g., <i>Lagopus lagopus</i>)	Pehdzéh Kì First Nation; Wrigley Community; TRRC; NWRRC
Harlequin	<i>Histrionicus histrionicus</i>	SRRB
Kingfisher	<i>Alcedinidae</i>	NWRRC
Least weasel	<i>Mustela nivalis</i>	Pehdzéh Kì First Nation
Lesser scaup	<i>Aythya affinis</i>	SRRB
Lynx	<i>Lynx canadensis</i>	Pehdzéh Kì First Nation; SRRB; NWRRC
Marmot	<i>Marmota spp.</i>	SRRB
Marten	<i>Martes americana</i>	Pehdzéh Kì First Nation; Wrigley Community; SRRB; NWRRC
Mink	<i>Neovison vison</i>	Pehdzéh Kì First Nation; SRRB; NWRRC
Moose	<i>Alces alces</i>	Dehcho First Nations; Pehdzéh Kì First Nation; Sahtu Dene and Métis; SRRB; TRRC; NWRRC
Mountain goat	<i>Oreamnos americanus</i>	SRRB
Muskrat	<i>Ondatra zibethica</i>	Dehcho First Nations; Pehdzéh Kì First Nation; SRRB; TRRC; NWRRC
Muskox	<i>Ovibos mochatus</i>	SRRB; TRRC; NWRRC
Northern pintail	<i>Anas acuta</i>	SRRB
Northern river otter/otter	<i>Lontra canadensis</i>	SRRB; Pehdzéh Kì First Nation
Norther shoveler	<i>Anas clypeata</i>	SRRB
Oldsquaw	<i>Clangula hyemalis</i>	SRRB
Pacific loon	<i>Gavia pacifica</i>	SRRB
Porcupine	<i>Erethizon dorsatum</i>	Dehcho First Nations; Pehdzéh Kì First Nation: SRRB
Red breasted merganser	<i>Mergus serrator</i>	SRRB
Red fox	<i>Vulpes vulpes</i>	Pehdzéh Kì First Nation; SRRB; NWRRC
Red squirrel	<i>Tamiasciurus hudsonicus</i>	SRRB
Red-throated loon	<i>Gavia stella</i>	SRRB
Ring-necked duck	<i>Aythya collaris</i>	SRRB

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Common Name	Latin Name	Identified By
Rock ptarmigan	<i>Lagopus mutus</i>	SRRB
Ruffed grouse	<i>Bonasa umbellus</i>	SRRB
Sandhill crane	<i>Grus canadensis</i>	SRRB
Songbird	<i>Oscines</i>	NWRRC
Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	SRRB; NWRRC
Snow goose	<i>Chen caerulescens</i>	SRRB
Snowshoe hare	<i>Lepus americanus</i>	Pehdzéh Kì First Nation; SRRB; TRRC
Snowy owl	<i>Nyctea scandiaca</i>	SRRB
Spruce grouse	<i>Dendragapus canadensis</i>	SRRB; NWRRC
Squirrel	Various	Pehdzéh Kì First Nation
Surf scoter	<i>Melanitta perspicillata</i>	SRRB
Trumpeter swan	<i>Cygnus buccinator</i>	Pehdzéh Kì First Nation; SRRB; NWRRC
Tundra swan	<i>Cygnus columbianus</i>	Pehdzéh Kì First Nation; SRRB; NWRRC
White-tailed deer	<i>Odocoileus virginianus</i>	SRRB
Whiskey jack	<i>Perisoreus canadensis</i>	NWRRC
Willow ptarmigan	<i>Lagopus lagopus</i>	SRRB; NWRRC
White-winged scoter	<i>Melanitta fusca</i>	SRRB
Wolf	<i>Canis lupus F</i>	Pehdzéh Kì First Nation; Sahtu Dene and Métis; SRRB; TRRC; NWRRC
Wolverine	<i>Gulo gulo</i>	Pehdzéh Kì First Nation; SRRB; NWRRC
Yellow-billed loon	<i>Gavia adamsii</i>	SRRB

Sources: Auld and Kershaw, 2005; Dehcho First Nations, 2011; IMG-Golder Corporation, 2006; McDonald, 2010; NWRRC, 2023; TRRC, 2022; SRRB, 2021b, 2007; SLUPB, 2023

11.2.3.1.1 Dehcho Region

Dehcho First Nations stated that a culture based in reciprocity with the land requires regular opportunities to go out on the land to sustain this relationship (DLUPC, 2006). Dehcho First Nations also reported that Dene culture and language are strongly tied to the land (DLUPC, 2006). Pehdzéh Kì First Nation reported resource harvesting as an important activity, stating that it provides a considerable amount of subsistence for families (Dessau, 2012 [PR#13]). In a recent report (DPRA, 2022) Wrigley, home primarily to Pehdzéh Kì First Nation, reported that over 65.8% of the residents (over the age of 15) participated in hunting and fishing activities, an increase of 31.4% since 1998 (DPRA, 2022; IMG-Golder Corporation, 2006). Additionally, 35.5% of the residents in the Wrigley area (over the age of 15) participated in trapping activities (DPRA, 2022). A recent report (DPRA, 2022) discussed that 50% of Wrigley residents reported that they had relied on meat obtained by hunting and fishing (for 75% or more of diet), which nearly doubled over 20 years when compared to 27.7% of Wrigley residents who reported reliance on harvested meat (for 75% or more of the diet) in 1998 (DPRA, 2022). Harvesting local country foods is important to avoid the high costs of living, understanding the economic value of wildlife over high-price meats available in stores (IMG-Golder Corporation, 2006). In 2004, the estimated price of food in Wrigley was approximately 74% higher compared to Yellowknife (comparable to Edmonton, Alberta) (IMG-Golder Corporation, 2006).

The Project traverses the Pehdzéh Kì N’deh area (DLUPC, 2006). The Pehdzéh Kì N’deh area is a large area between Wrigley and Blackwater River and is recognized as an important cultural area to Dehcho First Nations and Pehdzéh Kì First Nation. The Pehdzéh Kì N’deh area supports habitat for moose, woodland caribou, barren-ground caribou, black bears, wolves, migratory birds, and fish, and protects subsistence harvesting needs (DLUPC, 2006; Dessau, 2012 [PR#13]).

Dehcho First Nations have indicated that increase in white tail deer populations have likely attracted cougars into the area, which are increasingly observed (both directly and through tracks) throughout the Dehcho Region (Dehcho First Nations, 2011). Increased predator-species, such as cougars, can influence predator-prey relationships and the availability of harvestable food resources in the region, especially caribou, which become secondary prey in areas where predatory species become more abundant (Dehcho First Nations, 2011). Dehcho First Nations have observed that deer are easily drawn to accessible resources along seismic lines in and around oil and gas exploration activities in northern Alberta and British Columbia and can subsequently lure cougars (and other predatory species) further north (Dehcho First Nations, 2011).

Dehcho First Nations have also observed increased bear populations throughout the Dehcho Region. Increasing abundance of bear populations is associated with growing concerns raised by harvesters, including the consumption of potentially contaminated bear meat from bears that forage in dumps or other contaminated sites (Dehcho First Nations, 2011). Dehcho First Nations also expressed concerns regarding wildlife contaminated through exposure to oil and other contaminants to the environment (Dehcho First Nations, 2011).

Dehcho First Nations have expressed moderate concerns regarding overharvesting by recreational harvesters (Dehcho First Nations, 2011). Overharvesting by Indigenous hunters is not a concern as traditional harvesting has declined over the last few decades, but there has been a slow increase in Indigenous hunters entering accessible habitat areas in the Dehcho Region during the fall and winter months (Dehcho First Nations, 2011). Dehcho First Nations indicate that the number of animals harvested by recreational hunters is not known, and that moose harvests need to be monitored more closely (Dehcho First Nations, 2011).

11.2.3.1.2 Sahtu Region

Sahtu Dene and Métis reported that there are a variety of important wildlife species in the Sahtu Region, some of value as sustenance, others for cultural reasons or for ecological significance (indicator species) (SLUPB, 2022). In 2008, Sahtu communities reported that households relying on country foods for half or more of the diet represented double the amount of the Northwest Territories (NWT) entirely (SLUPB, 2022). In 2018, 46% of Sahtu harvesters over the age of 15 reported hunting or fishing for subsistence (DPRA 2022; IMG-Golder Corporation, 2006). In Norman Wells, 28% of households reported relying on country foods for half or more of the diet (SLUPB, 2022). Norman Wells Renewable Resources Council reported that country food is also important for the maintenance of health. In the NWRRC TLRU Study for the Project (2023), an NWRRC study participant (NWRRC.4) explained: “I can’t live on steak and porkchops....if I eat too much of that I get a sore stomach” (NWRRC, 2023). NWRRC study participants shared stories about growing up on the land—hunting, fishing, trapping, and harvesting throughout the NWRRC TLRU Study Area¹⁷ - and described the importance of eating country foods:

“We had to have been the healthiest kids in the Sahtu Region... I think so... was really good. We would just have the wild meat...we drank water or broth...we had fish...we had rabbits... beaver...all that good stuff. I don’t remember my Mom going to the store to buy meat. Ever.” (NWRRC.11; NWRRC, 2023).

According to the NWT Bureau of Statistics (2019), the cost of food is approximately 70.6% more expensive in Norman Wells when compared to the cost of food in Yellowknife and NWRRC reported that harvesting local country foods is a healthy alternative that also helps harvesters avoid the high costs of living (NWRRC, 2023; SLUPB, 2022). Tulita Renewable Resources Council reported that Sahtu harvesters in Tulita rely on harvested country food as part of a daily sustenance and for medicine throughout the year, and that harvested food is shared with Elders, youth, friends, and family (TRRC, 2022). Norman Wells Renewable Resources Council (2023) reported that wildlife resources can be harvested at any time, however, most often wildlife is harvested when an opportunity arises.

¹⁷ NWRRC TLRU Study Area aligns with the LAA and is defined as 1km on either side of the Project within the Sahtu Region.

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Norman Wells Renewable Resources Council study participants explained that most Sahtu land users do not practice seasonal harvests and commented that hunting can and does occur all year round, and can occur anywhere in the NWRRC TLRU Study Area, when available. Seasonal harvests were practiced more in the past, however in some instances hunting may occur annually due to accessibility (NWRRC, 2023). For example, NWRRC harvesters may hunt when the MVWR is open during the winter and the fall seasons (NWRRC, 2023). The MVWR provides access to wildlife along the MVWR, and resident (and non-resident) land users often hunt on ‘drive-by’ basis, either by truck or skidoo (NWRRC, 2023). Participants of the NWRRC study reported that most resident harvesting occurs when people drive between Tulita and Norman Wells and harvest wildlife based on availability when the MVWR is open (NWRRC, 2023).

The Project traverses the Deh Cho (Mackenzie River) SMZ (Zone #63) as identified within the SLUP (SLUPB, 2023). The SMZ is a 5 km wide buffer running the length of the Mackenzie River (Deh Cho), hereafter referred to as Mackenzie River, designated to protect the water quality, riparian habitat, cultural/heritage sites, and areas important for wildlife and wildlife harvesting (SLUPB, 2023).

The Project also intersects Petiniᓂah (Bear Rock) CZ (Zone #32). Bear Rock (Petiniᓂah) is surrounded by the Deh Cho (Mackenzie River) SMZ (Zone #63), at the confluence of Mackenzie River and Great Bear River. Bear Rock (Petiniᓂah) is a culturally significant site and important wildlife area for Sahtu Dene and Métis residing within and outside of the Sahtu Region (SLUPB, 2023). Tulita Renewable Resources Council identified an important mineral lick and salt river near Bear Rock (Petiniᓂah) which is of interest to TRRC because wildlife is attracted to the area (TRRC, 2022). Norman Wells Renewable Resources Council (2023) also noted that water in the creeks taste salty between Prohibition Creek and Bear Rock (Petiniᓂah), indicating there is a salt lick in the area that attracts wildlife. Local knowledge from TRRC identified important areas along the shores of Great Bear River important for hunting all year round (TRRC, 2022). Norman Wells Renewable Resources Council (2023) reported that Sahtu land users still hunt and trap at Bluefish Creek, and identified Vermillion Creek, Oscar Lake, and Kelly Lake (outside the RAA) as good trapping locations. Norman Wells Renewable Resources Council (2023) also identified Birch Creek as an old hunting site, but it is unknown if hunting still occurs at Birch Creek.

Tulita Renewable Resources Council identified several bear dens throughout the TRRC TLRU Study Area¹⁸, specifically along the MVWR, near the north side of the Tulita airport, and near Four Mile Creek (TRRC, 2022). An NWRRC participant explained that bear denning sites can be difficult to locate:

“It is traditionally known by our people that when bear den, they are very hard to find. They like places on the side, esker type lands, lands under small trees ...where they can hide” (NWRRC.1; NWRRC, 2023).

¹⁸ TRRC TLRU Study Area aligns with the LAA and is defined as 1 km around the proposed project PDA centered on Tulita.

Norman Wells Renewable Resources Council (2023) reported that some bear denning sites have been observed around Canyon Creek, Nota Creek, Six Mile Island, and Vermillion Creek. Norman Wells Renewable Resources Council study participants explained that bears go up into the mountains every year to den and to hibernate (February to March) and come back down from the mountains every spring (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) noted that recently there have been more bears observed in the NWRRC TLRU Study Area than before, potentially because bears are not hunted as often or are exploring new territory. Norman Wells Renewable Resources Council (2023) also identified a very large grizzly bear that lives at Canyon Creek and another that lives at Sucker Creek that are of interest. Norman Wells Renewable Resources Council (2023) reported fox dens and wolf dens in the NWRRC TLRU Study Area have been observed between Prohibition Creek and Bear Rock (Petınızah). Fox and wolves have been known to den at Canyon Creek; however, it is unknown if those denning sites are still occupied by wildlife (NWRRC, 2023).

Tulita Renewable Resources Council also reported an increase in muskox populations in the Tulita area (TRRC, 2022). Local knowledge from TRRC attributed the increase of muskox to previous road construction and operations in the Tulita area (TRRC, 2022). Norman Wells Renewable Resources Council (2023) identified that muskox are more abundant in the NWRRC TLRU Study Area than in recent years and reported that observations of muskox change annually. An NWRRC study participant explained: “one year I saw a bunch of muskox at the lake near Bear Rock, and then last year I didn’t see any” (NWRRC.1; NWRRC, 2023). Norman Wells Renewable Resources Council study participants have observed muskox eating all types of vegetation in the NWRRC Study Area, including the grasses, low bush, and the willows and explained that muskox are pushing caribou out of the area (NWRRC, 2023).

Although muskox may appear as an invasive species, NWRRC (2023) reported Elders have spoken about muskox in the Sahtu Region in the past. NWRRC study participant explained that muskox are cyclical: “Just like the rabbits, they disappear for so long and then they come back; that’s what these things do” (NWRRC.11; NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that muskox are hunted in the NWRRC TLRU Study Area and harvesting muskox is becoming more common by Sahtu land users, as good source of country food. Tulita Renewable Resources Council (2022) reported that Sahtu land users harvest muskox throughout the TRRC TLRU Study Area year-round, for food and for hides and crafts. An NWRRC study participant (NWRRC.9) described muskox as a ‘second gift from the creator’ to replace the caribou they are displacing (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that muskox are usually observed around the Great Bear River, as well as around Brackett River (within RAA) and Bennett Field. Norman Wells Renewable Resources Council (2023) reported that muskox breed in the fall and are extremely protective of their young. Norman Wells Renewable Resources Council described muskox as poor swimmers and indicated that muskox will only cross the river when the water is completely frozen, or they will drown (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that muskox generally avoid noise and activity, however they are not as sensitive as caribou to sensory disturbance.

The Sahtu Dene and Métis consider caribou to be very important and use hides for clothing and meat as a nutritional food source (McDonald, 2010; Auld and Kershaw, 2005).

Caribou includes the boreal ecotype of woodland caribou (*Rangifer tarandus caribou*) (hereafter referred to as boreal caribou) and barren-ground caribou (*Rangifer tarandus groenlandicus*) of the Bluenose-East herd (IMG-Golder Corporation, 2006). In 2005, subsistence harvest (i.e., harvest by Indigenous hunters and General Hunting License holders) of boreal and barren-ground caribou in the Pehdzéh Kì N’deh area was estimated at 50 caribou for the preceding year (IMG-Golder Corporation, 2006). Subsistence harvest numbers may vary from year to year, and the numbers were reported for both caribou populations with no breakdown provided. Through the project-specific engagement program, participants noted that caribou avoid or migrate around culverts, and expressed concern about potential project effects from sensory disturbance, such as vibration, on caribou (see Chapter 2).

The SRRB reported concerns regarding insects and higher incidence of disease and parasites on the health of barren-ground caribou herds and has stated that harvest regulation for all caribou populations within the Sahtu Region will reflect unique community conservation planning measures (SRRB, 2021a). The SRRB recommends each Indigenous government and organization to be responsible for the caribou that reside in their established harvest areas to perpetuate components of a traditional lifestyle and include youth in the caribou conservation decision-making (SRRB, 2016). Territorial stewardship such as this is rooted in reciprocal relationship between harvesters and caribou, which include the practice of respectful behaviour in return for caribou offering themselves for harvest (SRRB, 2016). SRRB has reported that TK holders and land users have emphasized the importance of protecting muskeg habitats, migration routes or corridors, as well as land bridges between lakes, calving grounds, and other seasonal caribou habitats (SRRB, 2016). Burn areas, particularly in late April and through early June, can also negatively affect caribou health and abundance (IMG-Golder Corporation, 2006; SRRB, 2016).

A number of historical and current caribou harvesting areas relevant to the Project identified through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies are listed in Table 11.4. Dehcho First Nations, Pehdzéh Kì First Nation, Sahtu Dene and Métis reported 24 locations within the PDA, LAA, and RAA that are of interest relative to caribou and caribou habitat, as defined in Table 11.4 (5658 NWT Ltd. and GNWT, 2011 [PR#16]; Dehcho First Nations, 2011; Dessau, 2012 [PR#13]; IMG-Golder Corporation, 2006; Golder, 2015; McDonald, 2010; NWRRC, 2023; TRRC, 2022; SLUP, 2013). Many locations overlap between study boundaries.

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Table 11.4 Traditional Caribou Harvesting and Habitat Identified by Indigenous Governments, Indigenous Organizations, and Other Affected Parties Relative to the RAA

Location	Within LAA	Within RAA**	Identified By:
Dehcho Region	✓*	✓	Dehcho First Nations
Around the town of Wrigley	✓*	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Pehdzéh Kì N'deh area ¹	✓*	✓	Pehdzéh Kì First Nation
Ochre River (Mackenzie River tributary)	✓*	-	Dehcho First Nations; Pehdzéh Kì First Nation
White Sand Creek (between kilometre marker [KM] 730 and KM 731) ²	✓*	-	Dehcho First Nations; Pehdzéh Kì First Nation
McConnell Range (between Tulita and Wrigley)	✓	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Franklin Mountains	-	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Nota Creek	-	✓	NWRRC
Prohibition Creek	-	✓	NWRRC
Canyon Creek	-	✓	NWRRC
Mackenzie Valley (North of Wrigley) ³	✓	-	Dehcho First Nations; Pehdzéh Kì First Nation
MVWR KM 750, KM 754, KM 776, KM 777, KM 781, KM 790 ⁴ (all large ungulates) (locations are approximately halfway between Tulita and Wrigley)	✓*	-	Dehcho First Nations; Pehdzéh Kì First Nation
Mackenzie River/Deh Cho (Mackenzie River)	✓	✓	Sahtu Dene and Métis
Between MVWR KM 900 and KM 930 ⁵ (Barren-ground caribou only)	✓*	-	Sahtu Region (SRRB)
Between MVWR KM 990 and KM 1030 ⁶ (Barren-ground caribou only)	✓*	-	Sahtu Region (SRRB)
Little Bear River	-	✓	Sahtu Dene and Métis
Around MVWR KM 840 ⁷ , (Boreal caribou only)	✓*	-	Sahtu Region (SRRB)
West of highway, between MVWR KM 810 and KM 830 ⁸ (Boreal caribou only)	✓*	-	Sahtu Region (SRRB)
South of MVWR KM 960 ⁹ (around Norman Wells) (Boreal caribou only)	✓*	-	Sahtu Region (SRRB)

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Location	Within LAA	Within RAA**	Identified By:
Norman Range Ecoregion (Barren-ground caribou only)	-	✓	Sahtu Region (SRRB)
Bear Rock (Petınızah) area	✓	-	Communities in the Sahtu Region (SRRB); TRRC
North of Tulita; along the highway between Norman Wells ¹⁰	✓*	-	Sahtu Region (SRRB)
East of Tulita; along the river ¹¹	-	✓	Project-specific engagement program
Great Bear River (as it intersects with the LAA and RAA)	✓	✓	TRRC

Notes:

* May occur within PDA

** Occurs within the RAA outside the LAA and PDA

¹ Pehdzéh Kì N'deh area is not mapped on Figure 11.2; the boundary of this area is not identified or disclosed in this report

² Location mapped as White Sand Creek on Figure 11.2

³ Location mapped as Wrigley on Figure 11.2

⁴ Dessau (2012 [PR#13]); Table 11, Table 12; Dessau (2012 [PR#13]: map – sheet 4); Dessau (2012 [PR#13]: map – sheet 6)

⁵ 5658 NWT Ltd. and GNWT (2011[PR#16]); Fig 8-4

⁶ 5658 NWT Ltd. and GNWT (2011[PR#16]); Fig 8-4

⁷ 5658 NWT Ltd. and GNWT (2011[PR#16]); Fig 8-4

⁸ 5658 NWT Ltd. and GNWT (2011[PR#16]); Fig 8-4

⁹ Specific location is not mapped; only Norman Wells is mapped on Figure 11.2

¹⁰ Specific location is not mapped; only Tulita and Norman Wells are mapped on Figure 11.2

¹¹ Specific location is not mapped; only Tulita is mapped on Figure 11.2

Sources: 5658 NWT Ltd. and GNWT, 2011 (PR#16); Dessau, 2012 (PR#13); Dehcho First Nations, 2011; IMG-Golder, 2006; Golder, 2015; McDonald, 2011; NWRRC, 2023; SLUPB, 2023; SLUBP, 2022; TRRC, 2022; Project Engagement Workshops (see Section 11.1.2)

11.2.3.2.1 Boreal Caribou

Sahtu Dene and Métis and Dehcho First Nations identify the primary food consumed by boreal caribou includes sage grasses, willow tips, hanging lichen, and spruce tree moss. Caribou are reported by Sahtu Dene and Métis and Dehcho First Nations to be found in habitats where these foods are accessible, with higher concentrations identified where other large ungulates are not present (McDonald, 2010; Dehcho First Nations, 2011).

Indigenous Governments, Indigenous Organizations and certain other affected parties report that boreal caribou are more sensitive to development activities, particularly due to habitat loss and seismic lines, which increase exposure of boreal caribou to wolf predation, and Indigenous Governments and Indigenous Organizations have expressed concerns about the potential for future development and cumulative effects on harvesting boreal caribou for TLRU (Auld and Kershaw, 2005; Dehcho First Nations, 2011; IMG-Golder Corporation, 2006).

Indigenous Governments, Indigenous Organizations and certain other affected parties have also advised that boreal caribou avoid the winter roads due to sensory disturbance (i.e., noise, pollution), therefore Indigenous Governments and Indigenous Organizations are concerned that effects of future road construction and operations and maintenance have the potential to affect the availability and accessibility of caribou for cultural use within proximity of the highway (Auld and Kershaw, 2005; Dehcho First Nations, 2011; IMG-Golder Corporation, 2006; TRRC, 2022).

Boreal caribou are lawfully harvested by Indigenous and resident hunters in the NWT. While overall boreal caribou harvest to date is low, there are concerns about the potential of local overharvesting, particularly in the vicinity of communities, roads, and waterbodies that may facilitate access to boreal caribou habitat (ECCC, 2020; SARC, 2012). For more information see Caribou and Moose (see Chapter 10).

11.2.3.2.1.1 Dehcho Region

Dehcho First Nations reported that boreal caribou are common throughout the Dehcho Region, are year-round inhabitants of the Pehdzéh Kì N’deh area (centred around the community of Wrigley) and use the shores of Blackwater Lake and Fish Lake¹⁹ (outside the RAA) for calving (Dehcho First Nations, 2011). Pehdzéh Kì First Nation and Dehcho First Nations identify the McConnell Range between Wrigley and Tulita, within the LAA, as a summering area for boreal caribou, and the open meadows of higher elevations as foraging and suspected calving areas (IMG-Golder Corporation, 2006). Some areas of higher caribou density include ‘white muskeg’ rich in ‘hanging moss,’ and open ‘bog’ (Dehcho First Nations, 2011).

Dehcho First Nations have observed that boreal caribou populations are relatively stable in most areas of the Dehcho Region, with some tendency for slow decline in the corridor between Mackenzie River, the Franklin Mountains, and within areas affected by forest fires, bison herds, increased hunting, and development pressure (Dehcho First Nations, 2011). Calving is also

¹⁹ Fish Lake is a commonly lake name, and the location is not identified or disclosed in this report

reported to be generally stable and observed herd sightings in fall and winter by Dehcho First Nations are noted to consist of both adult and young caribou, with the healthiest boreal caribou herd found east of the Franklin Mountains (Dehcho First Nations, 2011; IMG-Golder Corporation, 2006). During summer, boreal caribou tend to stay close to and within areas with greater amounts of muskeg terrain and then move more freely in fall and early winter throughout a range of habitats while gathering into larger groups. As favoured boreal caribou habitat becomes more widely known over time, particularly during winter, they will be more heavily targeted by non-Indigenous harvesters (Dehcho First Nations, 2011).

11.2.3.2.1.2 Sahtu Region

The Project traverses the Deh Cho (Mackenzie River) SMZ (Zone #63) of the SLUP, designed to protect water quality, riparian habitat, cultural/heritage sites, and areas important for wildlife and wildlife harvesting, including boreal caribou (SLUPB, 2023). Sahtu residents consider boreal caribou to be very important and report using caribou hides for clothing and caribou meat as a food source (McDonald, 2010). Sahtu Dene and Métis report caribou are found within the Deh Cho (Mackenzie River) SMZ (Zone #63) (SLUPB, 2023). Petiniᶇah (Bear Rock) CZ (Zone #32) is also an important wildlife area for caribou, located within the LAA (SLUPB, 2023; TRRC, 2022). Through the project-specific engagement program, participants identified the area east of Tulita (along Great Bear River) as an area which supports boreal caribou (see Section 11.1.2). In the Sahtu Region, boreal caribou do not migrate very far during the year (McDonald, 2010).

Norman Wells Renewable Resources Council study participants reported that woodland (boreal) caribou are hunted in the NWRRC TLRU Study Area, often around Canyon Creek, Nota Creek, Prohibition Creek, and Vermillion Creek (NWRRC, 2023). Norman Wells Renewable Resources Council explained that most NWRRC land users do not follow a seasonal harvest and will hunt boreal caribou when an opportunity arises (NWRRC, 2023). However, NWRRC (2023) reported that the majority of caribou hunting occurs in the fall and winter season when the MVWR is open and can provide access to important hunting areas. “I can tell you right now, that 90% of the of the people that hunt in this area (for moose and caribou) do it in the fall, and wintertime” (NWRRC.9; NWRRC, 2023).

Tulita Renewable Resources Council reported that Sahtu harvesters in Tulita harvest caribou throughout the TRRC TLRU Study Area surrounding Tulita all year round, and that caribou sightings have generally declined in the area (TRRC, 2022). Norman Wells Renewable Resources Council (2023) identified that many caribou calving sites have been taken over by muskox in the NWRRC TLRU Study Area, and NWRRC study participants explained that muskox have moved into caribou territory and are pushing caribou out of the area. However, NWRRC study participants reported that caribou may not be declining, but it is possible that herds are moving away from the area and away from any sensory disturbances (NWRRC, 2023). A NWRRC study participant described caribou as a smart animal: “It will find its own route. If it’s noisy here, it will go over there. We don’t know where they’re going” (NWRRC.4; NWRRC, 2023). Norman Wells Renewable Resources Council explained that caribou can spot people from a long distance away and are more easily frightened, are particularly sensitive to sensory disturbance in comparison to moose or muskox and will move away from the area and may not return (NWRRC, 2023).

Through the project-specific engagement program, participants expressed concern about potential effects of the Project on boreal caribou and boreal caribou harvesting along the MVWR in the Tulita area (see Chapter 2). Norman Wells Renewable Resources Council (2023) reported potential effects along the MVWR and within the NWRRC TLRU Study Area include sensory disturbance during construction and operations and maintenance that will continue to drive caribou away from the area. Norman Wells Renewable Resources Council raised concerns that land users will have to travel further to hunt boreal caribou once the Project is underway (NWRRC, 2023). Norman Wells Renewable Resources Council also expressed concerns about increased hunting pressure on caribou by non-resident hunters (NWRRC, 2023). Norman Wells Renewable Resources Council study participants provided recommendations to mitigate potential effects on caribou populations. These are included in Section 11.4.2.2.

11.2.3.2.2 Barren-ground Caribou

11.2.3.2.2.1 Dehcho Region

Dehcho First Nations report that barren-ground caribou have migrated from the Sahtu Region and have only recently returned to the Wrigley area after being away for approximately 50 years (Dehcho First Nations, 2011). Some barren-ground caribou of the Bluenose-East herd are found in the Pehdzéh Kì N’deh area, north of Blackwater Lake and Keller Lake (outside the Caribou and Moose LAA as defined in Chapter 10) (IMG-Golder Corporation, 2006). In the Wrigley area, overlap has historically been observed between boreal caribou range and barren-ground caribou range during mid-winter months, particularly around Fish Lake²⁰ (Dehcho First Nations, 2011), which is also outside of the Caribou and Moose LAA. Dehcho First Nations indicate that the closure and limiting of the barren-ground caribou harvest north of Yellowknife and increased access to river systems in the fall using jet boats may have added to overharvesting concerns (Dehcho First Nations, 2011). Dehcho First Nations have reported changes in the distribution of major species such as moose, muskox, and grizzly bear, which may increase competition and predation on barren-ground caribou herds or cause caribou to move out of those areas (Dehcho First Nations, 2011).

11.2.3.2.2.2 Sahtu Region

Sahtu residents harvest barren-ground caribou in the Norman Range Ecoregion, a small part of which overlaps the LAA northwest of Tulita (SLUPB, 2023). In the Sahtu Region barren-ground caribou are known by their herd names, including the Bluenose-East, Bluenose West, and Cape Bathurst herds (Auld and Kershaw, 2005). The current annual range of barren-ground caribou of the Bluenose-East herd does not overlap with the RAA, but their range has overlapped with a portion of the RAA in the past (see Section 10.2.2). There is no direct interaction with the Project. Through the project-specific engagement program, participants reported that the Bluenose-East caribou herd was harvested in the past around the mouth of the Great Bear River.

²⁰ Fish Lake is a common lake name, and the location is not identified or disclosed in this report.

According to the SRRB, barren-ground caribou have historically been harvested by Sahtu Dene and Métis hunters along the existing MVWR ROW around KM 900 and 930, and between KM 990 and KM 1030, within the RAA (5658 NWT Ltd. and GNWT, 2011 [PR#16]). MVWR ROW KM 1030 is just slightly north and outside of the LAA (see Figure 11.2). Sahtu Dene and Métis indicate that barren-ground caribou are an important subsistence resource, with communal hunts occurring during the fall migration and large community gatherings occurring on the land where meats and hides are processed (Auld and Kershaw, 2005). Roads and trails associated with the construction of the Project may improve hunter access to barren-ground caribou.

11.2.3.3 Moose

Moose harvesting is a component of the KLOI. Moose have been identified by Dehcho First Nations, Pehdzéh Kì First Nation, and Sahtu Dene and Métis as species of interest harvested for traditional use and have potential to be affected by the Project.

Through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies, approximately 25 moose harvesting and habitat areas were identified by Sahtu Dene and Métis, TRRC, Pehdzéh Kì First Nation, and Dehcho First Nations within the PDA, LAA, and RAA that are of interest relative to moose and moose habitat, as described in Table 11.5 (see Figure 11.2 [Appendix 11A [K’alo-Stantec, 2022a]; Dessau, 2012 (PR#13); 5658 NWT Ltd. and GNWT, 2011 [PR#16]; Dehcho First Nations, 2011; IMG-Golder, 2006; NWRRC, 2023; SLUPB, 2023; SLUBP, 2022; TRRC, 2022), Table 11.5 (5658 NWT Ltd. and GNWT, 2011 [PR#16]; Dehcho First Nations, 2011; Dessau, 2012 [PR#13]; IMG-Golder Corporation, 2006; TRRC, 2022; SLUPB, 2023).

Table 11.5 Moose Harvesting and Habitat Identified by Indigenous Governments, Indigenous Organizations, and Other Affected Parties Relative to the RAA

Location	Within LAA	Within RAA**	Identified By:
Dehcho Region	✓*	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Franklin Mountains	-	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Pehdzéh Kì N’deh area ¹	✓*	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Area around proposed Great Bear River Bridge	✓	-	Sahtu Dene and Métis; TRRC
Bear Rock (Petinı́zah) area	✓	-	Sahtu Dene and Métis; TRRC
Between MVWR KM 708 and KM 709 ²	✓	-	Dehcho First Nations; Pehdzéh Kì First Nation
Little Bear River	-	✓	Sahtu Dene and Métis
Between Bob’s Canyon to Vermillion Creek Southwater	✓*	✓	Dehcho First Nations; Pehdzéh Kì First Nation

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11.0 Assessment of Potential Effects on Culture and Traditional Land Use, Including Harvesting

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Location	Within LAA	Within RAA**	Identified By:
Prohibition Creek	-	✓	Dehcho First Nations; Pehdzéh Kì First Nation; NWRRC
Bluefish Creek	-	✓	NWRRC
Sucker Creek	-	✓	NWRRC
Canyon Creek	-	✓	NWRRC
Between White Sand Creek and Eestsaytoo Lake	-	✓	Dehcho First Nations; Pehdzéh Kì First Nation
MVWR KM 750, 754,776, 777, 781, 790 ³ (all large ungulates) (locations are approximately halfway between Tulita and Wrigley)	✓*	-	Dehcho First Nations; Pehdzéh Kì First Nation
Between MVWR KM 880 and KM 970 ⁴	-	-	Sahtu Region (SRRB)
Around MVWR KM 1050 (near Norman Wells) ⁵	-	✓	Sahtu Region (SRRB)
Mackenzie River	✓	✓	Sahtu Dene and Métis
Windy Island	-	✓	Sahtu Dene and Métis
Four Mile Island	✓	✓	Sahtu Dene and Métis
Twenty Mile Island	-	✓	NWRRC
Six Mile Island	-	✓	NWRRC
Ten Mile Island	-	✓	NWRRC
Norman Range Ecoregion	✓	✓	Sahtu Dene and Métis
Blackwater River (as it intersects with the LAA and PDA)	✓*	-	Dehcho First Nations; Pehdzéh Kì First Nation
Great Bear River (as it intersects with the LAA and RAA)	✓	✓	TRRC

Notes:

* May occur within PDA

** Occurs within the RAA outside the LAA and PDA

1 Pehdzéh Kì N'deh area is not mapped on Figure 11.2; the boundary of this area is not identified or disclosed in this report

2 Dessau (2012 [PR#13]); Table 11, Table 12; Dessau (2012 [PR#13]: map – sheet 4); Dessau (2012 [PR#13]: map – sheet 6)

3 Dessau (2012 [PR#13]); Table 11, Table 12; Dessau (2012 [PR#13]: map – sheet 4); Dessau (2012 [PR#13]: map – sheet 6)

4 5658 NWT Ltd. and GNWT (2011[PR#16]); Fig 8-4

5 5658 NWT Ltd. and GNWT (2011[PR#16]); Fig 8-4 (Location is mapped as Normal Wells on Figure 11.2)

Sources: Dessau, 2012 (PR#13); 5658 NWT Ltd. and GNWT, 2011 (PR#16); Dehcho First Nations, 2011; IMG-Golder, 2006; NWRRC, 2023; SLUPB, 2023; SLUPB, 2022; TRRC, 2022

11.2.3.3.1 Dehcho Region

The Pehdzéh Kì N’deh area is known by Dehcho knowledge holders and land users to provide habitat and hunting areas for moose (Dessau, 2012 [PR#13]). Moose are found throughout this area year-round and are typically observed along river valleys and the shores of larger lakes, with notably higher densities in the lower lying parts of the Franklin Mountains (within RAA), specifically the spruce forests, bogs, ponds, streams, and along shores of larger lakes and river valleys in the area (IMG-Golder Corporation, 2006). Dehcho First Nations and Pehdzéh Kì First Nation reported good moose habitat and pasturing areas within the LAA along the MVWR between Bob’s Canyon Creek and Vermillion Creek (Dessau, 2012 [PR#13]). Moose was recognized as the most important subsistence harvest species in the Dehcho Region; however, actual subsistence harvest numbers may vary from year to year (IMG-Golder Corporation, 2006).

Local knowledge collected from Pehdzéh Kì First Nation and Dehcho First Nations, and intermittent surveys conducted in the area, have indicated that moose populations in the Dehcho Region are either decreasing or considered to be stable (IMG-Golder Corporation, 2006). SRRB, Sahtu Dene and Métis report moose are drawn to post-burn vegetative landscapes and are not as noticeably affected by some landscape disturbance (IMG-Golder Corporation, 2006; SRRB, 2016).

11.2.3.3.2 Sahtu Region

Sahtu Dene and Métis identified moose as an important resource and staple food and continue to rely on moose for survival (SLUPB, 2022). Local knowledge from TRRC reported that families require moose for sustenance and to produce crafts and utilitarian items, and that meat is shared among the community with friends and family (TRRC, 2022). A single moose can yield up to 300 kilograms of meat (SLUPB, 2022). An NWRRC study participant described experiences about being young and harvesting moose with family: “The entire community would come and eat moose. Big pots would be boiling outside, and people would come and eat, and drink tea!” (NWRRC.11; NWRRC, 2023). Norman Wells Renewable Resources Council explained that harvesting moose is an important source of country food and is also an important traditional and cultural practice which offers opportunities for people to come together (NWRRC, 2023). Moose meat (as well as caribou meat) is smoked and dried, creating lighter and ready-to-eat meat (SLUPB, 2022).

Drying and smoking meat is still a common practice and is considered a delicious delicacy by Sahtu Dene and Métis (SLUPB, 2022). Sahtu hunters and trappers still prefer handmade mukluks to manufactured winter footwear; hides would be home-tanned and used extensively for making moccasins and heavy winter mitts (Auld and Kershaw, 2005). Hides are sewn together to use as tents and used as covers for large spruce frame boats (SLUPB, 2022). Some land users still use moose hides to make sinew, which is an extra sturdy sewing thread, ideal for sewing more bulky, sturdy items like footwear (SLUPB, 2022). Moosehide is essential for the soles, as caribou is neither thick nor tough enough (Auld and Kershaw, 2005).

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Sahtu harvesters and land users in Tulita stated that harvesting moose has always been culturally important, and moose continues to be harvested throughout the TRRC TLRU Study Area, specifically along the MVWR during the winter months (TRRC, 2022). Several NWRRC study participants also shared observations about moose and identified moose as a culturally important species that is still harvested throughout the NWRRC TLRU Study Area, most often during the fall and wintertime (NWRRC, 2023). NWRRC (2023) reported that moose tracks can be found along the MVWR, however participants explained that moose access that area mainly to cross the MVWR and do not use the MVWR as a wildlife corridor. NWRRC (2023) reported that moose tracks are also often observed around Bear Rock (Petinīzah) (NWRRC, 2023).

Norman Wells Renewable Resources Council study participants explained that moose are hunted throughout the NWRRC TLRU Study Area but are often pursued when tracks are spotted, and an opportunity presents itself (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) identified Canyon Creek, Prohibition Creek, Vermillion Creek, and Bluefish Creek as favourable moose hunting locations. Norman Wells Renewable Resources Council (2023) reported that moose can be hunted traveling the corridors to the islands during spring and identified Twenty Mile Island as a good place to hunt moose because of the delta there that attracts moose to the area. Norman Wells Renewable Resources Council (2023) identified Sucker Creek as traditional moose hunting area that is accessed by an old Indian trail, but it is unknown if Sucker Creek is still an accessible moose hunting site.

While Sahtu Dene and Métis identify moose harvesting locations throughout the Sahtu Region, several habitat and harvesting areas are clustered along the Great Bear River throughout the LAA and RAA (SLUPB, 2022). Sahtu Dene and Métis reported that Petinīzah (Bear Rock) CZ (Zone #32), within the LAA, is an important wildlife area for harvesting moose (SLUPB, 2023). Sahtu Dene and Métis also report harvesting moose along the Deh Cho (Mackenzie River), specifically within SMZ No. 63 (within LAA), with riparian areas in this zone yielding high moose densities during winter (SLUPB, 2023, 2016). Sahtu residents harvest moose in the Norman Range Ecoregion, a small part of which overlaps with the LAA and RAA northwest of Tulita (SLUPB, 2023).

Norman Wells Renewable Resources Council explained that a forest fire occurred at Bluefish Creek years ago and has since created lush green habitat desirable for moose (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) also identified an area near Jungle Ridge Creek, that had previously contained an oil well site, has been completely reclaimed and is now a good habitat for moose because of the fresh and abundant vegetation. Norman Wells Renewable Resources Council (2023) reported that good moose habitat includes places with a lot of willows and participants explained that when spring arrives in March moose move down to Six Mile Island, Ten Mile Island, and Twenty Mile Island because the islands offer suitable habitat for moose with an abundance of willows and vegetation in the springtime (NWRRC, 2023). Sahtu Dene and Métis have also observed moose habitat on the west side of the Great Bear River near Tulita (IMG-Golder Corporation, 2006) and identified important calving areas overlapping the LAA and RAA on the islands southwest and southeast of Tulita, and at Windy Island and Four Mile Island (EBA, 2006; IMG-Golder Corporation, 2006; SLUPB, 2023).

In addition to harvesting areas, Sahtu Dene and Métis reported information on moose habitat and calving grounds. Tulita Renewable Resources Council advised that lakes and islands contain important moose habitat with abundant mossy vegetation suitable for calving (TRRC, 2022). Norman Wells Renewable Resources Council reported that areas around Vermillion Creek have been identified as known moose calving areas, and that moose breed in the fall (NWRRC, 2023). They remarked that many moose calving areas have been taken over by muskox, however there are still many moose beds observed throughout the NWRRC TLRU Study Area (NWRRC, 2023). Study participants also identified areas in and surrounding Blackwater Lake (outside of the RAA) and Blackwater River as common breeding grounds for moose and caribou, due to the high number of moose and caribou calves that are observed in the area. Through the project-specific engagement program, engagement participants explained that the hard layer of snow that is typical in March is challenging for moose to traverse; therefore, moose tend to move to the islands to calve, which helps to protect the calves from wolves. Sahtu harvesters and land users in the area tend to stay away from calving areas (TRRC, 2022).

Norman Wells Renewable Resources Council (2023) reported that potential project effects on moose along the MVWR and the within the NWRRC TLRU Study Area include increased hunting pressure by non-resident hunters and increased fatalities of moose because of increased traffic in the area. Norman Wells Renewable Resources Council study participants shared concerns about additional project effects on moose in the NWRRC TLRU Study Area due to increased traffic and non-resident hunters and reported several instances in which non-resident hunters have come in from out of town, filled freezers with wildlife resources from the area, and have left a big mess where they had set up camp (i.e., garbage, skin, and gutting scraps) (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) also reported that noise has effects on moose in the NWRRC TLRU Study Area. Norman Wells Renewable Resources Council study participants explained that the intensity of noise can affect the level of response in wildlife, particularly moose (NWRRC, 2023). While wildlife may be disturbed by noise, NWRRC reported that moose are relatively unbothered by noise unless it is loud or certain types of noise, citing ground disturbance as a problem (NWRRC, 2023). In general, NWRRC (2023) reported that moose have become less afraid of people and may not move when approached by a person or a vehicle (along the MVWR).

11.2.3.4 Furbearers and Other Wildlife

Availability of furbearers and other wildlife and wildlife habitat is important to harvesters throughout the Dehcho and Sahtu regions. The geographical landscapes throughout the Dehcho and Sahtu regions are biophysically diverse and populated with coniferous forest, wetland, shrubland, and open water, which provide suitable habitats for a variety of furbearers and wildlife species of importance to Indigenous Governments and Indigenous Organizations.

11.2.3.4.1 Dehcho Region

The Pehdzéh Kì N’deh area is home to many furbearers, including fisher, muskrat, lynx, otter, red fox, and wolverine, and includes habitat throughout the Mackenzie Valley (IMG-Golder Corporation, 2006; Dessau, 2012 [PR#13]). Indigenous residents in the Dehcho Region consider trapping an important cultural activity (IMG-Golder Corporation, 2006). In 2018, Wrigley, home primarily to Pehdzéh Kì First Nation, reported over 65.8% of the residents (over the age of 15) participated in hunting and fishing activities, which is an increase from 34.4% in 1988; and 35.5% of the residents (over the age of 15) participated in trapping activities (DPRA, 2022). In 2018, 50% of Wrigley residents reported to rely on meat obtained through hunting and fishing as 75% or more of diet, which nearly doubled over the last 20 years as 27.7% of residents reported to rely on harvested meat for 75% or more of the diet in 1998 (DPRA, 2022). Pehdzéh Kì First Nation members report trapline cabins within the LAA have been in the areas of White Sand and Dam Creeks and Blackwater River (Dessau, 2012 [PR#13]). Overall, despite government incentives and comparatively high fur prices, trapping is decreasing as a result of high wages in the non-traditional sectors as a potential draw away from trapping activities (IMG-Golder Corporation, 2006).

11.2.3.4.2 Sahtu Region

Sahtu Dene and Métis land users consider trapping to be an important cultural activity and have expressed the importance of harvesting for the maintenance of subsistence-based lifestyles (IMG-Golder Corporation, 2006). Local knowledge from TRRC and NWRRC indicated that Sahtu land users in Tulita and Norman Wells harvest all types of wildlife species throughout the NWRRC TLRU and TRRC TLRU Study Areas between Tulita and Norman Wells (NWRRC, 2023; TRRC, 2022). Norman Wells Renewable Resources Council (2023) identified several wildlife species, including beaver, bear, fox, martin, mink, muskox, muskrat, lynx, rabbit, wolverine, and wolves are harvested throughout the NWRRC TLRU Study Area. Prohibition Creek, Vermillion Creek, Canyon Creek, and around Bear Rock (Petinı́zah) were reported as particularly favourable by Sahtu land users from Norman Wells for trapping fox, lynx, rabbit, and hunting muskox (NWRRC, 2023).

Tulita Renewable Resources Council explained that small game, including rabbits, beavers, and muskrats, are harvested through the TRRC TLRU Study Area in Tulita; however, TRRC reported that beavers and muskrats are typically harvested only during spring (April, May, June) (TRRC, 2022). Norman Wells Renewable Resources Council study participants explained that rabbit tracks are often observed along the MVWR and up to Bear Rock (Petinı́zah) and noted that rabbits travel this route (back and forth from the MVWR to Bear Rock [Petinı́zah]) in the summertime and wintertime (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that the willows along the MVWR provide a good habitat for rabbits and attract rabbits to the area. They reported that rabbit fur was traditionally used to craft parkas for travelling in the winter months when it was very cold. Study participants from NWRRC identified trapping for beavers occurs around Bluefish Creek and Fish Lake²¹ and that beavers often dam the rivers between Three Day

²¹ Fish Lake is a common lake name, and the location is not identified in this report.

Lake and Fish Lake. They noted that beaver pelts are traditionally good for crafting (NWRRC, 2023).

Wolves are also harvested along the MVWR by Sahtu harvesters in the Tulita area during the winter months, and throughout the TRRC TLRU Study Area year-round (TRRC, 2022). Norman Wells Renewable Resources Council (2023) reported that wolves are often observed north of Prohibition Creek and that the MVWR is known to be a wildlife corridor for wolves and wolverine. Norman Wells Renewable Resources Council (2023) reported larger wolf packs have been observed recently in the NWRRC TLRU Study Area and that wolves are preying on moose, caribou, rabbits, and other wildlife, which may affect the availability of wildlife for Sahtu harvesters. Sahtu Dene and Métis land users identified that there is a connection between the number of prey species and availability of harvestable wildlife (as a resource) and have observed that increasing wolf populations in recent years may be linked to a decrease in wolf trapping activities during this same period (McDonald, 2010). As a result, Sahtu Dene and Métis Elders have observed an increase in the abundance of other wildlife species, particularly muskox (McDonald, 2010). While Sahtu Dene and Métis identify furbearer harvesting locations throughout the Sahtu Region, several habitat and harvesting areas are clustered along the Great Bear River in the LAA and RAA (SLUPB, 2022).

11.2.3.5 Birds

Availability of birds and bird habitat is important to harvesters throughout the Dehcho and Sahtu regions. A number of bird harvesting sites (Table 11.6) and harvested birds (Table 11.3) have been identified through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies. Sahtu Dene and Métis and Dehcho First Nations reported 20 locations within the PDA, LAA, and RAA that are of interest relative to birds and bird habitat, as described in Table 11.6 (see Figure 11.2 (Appendix 11A [K’alo-Stantec, 2022a]; 5658 NWT Ltd. and GNWT, 2011 [PR#16]; Dehcho First Nations, 2011; Dessau, 2012 [PR#13]; IMG-Golder, 2006; NWRRC, 2023; SLUPB, 2022; SLUPB, 2023; TRRC, 2022). More detailed information can be found in Chapter 20: Assessment of Potential Effect on Birds and Bird Habitat.

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Table 11.6 Bird Habitat and Harvesting Locations Identified by Indigenous Governments, Indigenous Organizations, and Other Affected Parties Relative to the RAA

Location	Within LAA	Within RAA**	Identified By:
Petinizah (Bear Rock) CZ (Zone #32)	✓	-	Sahtu Dene and Métis; NWRRC
Between KM 840 and KM 850 (between Norman Wells and Tulita) ¹	✓*	-	Sahtu Region (SRRB)
Sahtu Region	✓*	✓	Sahtu Dene and Métis
Blackwater River (as it intersects with the LAA and PDA)	✓*	-	Dehcho First Nations; Pehdzéh Kì First Nation
Ochre River (as it intersects with the LAA and PDA)	✓*	-	Dehcho First Nations; Pehdzéh Kì First Nation
Vermillion Creek South	-	✓	Dehcho First Nations; Pehdzéh Kì First Nation; NWRRC
Prohibition Creek	-	✓	NWRRC
Canyon Creek	-	✓	NWRRC
Bluefish Creek	-	✓	NWRRC
Sucker Creek	-	✓	NWRRC
Four Mile Island	✓	✓	Sahtu Dene and Métis
Ten Mile Island	-	✓	NWRRC
Four Mile Creek	-	✓	TRRC
Little Bear River	-	✓	Sahtu Dene and Métis
Pehdzéh Kì N'deh area ²	✓	✓	Dehcho First Nations; Pehdzéh Kì First Nation
Great Bear River	-	✓	Dehcho First Nations; Pehdzéh Kì First Nation; TRRC
Area around proposed Great Bear River Bridge	✓	-	TRRC
Wrigley (area)	✓*	-	Dehcho First Nations; Pehdzéh Kì First Nation
Tulita (area)	✓*	-	TRRC
Mackenzie River	✓	✓	Dehcho First Nations; Pehdzéh Kì First Nation

Notes:

* May occur within the PDA

** Occurs within the RAA outside the LAA and PDA

¹ 5658 NWT Ltd. and GNWT (2011[PR#16]); Fig 8-4

² Pehdzéh Kì N'deh area is not mapped on Figure 11.2; the boundary of this area is not identified or disclosed in this report

Sources: 5658 NWT Ltd. and GNWT, 2011 (PR#16); Dehcho First Nations, 2011; Dessau, 2012 (PR#13); IMG-Golder, 2006; NWRRC, 2023; SLUPB, 2022; SLUPB, 2023; TRRC, 2022

11.2.3.5.1 Dehcho Region

The Pehdzéh Kì N’deh area provides important habitat for migratory birds within the Dehcho Region (Dessau, 2012 [PR#13]). The Pehdzéh Kì N’deh area includes wetland habitats important for sustaining waterfowl, including areas immediately surrounding Wrigley and two areas north of Blackwater River. All drainage areas intersecting the LAA (and potentially the PDA) are considered potential waterfowl habitat, including Blackwater and Ochre rivers, as well as major creeks and other smaller watercourses (Dessau, 2012 [PR#13]) (Figure 11.2).

Waterfowl such as ducks and geese species are traditionally harvested by Dehcho First Nations and Pehdzéh Kì First Nation, with traditional hunting grounds located near Blackwater River and Vermillion Creek South (Figure 11.2).

11.2.3.5.2 Sahtu Region

The SLUP states that the Petinìzah (Bear Rock) CZ (Zone #32) provides habitat for a variety of bird species, including nesting areas for raptors (SLUPB, 2023). The SLUP (2013) acknowledges three Important Bird Areas (IBAs) identified by Canadian Wildlife Services within the Sahtu Region, which represent important breeding habitats for several migratory species (SLUPB, 2023). The Lower Mackenzie River Islands is globally notable as a major stopover along the Western Central Flyway, hosting as many as 112,800 waterfowl and most of Canada’s population of snow geese (estimated to be around half a million) in spring (SLUPB, 2023). Local knowledge from TRRC identified an important migration route for waterfowl overhead of the area surrounding the proposed Great Bear River Bridge (TRRC, 2022). Norman Wells Renewable Resources Council (2023) identified Bluefish Creek migratory route for birds and reported that there is a chain of lakes that have not been identified on any maps between Sucker Creek and Bluefish Creek that attracts birds to the area because of the desirable habitat and abundance of food.

Harvesting birds has been an important part of Sahtu TLRU for generations and harvesting birds continues to be an important part of Sahtu culture (TRRC, 2022). Sahtu harvesters typically harvest waterfowl, including ducks and geese in the spring, and dry geese meat is considered a delicacy (SLUPB, 2022). Local knowledge from TRRC identified birds, including waterfowl, continue to be harvested all year round; geese are harvested, among other waterfowl, throughout the TLRU TRRC Study Area around Tulita in spring (April, May, and June) (TRRC, 2022).

Norman Wells Renewable Resources Council study participants also reported common waterfowl harvested in the NWRRC TLRU Study Area in the spring includes swan, geese, and ducks (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that swan, geese, and ducks can also be harvested in the NWRRC TLRU Study Area in the winter and identified Ten Mile Island as an area of interest for harvesting snow geese. Residents of Tulita have also identified Four Mile Island (intersecting the LAA and RAA) on the south side of the Mackenzie River as important for duck hunting (EBA, 2006). Tulita Renewable Resources Council reported that ptarmigans and chickens (grouse) are harvested in the TRRC TLRU Study Area in the summer, and chickens (grouse) are harvested along previous pipeline ROW near Four Mile Creek in the winter (TRRC, 2022). Norman Wells Renewable Resources Council (2023) reported that ptarmigans and chickens

(sharp tailed grouse, spruce grouse) are harvested all year round in the NWRRC TLRU Study Area because they are easily accessible, and are often harvested around Prohibition Creek, Vermillion Creek, Canyon Creek, around Bear Rock (Petinı́zah), and along the MVWR; however, NWRRC commented that spruce grouse and ptarmigan are more available in the summertime. Norman Wells Renewable Resources Council study participants communicated that birds stop along the MVWR to eat (NWRRC, 2023). They explained that the willows growing along the MVWR provides suitable habitat for ptarmigan and that ptarmigan tracks are often observed traveling back and forth from the MVWR to Bear Rock (Petinı́zah) in the winter and summer and reported that ptarmigans are harvested along that corridor (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that songbirds, whiskey Jacks, owls, kingfishers, and ravens are also harvested in the NWRRC TLRU Study Area in the summer.

Norman Wells Renewable Resources Council study participants identified that changes have been observed in bird migration and expressed concern that birds are moving in a different direction and are not observed as much in the NWRRC TLRU Study Areas as they previously were (NWRRC, 2023). A NWRRC study participant (NWRRC.9) explained that there are a lot less ducks in the NWRRC TLRU Study Area: “Ten...twelve years ago, at the cabin, ducks galore... in the creek... all over the place! Now, I bet I won’t see twenty ducks in the fall. They are just not there” (NWRRC, 2023).

11.2.3.6 Plants

The Project intersects three different and unique ecoregions in the Sahtu and Dehcho regions, including the Taiga Plains Low Subarctic, Taiga Cordillera Low Subarctic, and Boreal Cordillera High Boreal, and includes a diverse range of vegetation and timber resources (see also Appendix 18A [Vegetation and Wetlands]; K’alo-Stantec, 2022b).

Vegetation species of interest, used for a variety of traditional purposes, have been identified by Indigenous Governments and Indigenous Organizations, and renewable resource councils through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies, and are listed in Table 11.7. For more information see vegetation and wetlands (see Chapter 18) and associated TDR (Appendix 18A; K’alo-Stantec, 2022b).

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Table 11.7 Vegetation Species of Interest

Common Name	Latin Name	Identified By
Alpine fir	<i>Abies lasiocarpa</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Alum-root	<i>Heuchera richardsonii</i>	Pehdzéh Kì First Nation; Dehcho First Nations
American alpine sweet-vetch, sweetbroom	<i>Hedysarum alpinum</i>	Pehdzéh Kì First Nation; Dehcho First Nations
American milk-vetch	<i>Astragalus americanus</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Arrowhead	<i>Sagittaria cuneata</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Arrow-leaved coltsfoot	<i>Petasites sagittatus</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Balsam poplar	<i>Populus balsamifera</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Bistort, serpent grass	<i>Polygonum viviparum</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Black spruce	<i>Picea mariana</i>	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC
Blackcurrant	<i>Ribes nigrum</i>	NWRRC
Bladderwort	<i>Utricularia macrorhiza</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Bluebell	<i>Campanula rotundifolia</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Birch fungus	<i>Fomitopsis betuline</i>	NWRRC
Bog birch	<i>Betula glandulosa</i>	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC
Broad-leaved plantain	<i>Plantago major</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Buffaloberry, soopolallie, soapberry	<i>Soopolalli canadensis</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Bulrush	<i>Schoenoplectus acutus</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Canadian goldenrod	<i>Solidago canadensis</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Chagaa	<i>Inonotus obliquus</i>	NWRRC
Cloudberry, baked apple berry, yellowberry	<i>Rubus chamaemorus</i>	Pehdzéh Kì First Nation; Dehcho First Nations; NWRRC
Clubmoss	<i>Lycopodium annotinum</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Common bearberry, alpine bearberry, kinnikinnick	<i>Arctostaphylos</i> spp.	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC; NWRRC
Common blueberry	<i>Vaccinium</i> spp.	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC; NWRRC
Common juniper	<i>Juniperus communis</i>	Pehdzéh Kì First Nation; Dehcho First Nations; NWRRC
Creeping juniper	<i>Juniperus horizontalis</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Common Labrador tea	<i>Ledum groenlandicum</i>	Pehdzéh Kì First Nation; Dehcho First Nations; NWRRC

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Common Name	Latin Name	Identified By
Creeping wintergreen, teaberry	<i>Gaultheria hispidula</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Crowberry, blackberry	<i>Empetrum nigrum</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Dandelion	<i>Taraxacum officinale</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Dwarf birch	<i>Betula pumila</i> var. <i>glandulifera</i>	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC
Dwarf bog rosemary	<i>Andromeda polifolia</i>	Pehdzéh Kì First Nation; Dehcho First Nations
False hellebore	<i>Veratrum viride</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Field sagewort	<i>Artemisia campestris</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Fireweed	<i>Epilobium angustifolium</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Flat-topped white aster	<i>Aster umbellatus</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Giant hyssop	<i>Agastache foeniculum</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Gumweed	<i>Grindelia squarrosa</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Hemp nettle	<i>Galeopsis tetrahit</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Horsetail	<i>Equisetum arvense</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Jack pine	<i>Pinus banksiana</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Lamb’s quarters	<i>Chenopodium album</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Lichen	Various	Pehdzéh Kì First Nation; Dehcho First Nations
Lily pad root	<i>Aeonium</i>	NWRRC
Lindley’s aster, fringed aster	<i>Aster cilliolatus</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Lingonberry, bog cranberry, cowberry, mountain cranberry	<i>Vaccinium vitis-idaea</i>	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC; NWRRC
Lodgepole pine	<i>Pinus contorta</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Lousewort	<i>Pedicularis langsdorfii</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Low-bush cranberry	Various	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC; NWRRC
Lungwort, tall bluebells	<i>Mertensia aniculate</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Marsh skullcap	<i>Scutellaria galericulata</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Mitrewort	<i>Mitella nuda</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Mountain death camas	<i>Zigadenus elegans</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Mountain sorrel	<i>Oxyria digyna</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Northern bedstraw	<i>Galium boreale</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Northern black currant	<i>Ribes hudsonianum</i>	Pehdzéh Kì First Nation; Dehcho First Nations

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Common Name	Latin Name	Identified By
Northern bog laurel, pale bog laurel, swamp laurel	<i>Kalmia polifolia</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Northern ground-cone	<i>Boschniakia rossica</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Ostrich fern	<i>Matteuccia struthiopetris</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Ox-eye daisy	<i>Leucanthemum vulgare</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Pasture sage	<i>Artemisia frigida</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Pine	Various	Pehdzéh Kì First Nation; Dehcho First Nations
Pink wintergreen	<i>Pyrola asarifolia</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Pipssewa	<i>Chimaphiliaumbellatea</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Pitcher plant	<i>Sarracenia purpurea</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Prickly rose, rose hips	<i>Rosa acicularis</i>	Pehdzéh Kì First Nation; Dehcho First Nations; NWRRC
Purple avens	<i>Geum rivale</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Purple-stemmed aster	<i>Aster puniceus</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Pygmy flower, fairy candelabra	<i>Androsace septendrionalis</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Rat root	<i>Acorus calamus</i>	NWRRC
Red baneberry	<i>Actaea rubra</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Red willow (alder)	<i>Salix laevigata</i>	NWRRC
River alder, speckled alder	<i>Alnus rugosa</i>	Pehdzéh Kì First Nation; Dehcho First Nations;
Rock polypody fern	<i>Polypodium vulgare</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Sage	<i>Salvia officinalis</i>	NWRRC
Sand heather	<i>Hudsonia tomentosa</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Seaside arrow-grass	<i>Triglochin maritimum</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Sedge	<i>Carex aquatilis</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Shrubby cinquefoil	<i>Potentilla gracillis</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Smooth aster	<i>Aster laevis</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Sneezeweed	<i>Helenium autumnale</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Spiney wood fern	<i>Dryopeteris carthusiana</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Spreading dogbane	<i>Apocynum androsaemifolium</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Spruce	Various	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC; NWRRC
Stinging nettle	<i>Urtica dioica</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Strawberry bite	<i>Chenopodium captitatum</i>	Pehdzéh Kì First Nation; Dehcho First Nations

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Common Name	Latin Name	Identified By
Sweet flag, calamus	<i>Acorus americanus</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Sweet gale	<i>Myrica gale</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Sweet-grass	<i>Hierochloe odorata</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Tamarack	<i>Larix laricina</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Trembling aspen	<i>Populus tremuloides</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Water birch	<i>Betula occidentalis</i>	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC
Water calla	<i>Calla palustris</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Water smartweed	<i>Polygonum amphibium</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Western dock	<i>Rumex aquaticus</i>	Pehdzéh Kì First Nation; Dehcho First Nations
White birch, paper birch	<i>Betula papyrifera</i>	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC
White spruce	<i>Picea glauca</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Wild mint	<i>Mentha arvensis</i>	Pehdzéh Kì First Nation; Dehcho First Nations; NWRRC
Wild red currant	<i>Ribes triste</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Wild red raspberry, dewberry, dwarf raspberry	<i>Rubus</i> spp.	Pehdzéh Kì First Nation; Dehcho First Nations; NWRRC
Willow species	<i>Salix</i> spp.	Pehdzéh Kì First Nation; Dehcho First Nations; TRRC
Woodland strawberry, wild strawberry	<i>Fragaria vesca</i> spp.	Pehdzéh Kì First Nation; Dehcho First Nations
Yarrow	<i>Achillea millefolium</i>	Pehdzéh Kì First Nation; Dehcho First Nations; NWRRC
Yellow avens	<i>Geum aleppicum</i>	Pehdzéh Kì First Nation; Dehcho First Nations
Yellow pond lily	<i>Nuphar luten</i>	Pehdzéh Kì First Nation; Dehcho First Nations

Sources: EBA, 2006; IMG-Golder Corporation, 2006; NWRRC, 2023; TRRC, 2022

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Table 11.8 and Figure 11.3 list specific plant harvesting locations as identified by Indigenous Governments and Indigenous Organizations through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies (Appendix 11A [K’alo-Stantec, 2022a]; EBA, 2006; IMG-Golder Corporation, 2006; NWRRC, 2023; SLUPB, 2022; TRRC, 2022). Sahtu Dene and Métis and Dehcho First Nations reported 13 locations within the PDA, LAA, and RAA that are of interest relative to plants and plant harvesting, as described in Table 11.8 (EBA, 2006, IMG-Golder-Corporation, 2006; TRRC, 2022; NWRRC, 2023).

Table 11.8 Plant Harvesting identified by Indigenous Governments, Indigenous Organizations, and Other Affected Parties Relative to the RAA

Location	Within LAA	Within RAA **	Identified By:
Dehcho Region	✓*	✓	Dehcho First Nations
Sahtu Region	✓*	✓	Sahtu Dene and Métis; SRRB
Pehdzéh Kì N’deh area ¹	✓*	✓	Pehdzéh Kì First Nation
MVWR KM 724 (north of Wrigley) ²	✓*	-	Pehdzéh Kì First Nation
MVWR KM 782 (approximately halfway between Tulita and Wrigley) ³	✓*	-	Pehdzéh Kì First Nation
Wrigley (area)	✓*	-	Pehdzéh Kì First Nation
Along the MVWR (between Norman Wells and Tulita) ⁴	✓*	-	Sahtu Dene and Métis; SRRB; TRRC
Tulita (area)	✓*	-	TRRC
Plane Lake	✓*	-	TRRC
Dehdéleᑭ Tué (Sucker Lake/Three Day Lake)	-	✓	Sahtu Dene and Métis; SRRB
Great Bear River (West) (intersecting with the LAA and RAA)	✓	✓	TRRC
Around the proposed Great River Bridge area	✓		TRRC
Canyon Creek	-	✓	NWRRC

Notes:

* May occur within the PDA

** Occurs within the RAA outside the LAA and PDA

¹ Pehdzéh Kì N’deh area is not mapped on Figure 11.3; the boundary of this area is not identified or disclosed in this report

² Dessau (2012 [PR#13]); Table 11, Table 12; Dessau (2012 [PR#13]: map – sheet 4); Dessau (2012 [PR#13]: map – sheet 6)

³ Dessau (2012 [PR#13]); Table 11, Table 12; Dessau (2012 [PR#13]: map – sheet 4); Dessau (2012 [PR#13]: map – sheet 6)

⁴ Specific locations are not identified in this report, only Tulita and Norman Wells are mapped on Figure 11.3

Sources: EBA, 2006; IMG-Golder Corporation, 2006; NWRRC, 2023; SLUPB, 2022; TRRC, 2022

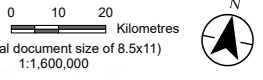


- Plant Harvesting Locations Identified by Indigenous Groups and Organizations**
- 4. Tulita
 - 6. MVH Road km Marker 782
 - 12. MVH Road km Marker 724
 - 13. Wrigley
 - 15. Norman Wells
 - 26. Ochre River
 - 36. White Sand Creek
 - 39. Dehdéleļo Tué / Sucker Lake / Three Day Lake
 - 49. Blackwater River
 - 52. Dehcho Region
 - 62. Great Bear Lake
 - 73. Canyon Creek
 - 85. Plane Lake



- Traditional Land Use**
- Plant Gathering / Vegetation
 - Proposed Mackenzie Valley Highway Project
 - Canyon Creek All Season Access Road (Constructed)
 - Prohibition Creek Access Road (In Construction)

- Proposed Borrow Source / Quarry and Access
- Local Assessment Area
- Regional Assessment Area
- Community
- Northwest Territories Highway
- Winter Road
- Region Boundary



Project Location Wrigley to Norman Wells, NWT
Client/Project Government of the Northwest Territories Mackenzie Valley Highway Project
 Prepared by CES on 8/10/2023
 TR by LN on 8/10/2023
 144903025-0132 REVA

Figure No. 11.3
Title

Plant Harvesting Locations in the Regional Assessment Area

Notes

1. This map is associated with Chapter 11 Section 11.2.3, Table 11.9
2. Coordinate System: NAD 1983 Northwest Territories Lambert
3. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics, n.d. Inventory of Landscape Change Map Viewer; GNWT, Centre for Geomatics, n.d. Open Data; MVLWB, n.d. Public Registry; Sahtu Land and Water Board, n.d. Public Registry; Environment and Natural Resources GNWT, Government of Canada, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd., EBA 2006; IMG-Golder Corporation 2006; TRRC 2022; NWRRC 2023
4. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS. Imagery date: 2021

11.2.3.6.1 Dehcho Region

Coniferous forest and wetlands are the most abundant landcover type within the LAA and RAA in the Dehcho Region. Large portions of the LAA and RAA have burned in the past, with fires within the LAA reported in 1990 and 1999 (see also Appendix 18A [vegetation and wetlands]; K’alo-Stantec, 2022b). Reforestation is important to Indigenous Governments, and Indigenous Organizations in the Dehcho Region, and concerns have been raised about the construction of the Project and potential effects on the land and forest (Dessau, 2012 [PR#13]).

Pehdzéh Kì First Nation and Dehcho First Nations have previously indicated that trees harvested are used for construction and building materials, fuel, and other purposes such as birch bark (*Betula papyrifera*, *Betula neoalaskana*) for basket making (IMG-Golder Corporation, 2006). Some plant gathering activities, such as fuel wood harvesting, are still common among Pehdzéh Kì First Nation households in Wrigley; approximately 90% still rely on wood-burning to heat their homes (IMG-Golder Corporation, 2006). Harvesting wood for personal use has high economic value to Wrigley residents as it saves individual costs for purchasing fuel wood or other heating fuels (IMG-Golder Corporation, 2006). Tree species harvested and used by Pehdzéh Kì First Nation include birch, lichen, spruce roots, and spruce gum. Indigenous Governments and Indigenous Organizations in the Dehcho Region are considering community-based forestry to provide access to quality, sustainable logging practices that emphasize traditional values and principles (DLUPC, 2006; IMG-Golder Corporation, 2006).

There are several species of plants and berries within the Dehcho Region that are of interest to Dehcho First Nations and Pehdzéh Kì First Nation. Medicinal plants and berries harvested by Dehcho First Nations provide relief for common colds and coughs (DLUPC, 2006). Dehcho First Nations also report other plants, such as lichens and berries, are used as dye ingredients for decorative and utilitarian items (DLUPC, 2006). Berries harvested include blueberries, low bush cranberries, cloudberries, and rose hips (EBA, 2006; IMG-Golder Corporation, 2006).

Culturally important plants found within the area include timber, flowering plants, berries, and medicinal plants (DLUPC, 2006). In 2001, Pehdzéh Kì First Nation members identified approximately 2,000 different harvesting sites around the community of Wrigley (IMG-Golder Corporation, 2006). The most common berry picking location in the Dehcho Region is located adjacent to the Mackenzie Highway (Highway #1) towards Fort Simpson (Łíídlı Kųę) (outside of the LAA and RAA) and along existing trails through Pehdzéh Kì N’deh area. Indigenous harvesters also pick berries along the existing pipeline corridor near Wrigley (IMG-Golder Corporation, 2006). According to Dehcho First Nations and Pehdzéh Kì First Nation, ritual and spiritual plant uses are considered to have no economic replacement value and possess an inherent cultural value that connects harvesters with cultural traditions and land (IMG-Golder Corporation, 2006).

11.2.3.6.2 Sahtu Region

The Sahtu Region is dominated by coniferous forest in both the LAA and RAA, while wetlands occupy about a quarter of the landcover type in the LAA and RAA. Fires in the LAA and RAA are common, with portions within the Sahtu Region burning at least once per decade (see Appendix 18A [vegetation and wetlands]; K’alo-Stantec, 2022b). The SRRB identified concerns of new plant species shifting diets for herbivores and subsequently displacing resident species with shrubs, which may potentially increase the potential for wildfires in the Sahtu Region (SRRB, 2016). A review of the available information indicates 24 plants or groups of plants are used for traditional purposes in the Sahtu Region, with all 24 expected in the ecoregions intersected by the NWRRC TLRU and TRRC TLRU study areas (Appendix 18A [vegetation and wetlands]; K’alo-Stantec, 2022b).

Within the Sahtu Region, 34% of the general population reported gathering berries (NWT Bureau of Statistics, 2019e), with 28% of the Indigenous population of Tulita and 32% of the Indigenous population of Norman Wells reporting engaging in berry gathering (NWT Bureau of Statistics, 2019b, 2019c). Several species of plants and berries within the Sahtu Region are of interest to Sahtu harvesters. Information shared provided by NWRRC and TRRC reported that plant harvesting is important for Sahtu land users and study participants reported gathering a variety of plants for food and medicine as part of their diet and to maintain health (NWRRC, 2023; TRRC, 2023).

Norman Wells Renewable Resources Council study participants stated that the NWRRC TLRU Study Area is important for harvesting raspberries, blueberries, blackcurrant, juniper berries, highbush cranberries, and lowbush cranberries (NWRRC, 2023). Of particular interest to NWRRC study participants is Canyon Creek, identified as an important area for harvesting cranberries, highbush cranberries, and blueberries (NWRRC, 2023). Sahtu Dene and Métis and TRRC reported harvesting plants and berries along Great Bear River (TRRC, 2022; SLUPB, 2022). Three Day Lake (or Sucker Lake) is also a popular berry and plant harvesting site for those living in and around Norman Wells (SLUPB, 2022). Along the Deh Cho (Mackenzie River) are plant and berry harvesting locations important to Indigenous harvesters inside and outside of the Sahtu Region (SLUPB, 2022). Tulita Renewable Resources Council reported that particular sections of the existing MVWR are important for berry picking during the summer months, as well as areas around Plane Lake (TRRC, 2022). Sahtu harvesters also commonly harvest blueberries throughout the Tulita area during the summer months (TRRC, 2022). However, NWRRC (2023) reported that there are not as many berries available for harvesting in the NWRRC TLRU Study Area now as in the past, which participants attribute to the land drying up, potentially related to effects of climate change. NWRRC (2023) identified an orange berry called cloudberry that used to be harvested in the NWRRC TLRU Study Area near Norman Wells that are no longer found.

Local knowledge provided by TRRC reported plant harvesting is important for Sahtu harvesters in Tulita as part of the diet and for medicines, and harvested plants are shared among community members, family, and friends, especially Elders and youth (TRRC, 2022). Norman Wells Renewable Resources Council study participants stated the NWRRC TLRU Study Area is important for gathering medicinal plants, including Labrador tea, as well as rat root, which is often found along

streams and around lakes (NWRRC, 2023). Norman Wells Renewable Resources Council identified that lily pad roots, red willow (or alder), mint, sage, spruce root, rosehips, and yarrow have been traditionally harvested in the NWRRC TLRU Study Area and are used as medicines (NWRRC, 2023). A NWRRC study participant reported birch fungi as an important resource and explained that burning birch fungi is a traditional method used to deter bears from camps during fish harvests and can be used as medicine when boiled for tea (NWRRC, 2023). Norman Wells Renewable Resources Council explained that one cup of boiled birch fungus tea each morning is known to lower cholesterol levels (NWRRC, 2023). Chagaa, harvested from the bark of birch trees, was also reported by NWRRC (2023) to be used as medicine and has medicinal properties important for the maintenance of health. NWRRC study participant reported that people used to rely and depend on the land for medicine, and that medicine was harvested for survival. They stated “People would pick a lot of different plants and know what their uses were for because they didn’t have a choice. Plants were picked and prepared the way they were supposed to be supposed to be prepared, for survival” (NWRRC.11; NWRRC, 2023).

Wood for fuel and tools was identified as important for traditional use by Indigenous Governments and Indigenous Organizations, and in the Sahtu Region (5658 NWT Ltd. and GNWT, 2011 [PR#16]; TRRC, 2022). Both wood and wood pellets are important for heating homes in the Sahtu Region. Within the Sahtu Region, wood is used for house heating in 274 (34%) households with 109 (13%) homes reporting wood as their main heat source (NWT Bureau of Statistics, 2018). Wood pellets are used for house heating in 18 (2%) households with 14 (2%) homes reporting wood pellets as their main heat source (NWT Bureau of Statistics, 2018). TRRC reported that wood is harvested along the MVWR to provide heating for homes during the winter months (TRRC, 2022).

Local knowledge holders in Tulita reported that previous road construction and operation of the MVWR has created build-ups of snow along the sides of the MVWR, which makes crossing the MVWR to access firewood more difficult, and concerns about snow build up because of potential project effects affecting accessibility of firewood were raised (TRRC, 2022). Wood is also collected for healing properties (TRRC, 2022). Local knowledge proved by TRRC identified healing properties in spruce gum, and other healing woods including birch bark, willow, and spruce branches (TRRC, 2022). Norman Wells Renewable Resources Council reported (2023) that the NWRRC TLRU Study Area contains a lot of big, tall spruce trees, especially along the MVWR, which is good habitat for wildlife year-round. NWRRC (2023) reported that while the winters were long and cold, the summers in Norman Wells could reach around 100 degrees (37 degrees Celsius), which helps support the maintenance of gardens and harvesting vegetation.

11.2.3.7 Fish

Fishing is an important activity and fish are a food source to the people of the Dehcho and Sahtu regions. The protection of fish and fish habitat in the Mackenzie Valley is of high cultural importance to Indigenous Governments and Indigenous Organizations in the Dehcho and Sahtu regions. The larger watercourses in the LAA are traditionally used for harvesting fish, while smaller watercourses may provide prey and nutrients to fisheries within the RAA.

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A number of fish species of interest (Table 11.9) have been identified through a review of publicly available literature (Appendix 11A; K’alo-Stantec, 2022a) and reported by Indigenous Governments, Indigenous Organizations, and other affected parties through the project-specific engagement program and project-specific TLRU studies. For a complete list of fish species in the RAA see Appendix 17A (fish and fish habitat; K’alo-Stantec, 2022c).

Table 11.9 Culturally Important Fish Species

Common Name	Latin Name	Identified By
Arctic char	<i>Salvelinus alpinus</i>	SRRB
Arctic grayling (bluefish)	<i>Thymallus arcticus (Pallas)</i>	Pehdzéh Kì First Nation; Dehcho First Nations; Sahtu Dene and Métis; SRRB; NWRRC
Broad whitefish	<i>Coregonus nasus (Pallas)</i>	Pehdzéh Kì First Nation; Dehcho First Nations; SRRB; NWRRC
Burbot (loche)	<i>Lota lota</i>	Pehdzéh Kì First Nation; Dehcho First Nations; Sahtu Dene and Métis; SRRB; NWRRC
Bull trout	<i>Salvelinus malma</i>	SRRB
Chum salmon (dog-face salmon)	<i>Oncorhynchus keta (Walbaum)</i>	Pehdzéh Kì First Nation; Dehcho First Nations; SRRB; NWRRC
Dolly varden	<i>Salvelinus confluentus</i>	SRRB
Coney (inconnu)	<i>Stenodus leuichthys (Güldenstadt)</i>	Pehdzéh Kì First Nation; Dehcho First Nations; Sahtu Dene and Métis; SRRB; NWRRC
Jackfish/northern pike	<i>Esox lucius (Linnaeus)</i>	Pehdzéh Kì First Nations; Dehcho First Nations; SRRB
Lake cisco	<i>Coregonus artedii (Lesueur)</i>	Pehdzéh Kì First Nation; Dehcho First Nations; SRRB
Lake trout	<i>Salvelinus namaycush</i>	Pehdzéh Kì First Nation; Dehcho First Nations; Sahtu Dene and Métis; SRRB
Lake whitefish (crookedback)	<i>Coregonus clupeaformis (Mitchill)</i>	Pehdzéh Kì First Nation; Dehcho First Nations; Sahtu Dene and Métis; SRRB; NWRRC
Longnose sucker	<i>Catostomus catostomus (Forster)</i>	Pehdzéh Kì First Nations; Dehcho First Nations; SRRB
Mountain whitefish	<i>Prosopium williamsoni</i>	Pehdzéh Kì First Nations; Dehcho First Nations
Pickrel/walleye	<i>Stizostedion vitreum (Mitchill)</i>	Pehdzéh Kì First Nations; Dehcho First Nations; Sahtu Dene and Métis; SRRB; NWRRC
Round whitefish	<i>Prosopium cylindraceum (Pallas)</i>	Pehdzéh Kì First Nations; Dehcho First Nations
Trout-perch	<i>Percopsis omiscomaycus (Walbaum)</i>	Pehdzéh Kì First Nations; Dehcho First Nations
White sucker	<i>Catostomus commersoni (Lacépède)</i>	Pehdzéh Kì First Nations; Dehcho First Nations

Sources: Auld and Kershaw, 2005; IMG-Golder Corporation, 2006; NWRRC, 2023; SRRB, 2021b; SLUPB, 2022

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Through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies, participants identified 20 fishing locations and areas of interest to fish and fish habitat relative to the Project within the PDA, LAA, and RAA, as described in Table 11.10 (see Figure 11.4; Appendix 11A [K’alo-Stantec, 2022a]; 5658 NWT Ltd. and GNWT, 2011 [PR#16]; Dessau, 2012 [PR#13]; EBA, 2006; Golder, 2015; IMG-Golder Corporation, 2006; TRRC, 2019; TRRC, 2022; SLUPB, 2023).

Table 11.10 Fish Harvesting Locations Identified by Indigenous Governments, Organizations, Knowledge Holders and Land Users Relative to the RAA

Location	Within LAA	Within RAA**	Identified By:
Pehdzéh Kì N’deh area ¹	✓*	✓	Pehdzéh Kì First Nation; Dehcho First Nations; Sahtu Dene and Métis
Sahtu Region	✓*	✓	Sahtu Dene and Métis
Area around proposed Great Bear River Bridge	✓	-	TRRC
Great Bear River (as it intersects with the LAA and RAA)	✓	✓	Communities in the Sahtu Region (SRRB); Elders in the K’ásho Got’ìneq and Tulft’a regions; TRRC; NWRRC
Ochre River	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations
Blackwater River	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations
Hodgson Creek (near Wrigley)	✓*	-	Pehdzéh Kì First Nation
Mackenzie River around Norman Wells ²	✓	✓	Sahtu Dene and Métis
Mackenzie River around Tulita ³	✓	✓	Sahtu Dene and Métis
Mackenzie River (south of Wrigley) ⁵	-	✓	Pehdzéh Kì First Nation; Dehcho First Nations
Dehdélelq Tué (Sucker Lake/ Three Day Lake)	-	✓	Sahtu Dene and Métis
Bluefish Creek	-	✓	NWRRC
Oscar Creek	-	✓	NWRRC
Sucker Creek	-	✓	NWRRC
Birch Creek	-	✓	NWRRC
Windy Island	✓	✓	Sahtu Dene and Métis
Little Bear River	-	✓	Sahtu Dene and Métis
Redstone River	✓	✓	Project-specific engagement program

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Location	Within LAA	Within RAA**	Identified By:
Lakes surrounding the Tulita area (fish spawning) ⁴	✓	✓	TRRC
Trout Lake	✓*	✓	NWRRC

Note:

* May occur within PDA

** Occurs within the RAA outside the LAA and PDA

¹ Pehdzéh Kì N'deh area is not mapped on Figure 11.4; the boundary of this area is not identified or disclosed in this report.

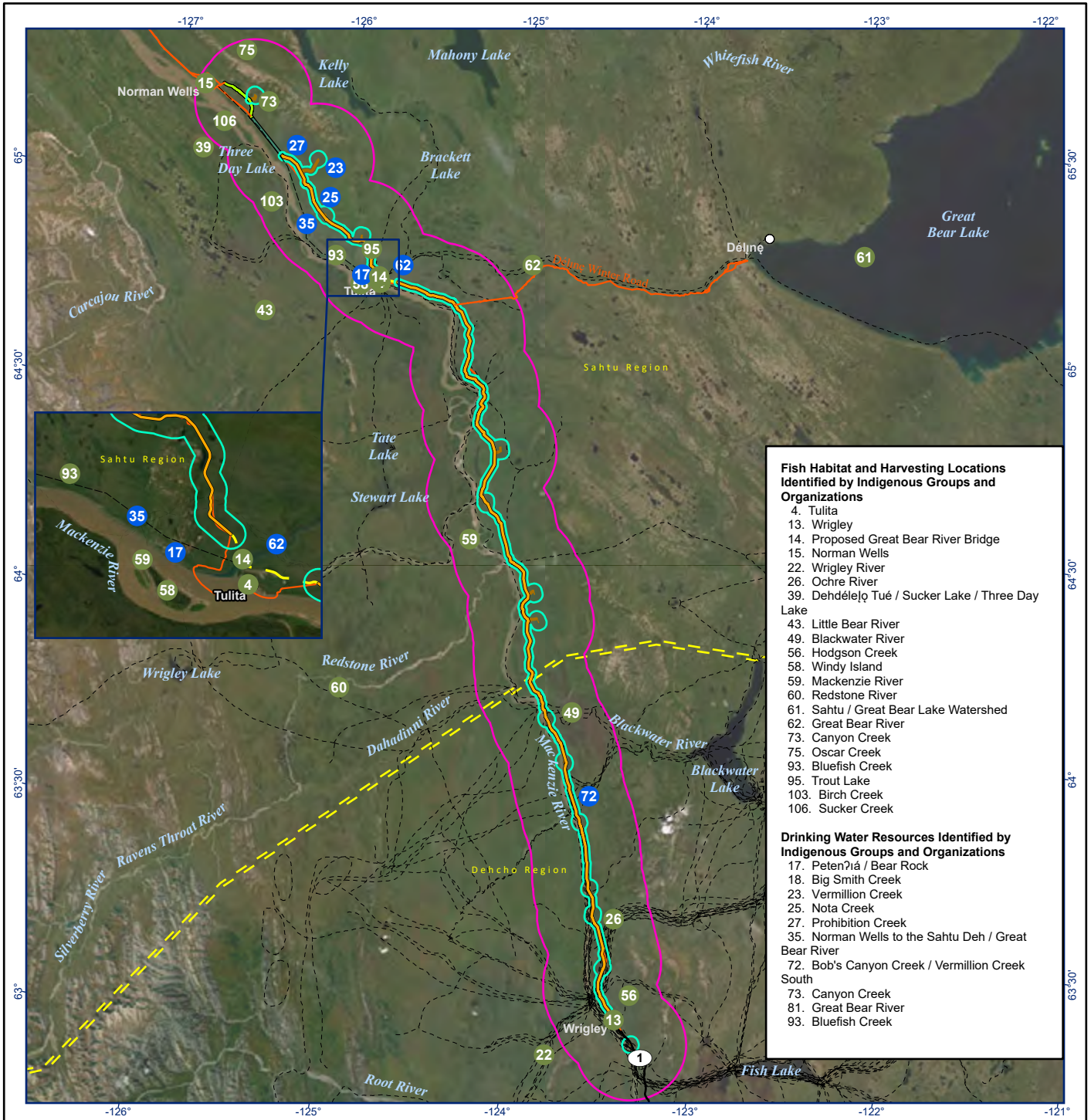
² Specific locations are not identified in this report, only Norman Wells is mapped on Figure 11.4. The Mackenzie River is also mapped.

³ Specific locations are not identified in this report, only Tulita is mapped on Figure 11.4.

⁴ The Town of Wrigley is mapped on Figure 11.4

⁵ Specific locations are not identified in this report, only Tulita is mapped on Figure 11.4

Sources: 5658 NWT Ltd. and GNWT, 2011 (PR#16); Dessau, 2012 (PR#13); EBA, 2006; Golder, 2015; IMG-Golder, 2006; NWRRC, 2023; SLUPB, 2023; TRRC, 2022



- Fish Habitat and Harvesting Locations Identified by Indigenous Groups and Organizations**
- 4. Tulita
 - 13. Wrigley
 - 14. Proposed Great Bear River Bridge
 - 15. Norman Wells
 - 22. Wrigley River
 - 26. Ochre River
 - 39. Dehdéleᑭ Tué / Sucker Lake / Three Day Lake
 - 43. Little Bear River
 - 49. Blackwater River
 - 56. Hodgson Creek
 - 58. Windy Island
 - 59. Mackenzie River
 - 60. Redstone River
 - 61. Sahtu / Great Bear Lake Watershed
 - 62. Great Bear River
 - 73. Canyon Creek
 - 75. Oscar Creek
 - 93. Bluefish Creek
 - 95. Trout Lake
 - 103. Birch Creek
 - 106. Sucker Creek
- Drinking Water Resources Identified by Indigenous Groups and Organizations**
- 17. Peten?á / Bear Rock
 - 18. Big Smith Creek
 - 23. Vermillion Creek
 - 25. Nota Creek
 - 27. Prohibition Creek
 - 35. Norman Wells to the Sahtu Deh / Great Bear River
 - 72. Bob's Canyon Creek / Vermillion Creek South
 - 73. Canyon Creek
 - 81. Great Bear River
 - 93. Bluefish Creek

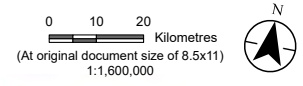


Traditional Land Use

- Fish / Fishing
- Water

- Proposed Mackenzie Valley Highway Project
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Proposed Great Bear River Bridge

- Proposed Borrow Source / Quarry and Access
- Local Assessment Area
- Regional Assessment Area
- Community
- Northwest Territories Highway
- Winter Road
- - - Trail
- Region Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 8/10/2023
 TR by LN on 8/10/2023

Client/Project: 144903025-0130 REV C

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No. **11.4**

Fish Habitat and Harvesting Locations and Drinking Water Resources in the Regional Assessment Area

Notes

1. This map is associated with Chapter 11 Section 11.2.3, Table 11.12
2. Coordinate System: NAD 1983 Northwest Territories Lambert
3. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics. n.d. Inventory of Landscape Change Map Viewer, GNWT. Centre for Geomatics. n.d. Open Data, MVLWB. n.d. Public Registry, Sahtu Land and Water Board. n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd., 5658 NWT Ltd. and GNWT 2011; Dessau 2012; EBA 2006; Golder 2015; IMG-Golder Corporation 2006; SLUPB 2013; TRRC 2019, TRRC 2022, NWRRC 2023
4. Background: World Topographic Map; Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS. Imagery date: 2021

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

11.2.3.7.1 Dehcho Region

Dehcho First Nations and Pehdzéh Kì First Nation in the Wrigley area also report the importance of fish and economic benefits saved from avoiding high market fish prices (IMG-Golder Corporation, 2006). The Mackenzie River is reported to be an important fishing area in the Dehcho Region (DLUPC, 2006). During summer and fall, members of Dehcho First Nations and Pehdzéh Kì First Nation harvest inconnu (coney) and artic grayling, which they either eat fresh, freeze, or feed to dogs. Lesser quantities of walleye and burbot are also taken (IMG-Golder Corporation, 2006). There is little fishing activity reported to occur during spring (IMG-Golder Corporation, 2006). Fish spawning sites identified during early project engagement are reported near the mouths of Ochre River and Blackwater River (within the LAA), as well as other watercourses crossed by the Project (Dessau, 2012 [PR#13]). Nine fish spawning sites have been identified in the LAA, including sites near the mouths of the Ochre and Blackwater Rivers, as well as in other tributaries along the route (DLUPC, 2006).

11.2.3.7.2 Sahtu Region

Fishing is an important cultural and social activity for Sahtu harvesters, and as a consistent source of accessible subsistence has played a major role in the well-being of Indigenous people in the Sahtu Region (Auld and Kershaw, 2005; TRRC, 2022). While wildlife is only available seasonally, some fish species are harvested year-round to supplement diets (Auld and Kershaw, 2005). Sahtu harvesters also commonly fish the Mackenzie River south to Blackwater River (within the RAA), and to Colville Lake (K’áhbamítúé) and surrounding islands (outside the RAA) (Auld and Kershaw, 2005). During summer months, Sahtu Dene and Métis families set nets up at fish camps throughout Deh Cho (Mackenzie River) and its tributaries, as well as fish lakes in the Sahtu Region, where fish are also dried (SLUPB, 2022).

Tulita Renewable Resources Council and NWRRC study participants identified several fish spawning areas located in lakes throughout the TRRC TLRU Study Area near Tulita that are of interest to Sahtu harvesters (NWRRC, 2023; TRRC, 2022). Norman Wells Renewable Resources Council (2023) identified that Bluefish Creek is of particular interest because fish are known to travel through Bluefish Creek to spawn. Norman Wells Renewable Resources Council (2023) reported that fish used to use Canyon Creek as a passage site for spawning; however, fish are no longer able to pass through that creek because the water is too low. Local knowledge provided by TRRC reported that Great Bear River is very important for fishing during the summer and winter months (TRRC, 2022). Local Sahtu harvesters explained that while some fishing occurs during the summer, most fishing occurs along Great Bear River during the winter season (TRRC, 2022). During winter, nets are still set up under the ice (SLUPB, 2022). Norman Wells Renewable Resources Council study participants identified many good fishing lakes and areas in the Sahtu Area including Aubrey Lake, Bluefish Creek, Birch Creek, Kelly Lake, Lennie Lake, Oscar Creek, Sucker Creek, and Trout Lake (NWRRC, 2023). Bluefish Creek, Birch Creek, Sucker Creek, Oscar Creek, and Trout Lake are within the LAA and RAA. Norman Wells Renewable Resources Council communicated that Trout Lake is known to be particularly abundant in small fish and is a common fishing location, especially in the fall (NWRRC, 2023).

Tulita Renewable Resources Council identified that locations near the proposed Great Bear River Bridge and at Trout Lake are culturally important sites commonly accessed by members of the community for fishing, camping, and for cookouts during the summer months, (TRRC, 2022). Local Sahtu harvesters and land users in Tulita raised concerns about potential project effects on Great Bear River and the areas around the proposed Great Bear River Bridge that may affect fish health and fishing in those areas (TRRC, 2022). The Project is not expected to affect the Great Bear River or the area surrounding the proposed Great Bear River Bridge.

An NWRRC participant noted that Lennie Lake (within RAA) was known to previously have a lot of fish and was a popular spot to put up fishing nets in the spring. Another study participant described the canoes being so full of fish that only one harvester could fit into the canoe without the canoe overflowing (NWRRC, 2023). Current use of Lennie Lake as a popular fish harvesting location is unknown by NWRRC study participants (NWRRC, 2023).

Other important fish species harvested in the Sahtu Region include lake whitefish (crookedbacks), lake trout, northern pike (jackfish), arctic grayling and inconnu (coney), pickerel, and burbot (loche) (Auld and Kershaw, 2005; SLUPB, 2022). Broad whitefish are also harvested (Tallman and Reist, 1997). Sahtu harvesters report that grayling (bluefish), inconnu (coney), trout, suckers, small whitefish, *thlo cha* (bull trout), jackfish, and salmon are common in the Sahtu Region, including Great Bear River, and small-sized bull trout are found in Mackenzie River (5658 NWT Ltd. and GNWT, 2011 [PR#16]; TRRC, 2019). Norman Wells Renewable Resources Council (2023) reported that Bluefish Creek is a known habitat for sucker fish, grayling, pickerel, inconnu (coney), burbot, trout, and salmon. Sucker Creek was identified by NWRRC as a good habitat for pickerel, sucker fish, and coney. An NWRRC study participant explained that families had fish camps at Sucker Creek and after fish were harvested, the fish would be dried, and families would make bales of fish to share with community members (NWRRC, 2023).

Norman Wells Renewable Resources Council (2023) also reported fishing locations of interest around Bear Rock (Petinı́ah), at the mouth of the Great Bear River, where grayling, trout, pickerel, inconnu (coney), sucker fish, and walleye are known to be harvested. Norman Wells Renewable Resources Council (2023) reported that ‘chubs’ (salmon) are also harvested around Bear Rock (Petinı́ah) and are harvested more now than in the past. They reported that fishing does occur all year round but generally occurs most often in the fall. Lakes and waterways in the Sahtu Region are reported to be abundant in fish and common species include trout, burbot, whitefish, northern pike, and inconnu (coney), though some fish may only be found at certain times of year (Golder, 2015). The SRRB has reported that fish habitat, populations, and abundances have decreased over the last 50 years as a result of past industrial disturbance and habitat disturbance as well as indirect effects associated with climate change (SRRB, 2021b).

11.2.3.8 Water

The Project is in the Mackenzie River basin and within the Central Mackenzie-Blackwater Lake, Central Mackenzie-the Ramparts, and Great Bear sub-basins (MRBB, 2021). Natural water quality of the Mackenzie River Basin, including water flowing into the LAA, is generally influenced by water flowing through the Precambrian Shield of the Mackenzie Mountains, as well as mountains surrounding Liard River (Golder, 2015). Liard River drains into Mackenzie River approximately 235 km upstream of Wrigley (Golder, 2015). Surface water quality in the Mackenzie-Great Bear Sub-Basin is influenced by two main sources: local sources and global sources. Local anthropogenic sources (i.e., sources within the Mackenzie-Great Bear Sub-Basin) include historical and existing mines, municipal sewage, oil and gas exploration activities, and other industries (MRBB, 2021).

Local natural sources include soils, bedrock, and forest fires from which naturally occurring constituents can be released. Some water quality parameters observed in the Mackenzie-Great Bear Sub-Basin originate in other parts of the world and travel through the atmosphere before being deposited there (MRBB, 2021). For more details of existing water quality and quantity in the RAA see water and sediment quality (see Chapter 16) and the associated TDR (Appendix 16A; K’alo-Stantec, 2022d).

Figure 11.4 (Appendix 11A [K’alo-Stantec, 2022a]; Golder, 2015; NWRRC, 2023; TRRC, 2022) maps a number of drinking water resources relative to the Project that have been identified through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies that are of interest to Indigenous Governments and Indigenous Organizations (Dessau, 2012 [PR#13]; Golder, 2015; TRRC, 2022). Several locations overlap the LAA and RAA, as described in Table 11.11.

Table 11.11 Drinking Water Resources Identified by Indigenous Governments, Indigenous Organizations, and Other Affected Parties Relative to the RAA

Location	Within LAA	Within RAA**	Identified By: (if applicable)
Springs which feed the large streams from Norman Wells to the Great Bear River; including Prohibition Creek	✓	✓	Sahtu Dene and Métis
Springs which feed the large streams from Norman Wells to the Great Bear River; including Vermillion Creek	✓	✓	Sahtu Dene and Métis; NWRRC
Springs which feed the large streams from Norman Wells to the Great Bear River; including Nota Creek	✓	✓	Sahtu Dene and Métis; NWRRC
Canyon Creek	-	✓	NWRRC
Bluefish Creek	-	✓	NWRRC
Great Bear River (as it intersects with the LAA and RAA)	✓	✓	TRRC; NWRRC
Big Smith Creek	-	✓	Sahtu Dene and Métis
Bear Rock (Petıńıřah) (spring)	✓	-	Sahtu Dene and Métis

Sources: Golder, 2015; NWRRC, 2023; TRRC, 2022

Notes:

* May occur within PDA

** Occurs within the RAA outside the LAA and PDA

11.2.3.8.1 Dehcho Region

Pehdzéh Kı First Nation have identified watercourses and riverbanks as traditional land use areas, and that these traditional areas require protection (Dessau, 2012 [PR#13]). Drainage areas intersected by the LAA are also considered potential waterfowl habitat, including Mackenzie River, Blackwater River, and Ochre River, as well as major creeks and other smaller watercourses (Dessau, 2012 [PR#13]). Dehcho First Nations have also indicated many factors influencing water quantity in the Dehcho Region, noting that the region is getting warmer and wetter overall with more rainfall in August and September and even into October, resulting in higher water levels on smaller rivers and streams (Dehcho First Nations, 2011).

11.2.3.8.2 Sahtu Region

Sahtu Dene and Métis identify water as a fundamental requirement of life, reporting that community members drink water from lakes and rivers and eat fish from the waters while out on the land (TRRC, 2022; SLUPB, 2022). Clean lakes and rivers also provide community drinking water, habitat for fish and wildlife, supports edible and medicinal plants, and acts as travel and shipping routes throughout the Sahtu Region (SLUPB, 2022; Golder, 2015). Clean water can support healthy and productive ecosystems, essential to the social, cultural, and economic well-being of traditional northern Indigenous cultures (SLUPB, 2022).

Tulita Renewable Resources Council reported that drinking water for the community of Tulita is collected from Great Bear River, and concerns were raised about potential project effects to both the quality and flow of water in Great Bear River (TRRC, 2022). Local knowledge from TRRC reported that drinking water-intake locations are located on the west side of Great Bear River (away from the community), and that Tulita community water trucks need to access the intake location year-round (TRRC, 2022). Concerns were raised about accessibility of the water intake locations to be used for the Project.

A number of springs, mostly underground, from Norman Wells to the Great Bear River have been mapped over time by Indigenous Governments and Indigenous Organizations in the Sahtu Region (Golder, 2015). Community members have identified springs that flow year-round in several locations near Prohibition Creek, Vermillion Creek, Nota Creek, and Big Smith Creek; these were identified as a good source of drinking water (Golder, 2015).

Norman Wells Renewable Resources Council study participants communicated that drinking water sources include any of the bigger creeks coming down from the mountains and explained that mountain water offers good, fresh drinking water, except for areas (creeks) which are higher in minerals (i.e., salty, sulfur-odour) (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that harvesting drinking water from the Great Bear River, Bluefish Creek, Prohibition Creek, and Vermillion Creek is most favourable. Prohibition Creek has been known to contain too many minerals at times for drinking (NWRRC, 2023). Norman Wells Renewable Resources Council participants explained that water around Bear Rock (Petinı́ah) can taste salty because of the way the land was formed in the area and communicated that there is a layer of salt that is under the shield which can influence water quality and taste (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that salty water is known to occur around Mile Thirty-Six. Canyon Creek was reported as a common place to get drinking water, however NWRRC reported it is not used as much now because water is too low (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that the water in Prohibition Creek and Vermillion Creek is also shallower in recent years.

In addition, NWRRC study participant (NWRRC.3) discussed a sulfur creek located around Bear Rock (Petinı́ah) that has a very strong odour and that “the creeks don’t freeze up because of the minerals and the warm water coming up from under the ground in that area” (NWRRC, 2023). Study participants reported that sulfur water can also occur near Vermillion Creek (NWRRC, 2023). One study participant described how the sulfur in the water at Vermillion Creek has curdled milk when used to make coffee, however the participant communicated that the water is still safe to drink (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) communicated that sulfur water has been traditionally used as medicine, either as a hot bath or foot soak, to rid the body of toxins, aches, and pains. “A long time ago, people would depend on that kind of water for medicinal use” (NWRRC.11; NWRRC, 2023).

Sahtu land users have observed that declining water levels have reduced fish and wildlife habitat, and has created additional challenges for water navigation, travel, and fishing due to drying of water bodies (e.g., Moose Lake²²) (Golder, 2015). Similarly, community members in the Sahtu Region have expressed concerns for water operation withdrawals from lakes near *Dehdélel̥o Tué* (Sucker Lake/Three Day Lake) as lakes in the area are shallow (Golder, 2015). Norman Wells Renewable Resources Council study participants raised concerns about the creeks and lakes drying up in the NWRRC TLRU Study Area, particularly the delta around Bluefish Creek, which can be seen when flying overhead by plane (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) also reported concerns about water quantity at Canyon Creek, which participants expressed has changed because of warming temperatures. Norman Wells Renewable Resources Council explained that there were areas along Canyon Creek that had previously contained several small ponds and was an ideal location for camping. However, the area has completely dried up (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that there is less rain in the NWRRC TLRU Study Area and lakes are lower, and the temperature of the water is warmer.

Norman Wells Renewable Resources Council (2023) reported observations of water freezing over later than previous. Norman Wells Renewable Resources Council also raised concerns regarding the quality of water in Fort Good Hope (K'asho Got'ine), hereafter referred to as Fort Good Hope, and reported that the water along the shoreline appears to have an oily sheen (NWRRC, 2023). While Fort Good Hope is not located in the RAA, Norman Wells Renewable Resources Council study participants shared concerns about previous development in the NWRRC TLRU Study Area, specifically oil drilling that occurred in Bluefish Creek, which study participants have attributed to be the cause of water quality decline in the NWRRC TLRU Study Area leading down to Fort Good Hope (NWRRC, 2023). Norman Wells Renewable Resources Council participants expressed concern with the level of honesty developers had during drilling operations and shared observations of increasing health issues in Fort Good Hope, which participants attribute to poor water quality (NWRRC, 2023).

Tulita Renewable Resources Council also reported concerns from local Sahtu harvesters about potential project effects to open-water sources from vehicle breakdown, specifically near Bear Rock (Petinı̥zah), which have potential to cause contamination or affect the flow of water in Great Bear River (TRRC, 2022). Norman Wells Renewable Resources Council discussed experiences of environmental contamination from vehicle fluid leaks and spills that have occurred along the MVWR in the NWRRC TLRU Study Area and raised concerns about potential project effects from vehicle operations and mechanical equipment contaminating open water resources during construction and operations and maintenance of the Project (NWRRC, 2023). Through the project-specific engagement program, participants reported concerns about potential project effects to the lakes and rivers in the RAA because of the increase in access to the area during construction and operations and maintenance of the Project.

²² The location of Moose Lake was unable to be determined.

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Sahtu harvesters in the Tulita areas mentioned notable water and ice features around the Tulita area related to overflow of water along the MVWR that may affect road conditions, including ice break-ups in Mackenzie River as well as beaver dams, which Sahtu knowledge holders explained have affected valued resources and TLRU around Great Bear River (TRRC, 2022). The area and road conditions between the community of Tulita and Four Mile Creek are reported by TRRC to be especially problematic throughout the year, primarily because of overflow (TRRC, 2022). Tulita Renewable Resources Council attributed water overflow and erosion along portions of the MVWR to previous road construction and operation (TRRC, 2022).

Norman Wells Renewable Resources Council discussions about notable water and ice features within the NWRRC TLRU Study Area were focused primarily on issues related to overflows and seepages of water around Bear Rock (Petııııah), which study participants explained can affect safety and accessibility to valued resources and TLRU in that area (NWRRC, 2023). Several participants discussed the areas around Bear Rock (Petııııah) and Bluefish Creek to be particularly problematic throughout the year, primarily because of overflow (NWRRC, 2023). Norman Wells Renewable Resources Council study participants explained that overflow is really bad in that area because water flows under Bear Rock (Petııııah) and out into Trout Lake (and can overflow around there) (NWRRC, 2023). These areas have been highlighted for the purposes of project design and safety.

Sahtu Renewable Resources Board has reported concerns that thawing permafrost will increase turbidity and solids in local streams, affecting water quality and quantity (SRRB, 2016). As described in the Cultural and Traditional Land Use TDR (see Appendix 11A, K’alo-Stantec, 2022a), Sahtu harvesters reported powerful ice breaks during the spring break around the area of the proposed Great Bear River Bridge that influence surface water quantity in the Sahtu Region (Golder, 2015; TRRC, 2019). Norman Wells Renewable Resources Council (2023) reported that large chunks of ice are no longer carried down the rivers because the water has been too low to move it.

“I remember when we were kids, even here at Norman Wells when were younger, when ice used to go...it used to go... you used to just be able to hear it.... and it was really powerful. And you don't see that very much anymore....Just a pile up here, and a pile up there.... and because it's so shallow too, it just sits there in big chunks” (NWRRC.11; NWRRC, 2023).

11.2.4 Access to Traditional Resources or Areas for Cultural Use

Access to traditional resources and areas for cultural use are important for lands users in the Dehcho and Sahtu regions to sustain the practice of TLRU and maintain cultural identity. Through the project-specific engagement program, a literature review of publicly available documents, and project-specific TLRU studies, specific trails travel route locations were identified. A total of 27 locations of interest have been identified within the PDA, LAA, and RAA, as described in Table 11.12 and Figure 11.5 (Appendix 11A [K’alo-Stantec, 2022a]; 5658 NWT Ltd. and GNWT, 2011 [PR#16]; GNWT, 2018; Golder, 2015; IMG-Golder Corporation, 2006; NWRRC, 2023; SLUPB, 2023; TRRC, 2022).

Table 11.12 Trails, Waterways, Travel Routes Identified by Indigenous Governments, Indigenous Organizations, and Other Affected Parties Relative to the RAA

Location	Within LAA	Within RAA**	Identified By:
Bear Rock (Petınızah)	✓	-	Sahtu Region; SRRB
Mackenzie River	✓*	-	Sahtu Region; SRRB; Pehdzéh Kì First Nation; Dehcho First Nations
Pehdzéh Kì N’deh area ¹	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations
Great Bear River to Great Bear Lake trail	✓*	-	Sahtu Region; SRRB
Backwater River trails (as it intersects the PDA and LAA)	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations
Ochre River trails (as it intersects the PDA and LAA)	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations
Vermillion Creek (south)	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations; NWRRC
Prohibition Creek to Canyon Creek	-	✓	NWRRC
Canyon Creek to Norman Wells	✓	✓	NWRRC
Vermillion Creek to Norman Wells	✓	✓	NWRRC
Bluefish Creek (into mountains)	-	✓	NWRRC
Canyon Creek (into mountains)	-	✓	NWRRC
Jungle Ridge Creek	-	✓	NWRRC
Tulita (area)	✓*	-	Project-specific engagement program
Norman Wells (from Tulita)	-	✓	Sahtu Region; SRRB; NWRRC
Along the MWVR around Tulita ²	✓*	-	TRRC

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Location	Within LAA	Within RAA**	Identified By:
Four Mile Creek	✓	✓	TRRC
Mackenzie River trails	✓	-	Pehdzéh Kì First Nation; Dehcho First Nations
Wrigley	✓	-	Pehdzéh Kì First Nation
Windy Island	-	✓	Sahtu Dene and Métis; NWRRC
Kelly Lake to Trout Lake	✓*	✓	NWRRC
Bluefish Creek to Kelly Lake	-	✓	NWRRC
Twenty Mile Island to Sucker Creek	-	✓	NWRRC
Twenty Mile Island trails (around island)	-	✓	NWRRC
Pipeline ROW	-	✓	NWRRC
Mountain Dene Trail head	-	✓	Sahtu Region
Dehdéleᑭ Tué (Sucker Lake/Three Day Lake) area	-	✓	Sahtu Dene and Métis

Notes:

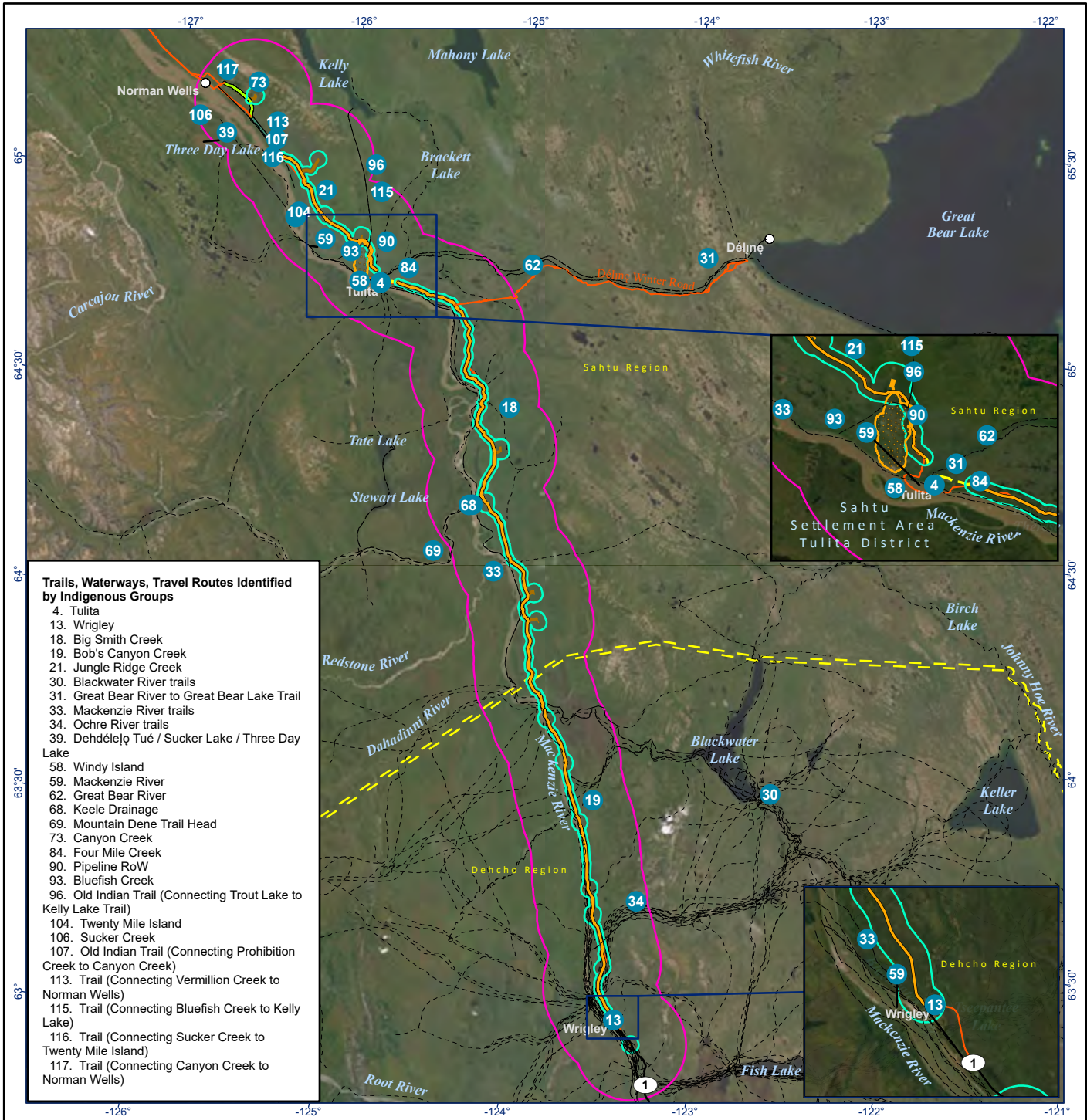
* May occur within PDA

** Occurs within the RAA outside the LAA and PDA

¹ Pehdzéh Kì N'deh area is not mapped on Figure 11.5; the boundary of this area is not identified or disclosed in this report

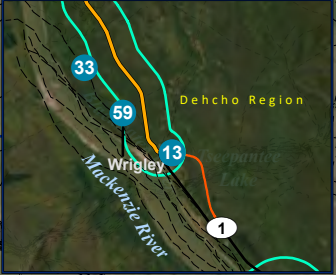
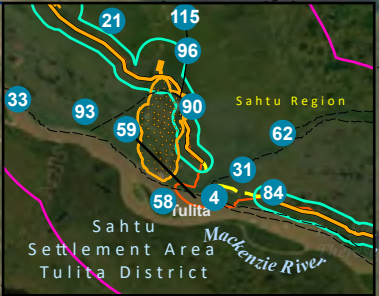
² Specific locations are not mapped, only Tulita is mapped on Figure 11.5

Sources: 5658 NWT Ltd. and GNWT, 2011 (PR#16); GNWT, 2018; Golder, 2015; IMG-Golder Corporation, 2006; NWRRC, 2023; SLUPB, 2023; TRRC, 2022



Trails, Waterways, Travel Routes Identified by Indigenous Groups

- 4. Tulı̄ta
- 13. Wrigley
- 18. Big Smith Creek
- 19. Bob's Canyon Creek
- 21. Jungle Ridge Creek
- 30. Blackwater River trails
- 31. Great Bear River to Great Bear Lake Trail
- 33. Mackenzie River trails
- 34. Ochre River trails
- 39. Dehdéleq Tué / Sucker Lake / Three Day Lake
- 58. Windy Island
- 59. Mackenzie River
- 62. Great Bear River
- 68. Keele Drainage
- 69. Mountain Dene Trail Head
- 73. Canyon Creek
- 84. Four Mile Creek
- 90. Pipeline RoW
- 93. Bluefish Creek
- 96. Old Indian Trail (Connecting Trout Lake to Kelly Lake Trail)
- 104. Twenty Mile Island
- 106. Sucker Creek
- 107. Old Indian Trail (Connecting Prohibition Creek to Canyon Creek)
- 113. Trail (Connecting Vermillion Creek to Norman Wells)
- 115. Trail (Connecting Bluefish Creek to Kelly Lake)
- 116. Trail (Connecting Sucker Creek to Twenty Mile Island)
- 117. Trail (Connecting Canyon Creek to Norman Wells)



- Traditional Land Use**
- Access and Trail
 - Trail
 - Proposed Mackenzie Valley Highway Project
 - Canyon Creek All Season Access Road (Constructed)
 - Prohibition Creek Access Road (In Construction)
 - Proposed Great Bear River Bridge

- Proposed Borrow Source / Quarry and Access
- Local Assessment Area
- Regional Assessment Area
- Community
- Northwest Territories Highway
- Winter Road
- Petı̄nı̄zah (Bear Rock) Conservation Zone
- Norman Range Ecoregion
- Region Boundary



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0129 REV'C

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No. 11.5
 Title

Trails, Waterways, Travel Routes in the Regional Assessment Area

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

11.2.4.1 Dehcho Region

Dehcho First Nations and Pehdzéh Kì First Nation in the Dehcho Region report traditional travel routes near the Pehdzéh Kì N’deh area western boundary, and several cabins and traplines in the area around the lakes connecting Wrigley by traditional trails, several of which are found along the MVWR (Dessau, 2012 [PR#13]; IMG-Golder Corporation, 2006). Pehdzéh Kì First Nation and Dehcho First Nations indicated that historic trails have been identified at the confluence of Hodgson Creek and Mackenzie River, and trails are found around Vermillion Creek South and along Blackwater and Ochre rivers; these trails provide access to traditional activities and connect to Wrigley, Blackwater Lake (outside of the RAA), and Fish Lake²³, where many cultural and spiritual sites are located (Dessau, 2012 [PR#13]).

11.2.4.2 Sahtu Region

The Sahtu Region is ecologically diverse and rich in cultural heritage and natural resources (Auld and Kershaw, 2005). As a record of land use over time, networks of traditional trails span 300,000 km² of land, narrated by traditional placenames and associated stories that tie Sahtu Dene and Métis to the land and culture (SLUPB, 2022). Intimately known by Sahtu Dene and Métis Elders, traditional trails provide access both to harvesting areas as well as to stories, rituals, and teachings about Sahtu Dene and Métis history and culture (SLUPB, 2022). Historically, trails and traditional place names provided access to subsistence areas for Dene, who travelled great distances across a vast territory to harvest and trade, until wildlife shortages during the fur trade and the discovery of oil in Norman Wells in 1919 resulted in changes to traditional use practices (Auld and Kershaw, 2005).

The land remains important to Sahtu Dene and Métis for the transfer of knowledge from one generation to the next. Cultural transmission is important to Sahtu Dene and Métis, and youth are taken on to the land to hunt, trap, fish, and monitor the land and wildlife (fish, water, wildlife). Cultural transmission is important for the protection of important resources, such as caribou, by teaching youth to take care of the land and to preserve and protect cultural traditions (SRRB, 2016). “When families travel on the trails that cross the Sahtu landscape, children are told the place names and their associated stories. As these stories are passed on, places become aids for remembering the vast oral tradition in Sahtu Dene and Métis culture is rooted” (SLUPB, 2022). Dene place names exist all across the Sahtu Region, linking the Dene people to the land, and thousands of years of history, spirituality, life ways, and what it means to be Dene (Auld and Kershaw, 2005).

²³ Fish Lake is common lake name, and the location is not identified in this report.

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Sahtu Dene and Métis trappers have mapped extensive trail networks, including both water and land routes; these seasonal and combined (water and land) trails connect settlements, hunting grounds, harvesting sites, camps, cabins, burial sites, and sensitive areas, inside and outside of the Sahtu Region (Auld and Kershaw, 2005; SLUPB, 2022). Sahtu harvesters are knowledgeable about trails and access to traditional resources and areas for cultural use along the MVWR due to the extensive history of TLRU area (NWRRC, 2023; TRRC, 2022).

Tulita Renewable Resources Council identified several trails, accessible from the community of Tulita and from Four Mile Creek, which lead to important harvesting, hunting, and other areas of interest to Tulita community members; however, trails are not used as much as they were in the past (TRRC, 2022). These sites can be accessed all year round either by vehicle, helicopter, all-terrain vehicles (ATV), or walking; or in the winter by skidoo or boat in the summer (TRRC, 2022). Norman Wells Renewable Resources Council (2023) identified that most sites and areas of importance for TLRU in the NWRRC TLRU Study Area are accessed by truck and skidoo in the wintertime along the MVWR and by boat, quad, and truck in the summertime. Norman Wells Renewable Resources Council (2023) reported that the old cutline near Kelly Lake to Bluefish Creek is now used as skidoo trail. The skidoo trails are commonly used by the people of Tulita primarily for the purposes of firewood collection (NWRRC, 2023). Norman Wells Renewable Resources Council explained that before modern vehicles were used, all sites and areas of importance for TLRU were accessed only by dogsled, dog teams, and snowshoes. “If you travel by dog you know you’re going to get there. Skidoos are not as dependable, and if they break down, then what? You have to walk. With dogs, they go all the time” (NWRRC.11; NWRRC, 2023).

Norman Wells Renewable Resources Council (2023) reported that dogsled trails near Sucker Creek have been identified and are currently marked. While dogsled and dog teams are not used to access TLRU sites, NWRRC values the reliability of dog team as opposed to modern day technology (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that most hunting will now occur on a drive-by basis, by truck or skidoo.

Norman Wells Renewable Resources Council (2023) also identified an “old Indian trail” that connects to Kelly Lake (outside of NWRRC TLRU Study Area) to Trout Lake, extending all along the mountains as well as between Prohibition Creek and Canyon Creek. An NWRRC study participant explained that Kelly Lake was only accessible by trail, but now the trail is very difficult to find because it is grown over (NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that harvesters would also walk from Tulita to Kelly Lake through old trails, and there is a known trail connecting Bluefish Creek to Kelly Lake. They identified another old Indian trail around Vermillion Creek that trails back to Norman Wells and another that connects Norman Wells to Canyon Creek. Norman Wells Renewable Resources Council (2023) identified old cut line trails at Bluefish Creek, at Canyon Creek going into the mountains, and at Jungle Ridge Creek which leads to an old oil well site.

Norman Wells Renewable Resources Council explained that even though cutlines do carve up the land, NWRRC participant (NWRRC.8) commented that “the terrain is harsh, and people were actually happy to see seismic lines go in because it made traveling so much easier” (NWRRC.8; NWRRC, 2023). Norman Wells Renewable Resources Council (2023) reported that Twenty Mile

Island is also accessible by trail, which extends into delta to access moose hunting locations throughout the islands. They reported an old Indian trail connects Twenty Mile Island to Sucker Creek. A trail around Windy Island, which connects the island to the mainland, was often used to access mountain sheep harvesting locations on Windy Island (NWRRC, 2023). It is unknown by NWRRC if the Windy Island trail is still currently accessed to harvest on Windy Island. The Norman Wells Pipeline ROW is also considered an access route, as NWRRC (2023) reported that land users use the ROW to access wildlife along the pipeline via skidoo. Through the project-specific engagement program, participants identified an old trapping trail between Bear Rock (Petiniᓃah) and Willow Lake (outside of the LAA).

Sahtu Dene have noted that the Sucker Lake/Three Day Lake (*Dehdéleᓴᓱ Tué*) area is the location of traditional trails to the mountains (Golder, 2015). Sahtu Dene previously indicated that traditional trails are present in Petiniᓃah (Bear Rock) CZ (Zone #32), and Great Bear River has been the most well-used travel route to Great Bear Lake and is part of many traditional stories and place names (5658 NWT Ltd. and GNWT, 2011 [PR#16]; Golder, 2015; Auld and Kershaw, 2005; SLUPB, 2023). According to interviews with Sahtu harvesters conducted by the TRRC, travel by boat is conducted along Great Bear River primarily to ferry supplies between Délīne and Tulita, as well as for travel to Délīne and from the areas (SHPSJWG, 2000; TRRC, 2019). Through the project-specific engagement program, participants reported that the Project will increase boat access to mountain rivers and hunting areas, which will increase harvesting opportunities, but at the same time concerns were expressed about potential for increased access to increase harvesting pressure on wildlife, especially by recreational or non-local harvesters.

The Mackenzie River from Blackwater River in the south, to Thunder River in the north has been an important travel route for centuries and continues to provide travel access important for Dene seasonal rounds (5658 NWT Ltd. and GNWT, 2011 [PR#16]). Sahtu Dene and Métis also indicated that the Mountain Dene Trail begins on the Mackenzie River at Tulita and crosses the Mackenzie Lowlands into the Keele River drainage (outside the RAA) (Golder, 2015). Sahtu Dene also identified the area around Mackenzie River as a cultural and heritage site, including traditional trails, recreation and gathering places, log and timber collection areas, and cabins. The designation allows for continued use of the river as an important regional and territorial transportation corridor (barge traffic, landing sites, winter road) (SLUPB, 2023).

Sahtu Dene and Métis are actively working to reclaim their culture and land, supported by the SLUP in the recognition and use of place names (SLUPB, 2022). The SLUP provides map data for many trails to and from Tulita and Norman Wells that intersect the RAA, most along waterways, such as Great Bear River and Mackenzie River, which are used year-round to access harvesting locations and link thousands of place names to a story and location (5658 NWT Ltd. and GNWT, 2011 [PR#16]; Auld and Kershaw, 2005). It is important to note that mapping is not a comprehensive process. While significant places and trails have been mapped for the protection of their cultural value and use, recorded and mapped locations represent only a small portion of land use and archaeological and historical sites (SLUPB, 2022). Sahtu Dene and Métis continue to build cabins, set traplines, and use the land; due to extensive and high frequency of land use, not all significant sites and trails are mapped and recorded (SLUPB, 2022).

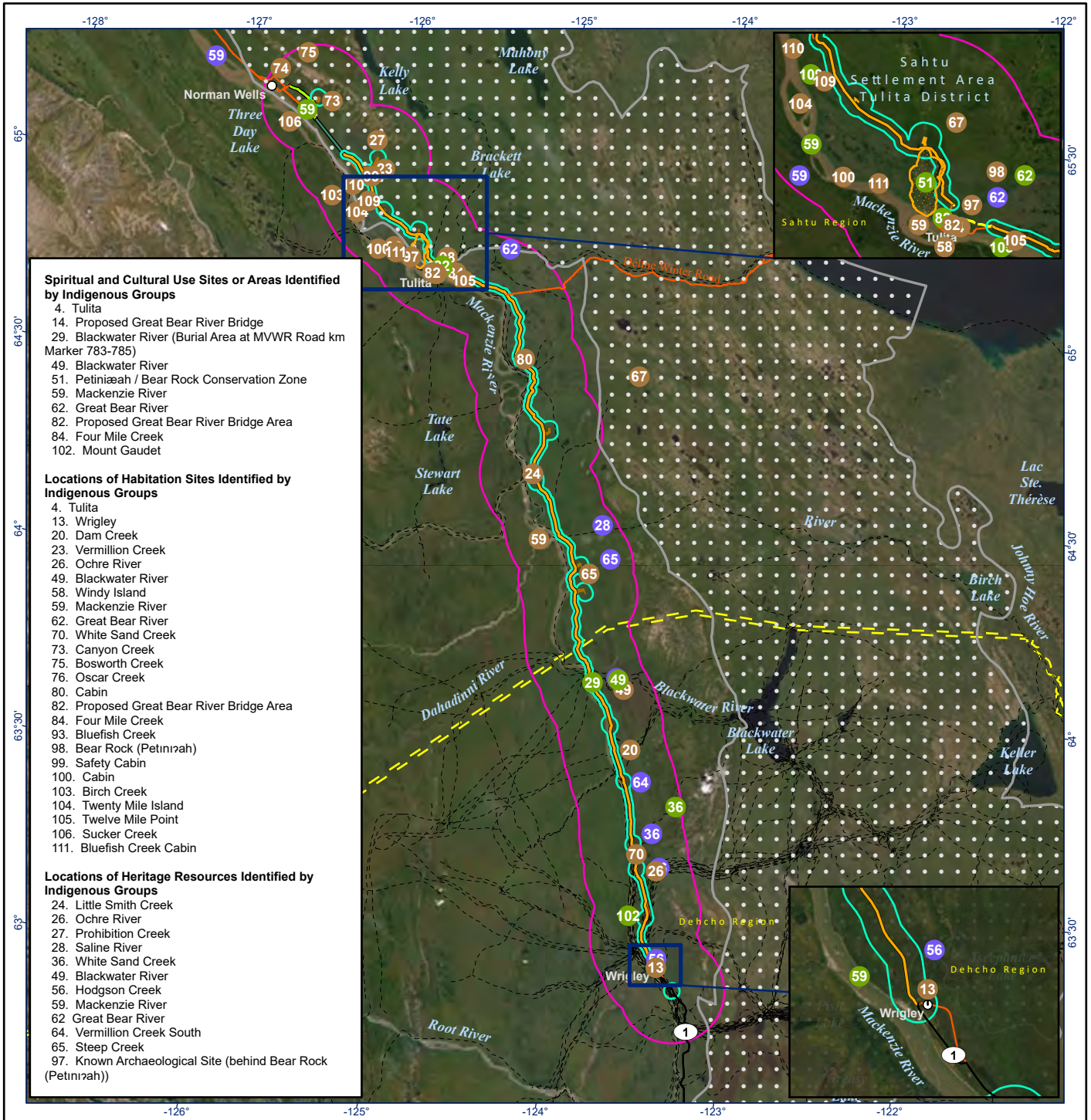
11.2.5 Cultural and Heritage Use Sites or Areas

Cultural and heritage use sites and areas include spiritual and cultural use sites and areas, heritage resources, and habitation sites, as well as associated landscapes, landscape features, and named places. Cultural and heritage use sites and areas are important to Indigenous Governments and Indigenous Organizations in the Dehcho and Sahtu regions²⁴. Residents of the Dehcho and Sahtu regions reported using the Sahtu and Dehcho regions for cultural use for centuries, relying on wildlife, fish, trees, plants, and other land and water resources for survival. Traditional trails and travelways and cultural sites and areas within the LAA and RAA have been identified through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies and are mapped in Figure 11.6.

11.2.5.1 Spiritual and Cultural Use Sites and Areas

Spiritual and cultural use sites and areas can include sacred places such as burials, ceremonial sites, and places of cultural or spiritual importance. Many landscapes and landscape features have important spiritual and cultural significance for Dehcho First Nations and Sahtu Dene and Métis. Through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies, nine spiritual and cultural use sites and areas relative to the Project have been identified by Indigenous Governments and Indigenous Organizations in the PDA, LAA, and RAA, as described in Table 11.13, and Figure 11.6 (Appendix 11A [K’alo-Stantec, 2022a]; Dessau, 2012 [PR#13]; EBA, 2006; Golder, 2015; IMG-Golder Corporation, 2006; GNWT, 2018; NWRRC, 2023; SHPSJWG, 2000; SLUPB, 2023; TRRC, 2022). For more information about heritage resources see Chapter 22 Heritage Resources.

²⁴ Hunting throughout the LAA and RAA, and outside the RAA has been described by Indigenous Governments and Indigenous Organizations in the Sahtu and Dehcho regions and is described in 11.2.3 above (IMG-Golder Corporation, 2006; SLUPB, 2023; 5658 NWT Ltd. And GNWT, 2011 [PR#16]) (see Appendix 19A [Wildlife and Wildlife Habitat], K’alo-Stantec, 2023) for additional information about locations. Similarly, locations associated with trapping, fishing, and plant gathering have been identified by Indigenous Governments and Indigenous Organizations in the Sahtu and Dehcho regions throughout the LAA and RAA, and outside the RAA and are described in Section 11.2.3 above (see Appendix 10A [Caribou and Moose]; K’alo-Stantec, 2022e) (see Appendix 17A [Fish and Fish Habitat]; K’alo-Stantec, 2022c). Places for hunting, fishing, fuel wood harvesting and berry picking are still relied on for a subsistence existence for residents of the Dehcho and Sahtu regions and augment the local economy in various ways (IMG-Golder Corporation, 2006).



- Spiritual and Cultural Use Sites or Areas Identified by Indigenous Groups**
- 4. Tulita
 - 14. Proposed Great Bear River Bridge
 - 29. Blackwater River (Burial Area at MVWR Road km Marker 783-785)
 - 49. Blackwater River
 - 51. Petinīzah / Bear Rock Conservation Zone
 - 59. Mackenzie River
 - 62. Great Bear River
 - 82. Proposed Great Bear River Bridge Area
 - 84. Four Mile Creek
 - 102. Mount Gaudet
- Locations of Habitation Sites Identified by Indigenous Groups**
- 4. Tulita
 - 13. Wrigley
 - 20. Dam Creek
 - 23. Vermillion Creek
 - 26. Ochre River
 - 49. Blackwater River
 - 58. Windy Island
 - 59. Mackenzie River
 - 62. Great Bear River
 - 70. White Sand Creek
 - 73. Canyon Creek
 - 75. Bosworth Creek
 - 76. Oscar Creek
 - 80. Cabin
 - 82. Proposed Great Bear River Bridge Area
 - 84. Four Mile Creek
 - 93. Bluefish Creek
 - 98. Bear Rock (Petinīzah)
 - 99. Safety Cabin
 - 100. Cabin
 - 103. Birch Creek
 - 104. Twenty Mile Island
 - 105. Twelve Mile Point
 - 106. Sucker Creek
 - 111. Bluefish Creek Cabin
- Locations of Heritage Resources Identified by Indigenous Groups**
- 24. Little Smith Creek
 - 26. Ochre River
 - 27. Prohibition Creek
 - 28. Saline River
 - 36. White Sand Creek
 - 49. Blackwater River
 - 56. Hodgson Creek
 - 59. Mackenzie River
 - 62. Great Bear River
 - 64. Vermillion Creek South
 - 65. Steep Creek
 - 97. Known Archaeological Site (behind Bear Rock (Petinīzah))



- Traditional Land Use**
- Cultural / Spiritual / Ceremonial
 - Habitation
 - Heritage Resource
- Proposed Mackenzie Valley Highway Project**
- Proposed Borrow Source / Quarry and Access
 - Local Assessment Area
 - Regional Assessment Area
 - Community
 - Northwest Territories Highway
 - Winter Road
 - Trail
 - Canyon Creek All Season Access Road (Constructed)
 - Prohibition Creek Access Road (In Construction)
 - Proposed Great Bear River Bridge
- Other Features**
- Petinīzah (Bear Rock) Conservation Zone
 - Norman Range Ecoregion
 - Region Boundary

0 10 20 Kilometres
(At original document size of 8.5x11)
1:1,700,000

Project Location
Wrigley to Norman Wells, NWT

Client/Project
Government of the Northwest Territories
Mackenzie Valley Highway Project

Prepared by CES on 8/10/2023
TR by LN on 8/10/2023

144903025-0176 REVA

Figure No.
11.6

Title
Cultural and Heritage Use Sites or Areas in the Regional Assessment Area

Notes

1. This map is associated with Chapter 11 Section 11.2.5, Tables 11.14, 11.15 and 11.16

2. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics, n.d. Inventory of Landscape Change Map Viewer, GNWT, Centre for Geomatics, n.d. Open Data, MVLWB, n.d. Public Registry, Sahtu Land and Water Board, n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd., 5856 NWT Ltd. and GNWT 2011; Dessau 2012; EBA 2006; Golder 2015; IMG-Golder Corporation 2006; GNWT 2018; TRRC 2022; SHPSJWG 2000; SLUPB 2013; NWRRS 2023

3. Coordinate System: NAD 1983 Northwest Territories Lambert

4. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
World Imagery: Earthstar Geographics
World Hillshade: Esri, USGS. Imagery date: 2021

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

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Table 11.13 Spiritual and Cultural Use Sites or Areas identified by Indigenous Governments and Indigenous Organizations Relative to the RAA

Location	Within LAA	Within RAA **	Identified By:
Bear Rock (Petınızah)	✓*	-	Sahtu Region; Sahtu Dene and Métis; TRRC; NWRRC
Mackenzie River	✓*	-	Pehdzéh Kì First Nation Dehcho First Nations
Pehdzéh Kì N’deh area ¹	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations
Blackwater River (between MVWR km Marker 783 and 785)	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations
Tulita	✓*	-	Sahtu Shúhta Got’ıne
Blackwater Creek	✓*	-	Dehcho First Nations; Pehdzéh Kì First Nation
Great Bear River Watershed	✓	✓	Sahtu Dene and Métis; TRRC
Area around proposed Great Bear River Bridge	✓	-	Sahtu Dene and Métis
Mount Gaudet	✓	-	Pehdzéh Kì First Nation

Notes:

* May occur within PDA

** Occurs within the RAA outside the LAA and PDA

¹ Pehdzéh Kì N’deh area is not mapped on Figure 11.6; the boundary of this area is not identified or disclosed in this report

Sources: Dessau, 2012; EBA, 2006; Golder, 2015; IMG-Golder Corporation, 2006; GNWT, 2018; NWRRC, 2023; SHPSJWG, 2000; SLUPB, 2023; TRRC, 2022

11.2.5.1.1 Dehcho Region

Cultural and spiritual sites were identified by the Pehdzéh Kì First Nation in the Pehdzéh Kì N’deh area (Dessau, 2012 [PR#13]). A spiritual site associated with moose hunting in the Mackenzie Valley area is located just south of Blackwater Creek. The Pehdzéh Kì N’deh area represents an important cultural area for the community of Wrigley (Dessau, 2012 [PR#13]). Pehdzéh Kì First Nation and Dehcho First Nations identified cultural and spiritual sites that are throughout the LAA. This includes a burial area that exists on both sides of the existing winter road north of Blackwater River, east of the Mackenzie River between MVWR KM 783 and KM 785 (Dessau, 2012 [PR#13]).

11.2.5.1.2 Sahtu Region

Sahtu and Dene Métis described the land as living and inhabited by entities and powers that are associated with important events or cultural legends and symbolize important rules, special conditions, and behaviours when travelling the land (SLUPB, 2022). Many sacred places are found throughout Sahtu and Métis lands (SLUPB, 2022). Their relationship with the landscape includes acts of reciprocity to respect the entities that inhabit the land, in essence to return the land for providing natural resources. There are special practices associated with cultural, spiritual, and sacred places, some of which are described by the Sahtu Heritage Places and Sites Joint Working Group in the Rakeke Gok’e Godi: Places We Take Care Of (SHPSJWG, 2000). Traditional place names can also provide memory cues and can bind the landscape to narrative and tradition. This can also be referred to as a social landscape (SHPSJWG, 2000).

Bear Rock (Petinı́zah) is reported as one of the most sacred sites for Sahtu Dene and has significant cultural value, and Sahtu Deh (Great Bear River watershed) in its entirety is considered an important heritage resource (SLUPB, 2023; 5658 NWT Ltd. and GNWT, 2011 [PR#16]). Local knowledge provided by TRRC and NWRRC identified the importance of Bear Rock (Petinı́zah) as a culturally significant, spiritual site of importance, associated with the story of Yamoria (NWRRC, 2023; TRRC, 2022). Yamoria is a legendary hero who made the land safe for the Dene by chasing away and killing giant beavers who were causing them grief (EBA, 2006). Sahtu harvesters and land users in Tulita described the great giant Yamoria as a hero who shot three beavers, put their pelts on Bear Rock (Petinı́zah), and then cooked the beavers at Four Mile Creek (TRRC, 2022). The story describes the grease from the cooked beavers seeping into the ground, and the smoke can still be seen coming from the side of the bank (TRRC, 2022).

Norman Wells Renewable Resources Council reported that Bear Rock (Petinı́zah) is also important for wildlife and wildlife habitat, and NWRRC study participant (NWRRC.1) expressed that Bear Rock (Petinı́zah) is “something that people really want to keep that way that it is” (NWRRC, 2023). Through the project-specific engagement program, engagement participants explained that the area is also associated with the story of the ‘serpent.’ Participants expressed that the Project should respect Dene culture and history and be located as far away as possible from Bear Rock (Petinı́zah) and recommended alternate routing to protect the sacred area. In response, the GNWT has proposed an alignment routing option 2 km north of the MVWR at Bear Rock (Petinı́zah) (see Chapter 5).

For more information on potential cultural, spiritual, and ceremonial sites, including burials, see heritage resources (see Chapter 22) and associated heritage resources TDR (see Appendix 22A; K’alo-Stantec, 2022f), which summarizes information on known archaeological sites within the assessment area.

11.2.5.2 Heritage Resources

The *Mackenzie Valley Resource Management Act* defines heritage resources as archaeological or historical sites, burial sites, camp sites, cabins, habitation sites, artifacts, and other objects of historical, cultural, or religious significance, and historical or cultural records. Heritage resources are recognized as unique and non-renewable resources that are tangible evidence of thousands of years of human history and reinforce the link between modern communities and land use history. For Indigenous Governments and Indigenous Organizations in the Sahtu and Dehcho regions, heritage resources are considered a component of cultural use, extending into the deep past. For more information about heritage resources see Chapter 22 Heritage Resources.

A total of 133 sites are currently on record with the Culture and Heritage Division within the RAA. Sites can range in size from a point (e.g., one isolated artifact) to a large campsite, village, trading post, or trail. This range in site size and in the differing accuracy of locational data due to decades of site records means that the likelihood of spatial overlap between a resource and the Project is approximate. As a result, potential project effects on known Heritage Resources have some uncertainty. Of these 133 sites within the RAA, 63 may reflect cultural use based on the available site descriptions. Knowledge holders in the Dehcho and Sahtu regions identified locations within Pehdzéh Kì N’deh area that include cabins, rare features, historic sites, and archaeological sites, many clustered at the north and west ends of Blackwater Lake (outside of the RAA), the mouth of Blackwater River, the shores of Fish Lake²⁵, and at the mouths of different creeks and rivers along the Mackenzie River, including Ochre River (IMG-Golder Corporation, 2006).

Through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies, locations of heritage resources are listed in Table 11.14 and presented on Figure 11.6 (Appendix 11A [K’alo-Stantec, 2022a]; Golder, 2015; Dessau, 2012 [PR#13]; 5856 NWT Ltd. and GNWT, 2011 [PR#16]; SLUPB, 2023; SLUPB, 2022). Thirteen locations of heritage resources have been identified within the PDA, LAA, and RAA, as described in Table 11.14. For more information see heritage resources (see Chapter 22) and associated heritage resources TDR (see Appendix 22A; K’alo-Stantec, 2022f), which summarizes information on known archaeological sites within the LAA.

²⁵ Fish Lake is a common lake name is not identified in this report

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Table 11.14 Location of Heritage Resources Relative to the RAA

Location	Within LAA	Within RAA**	Identified By:
Mackenzie River	✓*	-	Sahtu Region knowledge holders and land users; Pehdzéh Kì First Nation; Dehcho First Nations
Blackwater River	✓*	-	Pehdzéh Kì First Nations; Dehcho First Nations
Pehdzéh Kì N’deh area ¹	✓*	✓	Pehdzéh Kì First Nation; Dehcho First Nations
Ochre River	✓	-	Pehdzéh Kì First Nation; Dehcho First Nations
Hodgson Creek (near Wrigley)	✓*	-	Pehdzéh Kì First Nation
Prohibition Creek	✓	-	Sahtu Dene and Métis
Great Bear River	✓	-	Sahtu Dene and Métis
White Sand Creek	-	✓	Pehdzéh Kì First Nation Dehcho First Nations
Vermillion Creek South	✓	✓	Pehdzéh Kì First Nation; Dehcho First Nations
Steep Creek	✓	-	Sahtu Region knowledge holders and land users (SRRB)
Saline River	✓	-	Sahtu Region knowledge holders and land users (SRRB)
Little Smith Creek	-	✓	Sahtu Region knowledge holders and land users (SRRB)
Knwoan Archaeological Site behind Bear Rock (Petınırah)	✓		NWRRC

Notes:

* May occur within PDA

** Occurs within the RAA outside the LAA and PDA

¹ Pehdzéh Kì N’deh area is not mapped on Figure 11.6; the boundary of this area is not identified or disclosed in this report

Sources: Golder, 2015; Dessau, 2012 (PR#13); 5856 NWT Ltd. and GNWT, 2011; SLUPB, 2023; SLUPB, 2022

11.2.5.2.1 Dehcho Region

The Pehdzéh Kì N’deh area is home to ecological and cultural values (Dessau, 2012 [PR#13]). Although Pehdzéh Kì First Nation noted that they would prefer traditional lands and resources to be protected, Pehdzéh Kì First Nation previously provided information about several important traditional land use sites, ancestral areas, and trails potentially affected by the Project where Pehdzéh Kì First Nation practices traditional activities so that traditional and ancestral sites can be respected and considered in mitigation measures (Dessau, 2012 [PR#13]). The Mackenzie Valley corridor has been subject to archaeological desktop studies as well as field assessments since the early 1970s; these studies have addressed slightly different footprints related project proposals, including the Mackenzie Gas Project and, more recently, the Mackenzie Valley Fibre Link.

Pehdzéh Kì First Nation indicated that their traditional hunting grounds in the vicinity of White Sand Creek are located near concentrations of archaeological sites (Dessau, 2012 [PR#13]). Historic camps, cabins, historic trap, historic trails, trading posts, and graves have been identified at the confluence of Hodgson Creek and the Mackenzie River, as well as at Vermillion Creek South around Wrigley (Dessau, 2012 [PR#13]). The Pehdzéh Kì N’deh area contains the Old Wrigley town site, as well as burial sites and traditional travel routes near its western boundaries (Dessau, 2012 [PR#13]). Historic cabins located along the Mackenzie River, both north and south of Wrigley, are accessible by land or water and are often used seasonally by local trappers (IMG-Golder Corporation, 2006). Pehdzéh Kì First Nation and Dehcho First Nations noted that Blackwater River is a special traditional area that is home to a sacred old grave, and Willow Lake River (outside of the RAA) is where there is a burial ground (Dessau, 2012 [PR#13]).

11.2.5.2.2 Sahtu Region

Sahtu Dene and Métis have also reported that the Deh Cho (Mackenzie River) SMZ (Zone #63) includes archaeological and burial sites (SLUPB, 2023). The Mackenzie River is a symbolic focal point of Sahtu Dene and Métis culture and history. It is an important heritage harvest and subsistence use location for Indigenous people in and outside of the Sahtu Region. Historic camps, cabins, graves, historic features, and historic trails have been identified by Sahtu knowledge holders and land users along the terraces of Steep Creek, Saline River, Little Smith Creek, and various locations along the previous proposed highway route (see Table 11.13 and Figure 11.6) (5658 NWT Ltd. and GNWT, 2011 [PR#16]). Through the project-specific engagement program, participants also identified Fish Lake²⁶ as a sacred burial site which should not be disturbed. Norman Wells Renewable Resources Council advised that there are no known archaeological sites in the NWRRC TLRU Study Area. Study participants also noted that previous archaeological excavations occurred behind Bear Rock (Petınızah), but it is unknown if any artifacts or resources were recovered (NWRRC, 2023).

²⁶ Fish Lake is a common lake name and may refer to Trout Lake; the location is not identified in this report

11.2.5.3 Habitation Sites

Habitation sites can include historical and currently used and accessed long-term or short-term (seasonal) habitation sites. Through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies, approximately 23 actively used habitation sites have been identified in the PDA, LAA, and RAA, as described in Table 11.15 and Figure 11.6 (Appendix 11A [K’alo-Stantec, 2022a]; 5856 NWT Ltd. and GNWT, 2011; Dessau, 2012 [PR#13]; Golder, 2015; NWRRC, 2023; SLUPB, 2023; TRRC, 2022).

For more information about heritage resources see Chapter 22 Heritage Resources.

Table 11.15 Habitation Sites Relative to the RAA

Location	Within LAA	Within RAA**	Identified By:
Pehdzéh Kì N’deh area ¹	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations
Great Bear River (around Bear Rock [Petinı̀zah])	✓	-	Elders in the K’ásho Got’ı̀neę and Tulita regions; TRRC; NWRRC
Area around proposed Great Bear River Bridge (camping)	✓*	✓	TRRC
Mackenzie River	✓	-	Sahtu Dene and Métis; Pehdzéh Kì First Nation; Dehcho First Nations
Blackwater River	-	✓	Pehdzéh Kì First Nation; Dehcho First Nations
Ochre River	-	✓	Pehdzéh Kì First Nation; Dehcho First Nations
Four Mile Creek (camping area)	✓*	-	TRRC
Tulita	✓*	-	TRRC
Cabins in Tulita (along the MVWR) ²	✓*	-	TRRC
White Sand Creek	✓*	-	Pehdzéh Kì First Nation; Dehcho First Nations
Dam Creek	-	✓	Pehdzéh Kì First Nation; Dehcho First Nations
Wrigley	✓	-	Pehdzéh Kì First Nation
Cabin along the Project KM 772 to 774	✓*	-	Project-specific engagement program
Cabins (Locations confidential)	✓	-	Project-specific engagement program
Bluefish Creek (fish camp area)	-	✓	NWRRC
Near Bluefish Creek (cabin)	-	✓	NWRRC
Canyon Creek (cabin)	-	✓	NWRRC
Prohibition Creek (cabin)	-	✓	NWRRC

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Location	Within LAA	Within RAA**	Identified By:
Birch Creek (across from Twenty Mile Island) (cabin)	-	✓	NWRRC
Vermillion Creek (safety cabin)	✓	✓	NWRRC
Vermillion Creek (cabin)	-	✓	NWRRC
Twelve Mile Point (cabin)	-	✓	NWRRC
Sucker Creek	-	✓	NWRRC

Notes:

* May occur in the PDA

** Occurs within the RAA outside the LAA and PDA

¹ Pehdzéh Kì N'deh area is not mapped on Figure 11.6; the boundary of this area is not identified or disclosed in this report

² Specific locations are not identified, only Tulita is mapped on Figure 11.5

Sources: 5856 NWT Ltd. and GNWT, 2011; Dessau, 2012 (PR#13); Golder, 2015; NWRRC, 2023; SLUPB, 2023; TRRC, 2022

11.2.5.3.1 Dehcho Region

Dehcho First Nations and Pehdzéh Kì First Nation identified a number of camps within the LAA and RAA which help facilitate hunting and fishing in the area. These cabins are often accessible by land or water, and often are used seasonally by local trappers (IMG-Golder Corporation, 2006). Pehdzéh Kì First Nation have identified several lookout towers; one is located in the northwest corner, one west of Fish Lake²⁷, and one on the east bank of the Mackenzie River north of Wrigley (IMG-Golder Corporation, 2006). Historical cabins located along Mackenzie River, both north and south of Wrigley, are accessible by land or water and are often used seasonally by local trappers (IMG-Golder Corporation, 2006). Previous reports have identified the area around tributaries to the Mackenzie River have been used for camping (Golder, 2015). Some trapline cabins have been identified by Pehdzéh Kì First Nation in Wrigley, throughout White Sand Creek, and Blackwater River (locations are within PDA and LAA) (Dessau, 2012 [PR#13]).

²⁷ Fish Lake is a common lake name, and the location is not identified in this report

11.2.5.3.2 Sahtu Region

Tulita Renewable Resources Council identified several cabins belonging to Tulita community members, as well as an emergency cabin, along the MVWR²⁸ (in Tulita) that are frequently used and accessed all-season by ATV, vehicle, walking, or by boat in the summer (TRRC, 2022). Through the project-specific engagement program, participants identified important family cabins located 45 km south of Tulita and approximately 100 feet (30 m) from the PDA. Norman Wells Renewable Resources Council study participants identified several cabins belonging to Sahtu land users and community members located at Birch Creek (across from Twenty Mile Island), (near) Bluefish Creek, Canyon Creek (at the end of the cliff on the Tulita side), Prohibition Creek, at the mouth of Vermillion Creek, and at Twelve Mile Point (NWRRC, 2023). NWRRC (2023) also identified a safety shelter located at Vermillion Creek, which is available for use when land users are caught in bad weather or need a place to go.

Norman Wells Renewable Resources Council (2023) reported that there are areas for camping located around the safety shelter located at Vermillion Creek. Norman Wells Renewable Resources Council (2023) identified camping areas around Bear Rock (Petunizah) along the Bear River and at Bluefish Creek, used in the summer. Tulita Renewable Resources Council (TRRC, 2022) also identified camping areas at Four Mile Creek, Trout Lake, along the Great Bear River, and near the proposed Great Bear River Bridge.

Norman Wells Renewable Resources Council (2023) reported known fish camps and habitation sites are located Bluefish Creek. They stated that people do not camp as much as before, and that cabins are used more often when out on the land (NWRRC, 2023). These include cabins along the Mackenzie River and along the Islands on the Mackenzie River, outside of the NWRRC TLRU Study Area.

11.3 Project Interactions with Culture and Traditional Land Use

Table 11.16 identifies the project activities that might interact with cultural and traditional land use, including harvesting. These interactions are indicated by a check mark and are discussed in detail in Section 11.5 in the context of effects pathways, standard and project-specific mitigation, and residual effects. A justification for no effect is provided in the sub-chapters following the table.

Through the project-specific engagement program, participants reported concerns about potential effects of the Project on wildlife because of the increase of traffic during construction and operations and maintenance. Engagement participants also expressed interest in addressing the uncertainty in harvesting conditions (fish, wildlife), and working together to monitor wildlife harvesting in a manner which applies to stewardship practices based on Dene laws. The GNWT is open to and interested in discussing with Indigenous Governments, Indigenous Organizations, and other select affected parties, such as renewable resources councils, how best to integrate community-based monitoring into the Project.

²⁸ Exact locations of cabins and the emergency cabin identified by TRRC (2022) are not disclosed in this report.

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No effects on cultural sites or areas are predicted during construction due to road base, compaction, and resurfacing; and closure and reclamation of MVWR and temporary borrow sources/quarries, camps, and workspaces given no new disturbance is expected during these activities. No effects on access to resources or areas for cultural use or effects on cultural sites or areas are predicted during construction or operations and maintenance relative to employment and contracted goods and services as these activities similarly do not create a physical disturbance. Bridge and culvert maintenance is not expected to affect cultural use sites or areas as no new disturbance will take place during these activities.

Table 11.16 Project-Environment Interactions with Culture and Traditional Land Use

Physical Activities	Timing	Environmental Effects		
		Change in Availability	Change in Access	Change in Sites or Areas
Construction Phase				
Mobilization of equipment, materials, and fuel, resupply, and demobilization	Summer and winter	✓	✓	✓
Establishment and operation of camps	Year-round	✓	✓	✓
Site preparation of ROW, access, and workspaces	Winter	✓	✓	✓
Borrow source and quarry development and operations, including blasting, crushing, sorting, and stockpiling	Year-round	✓	✓	✓
Material haul	Year-round	✓	✓	✓
Embankment and quarry access road construction, including road cuts	Winter; road cuts in summer or winter	✓	✓	✓
Culvert installations	Summer or winter	✓	✓	✓
Road base placement, compaction, and surfacing	Summer	✓	✓	-
Water withdrawal to support construction activities	Year-round	✓	✓	✓
Closure and reclamation of MVWR and temporary borrow sources/quarries, camps, and workspaces	Summer	✓	✓	-
Employment and contracted goods and services ¹	Year-round	✓	-	-
Operations and Maintenance Phase				
Borrow source and quarry operations, including blasting, crushing, sorting, and stockpiling	Summer	✓	✓	✓
Material haul and stockpiling	Summer	✓	✓	✓
Operation of and activities at maintenance yards	Year-round	✓	✓	✓
Water withdrawal for dust control	Summer	✓	✓	✓
Employment and contracted goods and services ¹	Year-round	✓	-	-

Physical Activities	Timing	Environmental Effects		
		Change in Availability	Change in Access	Change in Sites or Areas
Presence and use of the highway	Year-round	✓	✓	✓
Highway and access road maintenance including snow clearing, repair, grading, dust control	Year-round	✓	✓	✓
Vegetation control	Summer	✓	✓	✓
Bridge and culvert maintenance	As needed	✓	✓	-

Notes:

✓ = Potential interaction

- = No interaction

- 1 Project employment and expenditures are generated by most project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, “Employment and contracted goods and services” have been introduced as an additional component under each project phase.

11.4 Assessment of Residual Effects on Culture and Traditional Land Use

Based on project interactions with the environment identified in Table 11.16, the Project may affect the Culture and Traditional Land Use, Including Harvesting VC (“cultural use”). Potential effects, effect pathways, and mitigation measures to reduce the effects on cultural use, as well as residual effects and associated analytical assessment techniques, are described in Section 11.4.1.

11.4.1 Analytical Assessment Techniques

Cultural use depends on the conditions for traditional activities and practices being present; that is, that traditional resources are available to be harvested and lands are accessible, including sites such as harvesting areas and that harvesters are available to harvest and are not otherwise working on the Project. The effects assessment considers change in the distribution, diversity, and abundance of traditionally used resources, access to those resources and areas, and changes to the sites and areas themselves. The assessment of project effects on cultural use considers the conclusions from the assessments of wildlife and wildlife habitat (Chapter 19), vegetation and wetlands (Chapter 18), fish and fish habitat (Chapter 17), water and sediment quality (Chapter 16), air quality (Chapter 12), and noise (Chapter 13) where they apply to potential project effects on cultural use and harvesting. Information from publicly available sources was also considered where Indigenous Governments, Indigenous Organizations, and other affected parties have identified potential pathways of effects based on their experiences with other development projects. This assessment acknowledges that Indigenous Governments, Indigenous Organizations,

and other affected parties may choose not to practice traditional activities or use traditional sites and areas near the Project for various cultural, aesthetic, or spiritual reasons.

11.4.2 Change in Availability of Traditional Resources for Cultural Use

11.4.2.1 Project Pathways

The Project has the potential to affect the availability of traditional resources for cultural use including wildlife, plants, fish, and water, during construction and operations and maintenance. Construction activities with potential to affect availability of traditional resources for cultural use include:

- Vegetation clearing and control for the establishment and operation of camps
- Clearing of the ROW, access, and workspaces; borrow source and quarry development and operations, including blasting, crushing, sorting, and stockpiling
- Embankment and quarry access road construction, including road cuts
- Culvert installations and maintenance
- Water use for camp use, winter travel lane construction, compaction and dust control
- Snow clearing, grading, and dust control
- Mobilization and demobilization of equipment, materials, and fuel
- Closure and reclamation of the MVWR and temporary borrow sources/quarries, camps, and workspaces

During operations, activities also have the potential to directly or indirectly affect the availability of traditional resources for cultural use, such as:

- Borrow and quarry operations, including blasting, crushing, sorting, and stockpiling, and material haul and stockpiling
- Snow clearing, grading, and dust control
- Vegetation control
- Operations of camps
- Water withdrawal for dust control
- Use of the highway

11.4.2.1.1 Changes to Wildlife

Wildlife health may be affected through contact with or ingestion of soil, sediment, food, or water and through sensory disturbance during construction and operations and maintenance phases. The Project has the potential to affect wildlife as a resource for cultural use during construction and operations and maintenance phases of the Project due to changes in habitat, mortality, and health. Several NWRRC study participants raised concerns about potential effects on wildlife due to contamination from vehicle fluid and other contaminants during road construction and operations and maintenance if vehicles are broken down and abandoned, especially for extended periods of time (NWRRC, 2023). The NWRRC study participants reported there have been several instances where vehicles have been abandoned for months, and the MVWR between Fort Good Hope and Norman Wells is particularly notable for vehicle abandonment (NWRRC, 2023). Norman Wells Renewable Resources Council communicated that animals can smell the chemicals from the vehicles and will move away from the area or will change their route (NWRRC, 2023).

Physical activities during construction (vegetation clearing, beaver dam removal), and sensory disturbance (i.e., noise, light, dust) from operational camps, clearing ROW, access and workspace, borrow source and quarry development operations (blasting, crushing, sorting, stockpiling), and embankment and quarry access road construction and road cuts, as well as culvert installations, can have direct and indirect effects on the availability of wildlife within the LAA. The construction and operations and maintenance of roadways and borrow/quarry locations may create physical barriers and sensory disturbances have potential to affect wildlife movement patterns (for example, caribou movement), and hinder wildlife’s ability to move throughout the landscape during project construction and operations and maintenance, thus potentially reducing the number of animals available for harvest.

Potential pathways which may influence caribou and moose include direct disturbance to preferred habitats used during their annual cycle (overwintering, calving, fall) including wetlands and marshes, migration routes and corridors and mature forests (Dehcho First Nations, 2011; McDonald, 2015; EDI, 2023). Norman Wells Renewable Resources Council reported that previous effects of road construction and operations and maintenance have affected migratory patterns (birds and wildlife) and calving locations of wildlife (specifically large ungulates) in the NWRRC TLRU Study Area and around the MVWR (NWRRC, 2023). As stated in Section 10.5.5.3, the Project is expected to result in changes in boreal caribou and moose health within the Caribou and Moose LAA (which is the same area as the RAA for cultural use). Exposure to potential contaminants and sensory disturbance may occur within the Caribou and Moose LAA as a result of the Project; however, it is anticipated that a change in boreal caribou and moose health will remain within the natural range of variability and the residual effect is not expected to alter the population viability or persistence of boreal caribou and moose within the Caribou and Moose LAA.

Operations and maintenance activities are not anticipated to result in direct loss of wildlife habitat; however, indirect effects, including sensory disturbance (noise, light, dust) associated with the Project (i.e., borrow source and quarry operations including blasting, crushing, sorting, stockpiling, maintenance camps), can potentially affect the availability of wildlife adjacent to the LAA and along the highway due to the continuation of edge effects and potential change in wildlife

movements that occurred during the construction phase. Project-related vehicle movements within the LAA during construction, and public traffic resulting from the presence of the highway during operations and maintenance, are the primary pathways with potential to increase wildlife mortality risk by increasing the potential for vehicle-wildlife collisions.

Norman Wells Renewable Resources Council expressed concern that potential project effects on wildlife, including increased traffic and noise along the MVWR, and increase in non-resident visitors and hunters, may compound existing effects on wildlife identified by NWRRC, including effects related to noise, vehicle traffic, and non-resident hunters traveling on the MVWR (NWRRC, 2023). Following construction, the Project will enable year-round hunting and fishing along the ROW, which may place additional harvesting pressure on resources for current use. These pathways are further described in Chapter 10 (caribou and moose), (Section 10.4.4.3) and Chapter 17 (fish and fish habitat), (Section 17.4.3.2). Additional traffic for the purposes of snow clearing, grading, and dust control has potential to increase sensory disturbances to wildlife and can influence availability of harvestable wildlife near the LAA.

Wildlife health may be affected through potential run-off from snow clearing, grading, and dust control activities, which have potential to influence the quality of receiving terrestrial environments. These pathways are further described in air quality (Section 12.4.2, noise (Section 13.4.2), vegetation and wetlands (Section 18.3), fish and fish habitat (Section 17.4.3.2), bird and bird habitat (Section 20.3), socioeconomic impact assessment (Section 9.8), and wildlife and wildlife habitat (Section 19.3).

Concerns about potential effects of the Project on wildlife were raised by Pehdzéh Kì First Nation, specifically moose (Dessau, 2012 [PR#13]). Dehcho First Nations and Sahtu community members both raised concerns about potential effects of the Project on wildlife habitat, and specifically caribou health and well-being. Through the project-specific engagement program, participants expressed concerns about increased access to hunting activities and improper hunting practices by non-Indigenous harvesters as a result of the Project. Norman Wells Renewable Resources Council (2023) also provided examples of non-residents releasing wildlife from traps and have observed non-residents feeding wildlife. Additionally, NWRRC expressed concern about feeding wildlife because wildlife will look forward to human interaction and may have to be put down (NWRRC, 2023).

The Project has potential to change bird habitat, resulting in changes to bird health and bird mortality as a result of removal of upland and wetland habitats during vegetation removal for establishment and operation of camps; clearing of the ROW; access to workspaces; borrow source and quarry development and operations, including blasting, crushing, sorting, and stockpiling; and embankment and borrow source/quarry access road construction. Indirect effects (sensory disturbance and dust deposition) are predicted through the activities mentioned, as well as highway maintenance and use of the highway by the public during operations. These pathways are further described in Section 20.3 (bird and bird habitat). Changes in bird habitat may reduce the number of birds available to Indigenous harvesters at specific harvesting locations.

Sahtu harvesters in the Tulita area raised concerns about potential effects on waterfowl during project construction and operations and maintenance along Great Bear River (near the proposed Great Bear River Bridge) and explained that migration patterns have already shifted because of changing weather in the Sahtu Region. Different species of birds are starting to appear around Tulita that have not been observed in the past, specifically magpies (TRRC, 2022). However, TRRC reported that Sahtu harvesters and land users in the Tulita area are not sure why this is occurring (TRRC, 2022). Local knowledge from TRRC also identified a decline in waterfowl health and reported the presence of disease among waterfowl, which has affected TLRU in the Tulita area (TRRC, 2022).

11.4.2.1.2 Changes to Plants

Changes in vegetation and wetlands have the potential to reduce the number of plants and plant harvesting locations available to Indigenous harvesters. The Project has the potential to affect plants for cultural use during the construction and operations and maintenance phases of the Project. Changes to plants are anticipated to occur during construction as a result of clearing the ROW for the highway and clearing of areas for the borrow sources and quarries and associated access roads. Borrow and quarry source development, material haul, road compaction and surfacing, road cuts, culvert installation, and access road construction, in addition to reclamation of the MVWR and temporary borrow sources/quarries, camps, and workspaces, may result in loss or alteration of vegetated areas, alteration of surface and sub-surface water flow paths, and disturbance of the underlying soils, including potential effects of dust deposition from increased traffic and construction activities. Project activities requiring vegetation control may have potential to influence availability and access to vegetation sites if removed for clearing, or the construction and maintenance of culverts or bridges. These pathways are further described in Section 18.4 (Vegetation and Wetlands).

During the operations and maintenance phase of the Project, direct and indirect effects on vegetation availability will continue due to ongoing vegetation control and dust deposition associated with borrow source and quarry operations, material haul and stockpiling, road maintenance, and public use of the highway. Potential run-off from snow clearing and dust control activities has potential to cause changes to water quality and receiving environments. Increased highway traffic and maintenance will continue to increase access to vegetation. Increased sensory disturbance can influence harvesters’ and other land users’ sense of place and use of and access to important vegetation and wetland areas. Changes to vegetation and wetlands from the Project may also affect fish and fish habitat (see Section 17.4), wildlife and wildlife habitat (see Section 19.4), and people (see Sections 9.5, 9.7, and 9.9).

Concerns about potential effects were raised by Pehdzéh Kì First Nation and Dehcho First Nations, specifically potential effects on the land and forest (Dessau, 2012 [PR#13]). The SRRB raised concerns about potential effects on resident species, including effects from increasing invasive species, which can influence potential for wildfires (SRRB, 2016). Elders in the K’ásho Got’ıne and Tulita regions also noted concerns about potential effects associated with land clearing, including increased rates of thawing permafrost, leading to problems with vegetation establishment, erosion, and slumping on the banks of the Sahtu waterbodies, which has previously been linked to

erosion in Great Bear River and other waterbodies in the area (Auld and Kershaw, 2005; Golder, 2015). Changes in vegetation and wetlands and changes resulting from removal of permafrost may result in decreased plants and plant harvesting locations available to Indigenous harvesters.

Norman Wells Renewable Resources Council study participants raised concerns about changing temperatures and the cumulative effects of climate change on vegetation during project construction and operations and maintenance (NWRRC, 2023). However, NWRRC participants noted that the Project will provide access to other berry harvesting locations outside of the NWRRC TLRU Study Area (other than only at Canyon Creek) (NWRRC, 2023).

11.4.2.1.3 Changes to Fish

The Project has the potential to change fish and fish health during the construction and operations and maintenance phases of the Project. During construction, activities near watercourses, such as infilling around culvert installations and placement of rip rap along banks of waterbodies that will be crossed by the highway, have potential to result in increased fish mortality. Changes to riparian areas can affect fish health due to direct loss or barriers to fish habitat, as well as change in sediment quality. Culverts, if not appropriately designed or installed could prevent fish from accessing spawning and rearing habitats. Effects on fish health may occur if increased access to large-bodied fishing sites intensifies fishing. Arctic grayling is the most common large-bodied fish found in watercourses crossed by the Project and the most likely to be affected by an increase in fishing pressure. Most watercourses intersected by the Project are mainly limited to forage fish and would not be subject to increased fishing pressure (see Section 17.4.3.2).

During operations and maintenance, potential run-off from snow clearing, grading, and dust control activities has potential to cause change to water quality and aquatic environments. Changes to water quality can potentially occur during construction, operation, or maintenance of the highway (i.e., spills), which can potentially indirectly affect the health of fish and fish habitat and availability. Changes to fish habitat has potential to affect availability of harvested species (including sport fish), where present, and may affect fish and roe available to Indigenous harvesters at specific locations. These pathways are further described in fish and fish habitat (see Section 17.4.2).

Additionally, the Pehdzéh Kì N’deh area represents an important cultural area that identifies Pehdzéh Kì First Nation’s subsistence harvesting needs and fish habitats (DLUPC, 2006). Elders and land users in the Sahtu Region have also expressed concern about potential effects in this area, which may affect the health of the region’s fish, specifically fish habitat, spawning, and fish abundance due to direct effects from development and industry, as well as indirect effects from climate change (SRRB, 2021b; Golder, 2015).

Through the project-specific engagement program, participants expressed concerns that existing culverts along the MVWR have blocked the passage of fish along the river. Participants also expressed concern about potential effects of the Project on fishing at Great Bear Lake (outside the LAA) related to potential increased use of Great Bear Lake by recreational and local harvesters.

11.4.2.1.4 Changes to Water

The Project has the potential to affect water during the construction and operations and maintenance phases of the Project by potentially changing water quantity, quality, and drainage patterns. During construction, site preparation, borrow source and quarry development, water withdrawal, culvert installation, and embankment and quarry access road construction have potential to directly affect surface drainage patterns and cause sedimentation and erosion, which can indirectly affect streamflow or lake volume. Other project activities, including closure and reclamation of the MVWR, temporary borrow sources/quarries, temporary camps, and workspaces, can potentially affect surface drainage and lead to erosion and sedimentation.

During operations and maintenance, the the completed highway can ultimately create changes in streamflow patterns and erosion and sedimentation processes within streams. Additional operations and maintenance activities, including water withdrawal for dust suppression, have potential to affect streamflow and lake volume, though mitigation measures are considered effective at maintaining ecological requirements in lakes and streams (Section 15.5). Potential run-off from snow clearing, grading, and dust control activities has potential to change the quality of water and receiving aquatic environments. Changes in water quantity and quality have the potential to reduce the availability or quality of water to traditional users. This pathway is further described in Section 15.1.3 (water quantity) and Section 16.1.3 (water and sediment quality).

Elders, land users, and community members in the Sahtu Region previously expressed concern about potential effects of the Project on human health through water and air quality, and consequently the health of the region’s wildlife, fish, and vegetation (Golder, 2015). Sahtu Elders have linked decreasing water levels to a reduction in fish and wildlife habitat, as well as creating additional challenges for water navigation, travel, and fishing (Golder, 2015). Sahtu Region residents have expressed concerns about potential effects of the Project on water quality and quantity in the Sahtu Region, including contamination, which could be far reaching due to the speed at which surface and groundwater flows; patterns of surface water flow and potential groundwater changes; increased sediment from vegetation clearing along waterbodies from effects of blasting, runoff, and thawing permafrost (erosion, flooding, scouring, reduced land subsistence), which also can affect ground water and surface water; and effects on Norman Wells water quality (Dessau, 2012 [PR#13]; Golder, 2015).

Sahtu Renewable Resources Board reported concern that thawing permafrost will increase turbidity and solids in local streams, affecting water quality (SRRB, 2016). Norman Wells Renewable Resources Council (2023) reported that the water in Prohibition Creek and Vermillion Creek (as well as other spring-fed drinking water resources in the NWRRC TLRU Study Area, such as Canyon Creek) are also shallower in recent years and study participants are concerned about cumulative effects on creeks if water is taken from those areas for project activities (NWRRC, 2023). Concerns were raised regarding potential effects of the Project on permafrost and perpetuation of permafrost thaw, which has been linked to erosion in Great Bear River and other waterbodies in the area (Golder, 2015; Auld and Kershaw, 2005). Change in water quality and quantity could also affect the conditions for current use, potentially resulting in avoidance by Indigenous harvesters.

Physical changes caused by ground disturbance could result in changes to permafrost, slope and soil instability, erosion/sedimentation, and subsidence of the ground surface. Changes in permafrost may result in changes to vegetation relied upon by wildlife or by current use harvesters. These pathways are further described in Section 14.4 (soils, terrain, and permafrost).

As discussed in Section 5.2 (project design), the Project’s routing and design have integrated the existing MVWR to the extent practicable, which will reduce the effects on the availability of resources for cultural use because there will be reduced direct loss of vegetation and wildlife habitat as compared to clearing a new ROW. Project-specific management plans, including the WMMP, Permafrost Protection Plan (PPP), Erosion and Sedimentation Control Plan (ESCP), and SCP, will be implemented during the construction and operations and maintenance phases, and standard industry practices and mitigation measures will also be implemented. These are summarized in Table 11.17.

11.4.2.2 Mitigation Measures

Measures proposed to reduce changes to the availability of traditional resources are summarized in Table 11.17.

Table 11.17 Potential Effects and Mitigation Measures for Culture and Traditional Land Use – Change in availability

Effect Name	Effect Pathway	Mitigation Measures
<p>Change in availability of traditional resources for cultural use</p>	<ul style="list-style-type: none"> • Vegetation clearing associated with construction could result in a loss of habitat for species of traditional importance, including plants and animals relied on for traditional hunting, trapping, or plant harvesting • Sensory disturbance has the potential to affect the availability of habitat or distribution of species of traditional importance • Loss or alteration of habitat resulting from disturbance to watercourses • Potential effects on wildlife health, which could affect the availability of traditional resources • Indirect effects on the experience of Indigenous peoples, which adversely alter the perceived value of availability of traditional resources for cultural use 	<ul style="list-style-type: none"> • The GNWT will notify communities of project activities and schedules, including provision of project maps and design components, and discuss key traditional harvesting periods. • Removal of vegetation will be limited to the width of the ROW and workspaces. • Known areas of collection of plants of interest to Indigenous Governments, Indigenous Organizations, and other affected parties will be avoided where possible. Clearing schedules will be communicated in advance of clearing to provide an opportunity to collect plant material from the PDA. • A project-specific ESCP will be developed and implemented. • The Project will follow measures in the PPP to reduce ponding, erosion, and damage to permafrost. • A Wildlife Management and Monitoring Plan (WMMP) will be developed and implemented. The WMMP will contain detailed monitoring and mitigation measures to be implemented for the duration of the construction and operations and maintenance of the Project. • Water withdrawal will be in accordance with Fisheries and Oceans Canada (DFO) measures to protect fish and fish habitat and the Interim code of practice: end-of-pipe fish protection screens for small water intakes in freshwater. • Water withdrawal for dust suppression will be completed from candidate sources identified in Chapter 5, and extraction volumes will be limited to amounts that will not affect the ecological function of the waterbody. • Water flow and fish passage will be maintained during construction. • Culverts will be designed and constructed to maintain water flow and fish passage. • Drainage culverts will be constructed along the roadway to facilitate water movement and maintain drainage patterns. • Construction on cleared ground will be conducted during dry or frozen conditions, or use rig matting to reduce soil compaction, rutting, and erosion.

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Effect Name	Effect Pathway	Mitigation Measures
<p>Change in availability of traditional resources for cultural use (cont'd)</p>		<ul style="list-style-type: none"> • Construction and quarry development activities will be reduced, where possible and where spatial overlap is expected, during sensitive periods for wildlife, in accordance with the WMMP. • Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP. • Caribou and moose will have the right of way on all project infrastructure during construction as detailed in the WMMP. • The WMMP will outline how risks to migratory birds will be managed in accordance with ECCC’s Guidelines to Reduce Risk to Migratory Birds (ECCC, 2021) if activities that could result in risk of harm cannot be avoided (e.g., pre-clearing nest surveys). • Vegetation clearing will be completed outside the migratory bird nesting period of May 4 to August 22 (Zone B8; ECCC, 2018) and will consider the Critical Breeding Periods for Raptor Species of the Northwest Territories (Shank and Poole, 2016) to avoid disturbing species that breed prior to the migratory bird nesting periods. • Abandoned sections of MVWR ROW and access roads will be closed and reclaimed. • Rip rap repair and culvert construction will be timed to avoid restricted activity periods for fish, as applicable to the watercourse. • A Spill Contingency Plan (SCP) will be developed and Implemented Spill contingency measures will be implemented in accordance with the SCP. • A Waste Management Plan (WMP) will be developed and implemented. • An Explosives Management Plan (ExMP) will be developed and implemented. • The SCP will include procedures to prevent and respond to spills. • Equipment originating outside of the NWT will be cleaned prior to mobilization to avoid introduction of invasive species.

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Effect Name	Effect Pathway	Mitigation Measures
Change in availability of traditional resources for cultural use (cont'd)		<ul style="list-style-type: none"> • Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m from the high-water mark and in a manner to prevent any deleterious substances from entering the water. • Machinery will not be left in any waterbody. • Vehicles parked for more than 2 hours will use drip trays. • A project-specific PPP will be developed and implemented. • A dust control program using water will be implemented during construction and operations and maintenance.

Valued component-specific mitigation measures are also provided in assessment chapters for wildlife and wildlife habitat (see Section 19.4), vegetation and wetlands (see Section 18.4), fish and fish habitat (see Section 17.4), water and sediment quality (see Section 16.4), air quality (see Section 12.4), and noise (see Section 13.4). Recommendations from Indigenous Governments, Indigenous Organizations and other affected parties included:

- Avoid access to Wrigley
- Move alignment as far as possible from Mackenzie River
- Avoid sensitive moose areas, including harvesting²⁹ (KM 709.5 to 711, Ochre River KM 724, White Sand Creek KM 732, Vermillion Creek KM 750.1, Bob’s Canyon Creek KM 753.5, Dam Creek KM 764)
- Avoid traditional hunting ground (Vermillion Creek KP 748 to KP 754)

These recommendations were incorporated into project design, where possible (see Table 5.2), noting that the Dehcho Region segment of the Project begins approximately one kilometre north of Wrigley. Specific recommendations from Indigenous Governments, Indigenous Organizations and other affected parties related to availability of traditional resources for cultural are summarized in Table 11.18.

²⁹ Note KM are relative to MVWR; Dessau (2012 [PR#13]); Table 11, Table 12; Dessau (2012 [PR#13]: 39)

11.4.2.2.1 Wildlife

Through a review of publicly available literature, and the project-specific engagement program, additional mitigation recommendations have been provided by Indigenous Governments and Indigenous Organizations and certain other affected parties relative to the availability of wildlife and wildlife harvesting in Table 11.18.

Table 11.18 Recommended Mitigations by Indigenous Governments, Indigenous Organizations, and Other Affected Parties

Recommendations	Commitment
Project personnel will be prohibited from hunting wildlife while working on the Project (Dehcho First Nations, 2011).	Project personnel will be prohibited from hunting wildlife while housed in work camps for the Project (Table 11.22).
Identify and implement measures to encourage increased traditional harvesting of wolf and bear in order to limit population growth, while monitoring predator populations; implementing measures to revive and increase traditional harvesting styles should be considered (Dehcho First Nations, 2011).	The GNWT will continue to implement existing wildlife monitoring programs consistent with its role as wildlife resource manager, recognizing that new programs and additional resources may be required to address issues specific to the Project. GNWT will continue to refine the WMMP throughout the environmental assessment process and is open to and interested in discussions with Indigenous Governments, Indigenous Organizations, and other affected parties on how best to incorporate their recommendations.
On-going monitoring of predator and prey species needs to be further evaluated, with a focus on boreal caribou predation rates (Dehcho First Nations, 2011).	The boreal caribou collar program, currently completed by GNWT-ECC, will continue to collect ongoing information on distribution, movements, and mortality. Existing and newly collected data will be analyzed to obtain movement information to assist in determining adverse effects of the Project.
Installation of wildlife cameras between Wrigley and Norman Wells to monitor potential effects of project construction (land disturbance, i.e., clearing) on wildlife migration (Dehcho First Nations, 2011).	
Installation of wildlife cameras between Wrigley and Norman Wells to monitor potential effects of project construction (land disturbance, i.e., clearing) on wildlife migration (Dehcho First Nations, 2011).	
Limiting any disturbance during the mid to late winter when energy conservation is important and wildlife relocation is difficult due to snow conditions (Dehcho First Nations, 2011).	The area of direct ground disturbance will be limited by following the pre-existing winter road alignment to the extent possible (Table 11.22). Construction and quarry development activities will be reduced, where possible and where spatial overlap is expected, during sensitive periods for wildlife, in accordance with the WMMP (Table 11.17, Table 11.22).

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Recommendations	Commitment
<p>Protecting known and likely calving habitat and limiting disturbance to wetlands, marshes, and burn areas from late April and through early June (Dehcho First Nations, 2011).</p>	<p>A WMMP will be developed and implemented (Table 11.17).</p> <p>Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP (Table 11.17, Table 11.22).</p> <p>Construction and quarry development activities will be limited during sensitive periods for wildlife in accordance with the WMMP (Table 11.17, Table 11.22).</p> <p>Caribou and moose will have the right of way on all project infrastructure during construction as detailed in the WMMP (Table 11.17, Table 11.22).</p>
<p>With support from the GNWT Department of Infrastructure (INF) and the GNWT Department of Environment and Climate Change (ECC), Dehcho First Nations (2011), and NWRRC (2023) request that harvesting uncertainties should be addressed in relation to increased harvesting pressure, including:</p> <ul style="list-style-type: none"> • Mandatory hunting monitors or guardians for all non-resident hunters • Game wardens to monitor hunting game for non-resident hunters • Regulations and restrictions for non-resident hunters (i.e., hunting locations and allowances) 	<p>Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project (Table 11.22).</p> <p>The GNWT will continue to implement existing wildlife monitoring programs consistent with its role as wildlife resource manager, recognizing that new programs and additional resources may be required to address issues specific to the Project.</p> <p>The GNWT will continue to refine the WMMP throughout the environmental assessment process and is open to and interested in discussions with Indigenous Governments, Indigenous Organizations, and other affected parties on how best to incorporate their recommendations.</p> <p>The GNWT will establish two positions dedicated to assisting with the implementation of the WMMP.</p> <p>The WMMP will be designed to determine if the highway is resulting in a pattern or level of harvest mortality for moose and caribou that would suggest a conservation concern or need for additional harvest management actions.</p> <p>The GNWT is open to further discussions with the Guardian Program to explore how best implement it for the Project. Environmental Monitors will be employed as part of the contracting of the Project.</p>
<p>Implement a 5 to 10-year moratorium on hunting to protect and monitor the baseline of caribou and moose, and to protect large ungulates (more targeted) (Dehcho First Nations, 2011).</p>	<p>The WMMP will be designed to determine if the highway is resulting in a pattern or level of harvest mortality for moose and caribou that would suggest a conservation concern or need for additional harvest management actions.</p>

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Recommendations	Commitment
<p>Avoid or reroute around moose pastures and habitats and maintain moose pastures (Dehcho First Nations, 2011).</p>	<p>The alignment routing corridor has been moved to the west and has been expanded in an area of moose pasture north of Mount Gaudet to accommodate a route alternative (see Section 5.2.3). Removal of vegetation will be limited to the width of the ROW and workspaces (Table 11.17). Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP (Table 11.17, Table 11.22).</p>
<p>It is recommended that safety and security protocols be in place to mitigate potential project effects causing disruptive occurrences, such as effects to migration routes, in the NWRRC TLRU Study Area (NWRRC, 2023).</p>	<p>A WMMP will be developed and implemented (Table 11.17). Construction and quarry development activities will be reduced, where possible and where spatial overlap is expected, during sensitive periods for wildlife, in accordance with the WMMP (Table 11.17; Table 11.22). Caribou and moose will have the right of way on all project infrastructure (Table 11.17, Table 11.22). Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP (Table 11.18, Table 11.24). The WMMP will outline how risks to migratory birds will be managed in accordance with ECCC’s Guidelines to Reduce Risk to Migratory Birds (ECCC, 2021) if activities that could result in risk of harm cannot be avoided (e.g., pre-clearing nest surveys) (Table 11.17). Vegetation clearing will be completed outside the migratory bird nesting period as specified in the WMMP.</p>
<p>Monitor potential effects of vibration from project construction and operation on wildlife (Dehcho First Nations, 2011)</p>	<p>The GNWT will continue to implement existing wildlife monitoring programs consistent with its role as wildlife resource manager, recognizing that new programs and additional resources may be required to address issues specific to the Project. GNWT will continue to refine the WMMP throughout the environmental assessment process and is open to and interested in discussions with Indigenous Governments, Indigenous Organizations, and other specific affected parties on how best to incorporate their recommendations. Vehicles and equipment will be equipped with manufacturer-recommended noise muffling equipment (Table 11.24).</p>

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Recommendations	Commitment
<p>The GNWT-ECC work with NWRRC (and other local Indigenous Governments, Indigenous Organizations and RRCs) to develop a conservation plan prior to construction, and that all companies working on the Project should be aware of the plan and work together to mitigate potential project effects on wildlife. This should include a specific management plan to monitor effects to caribou (I.e., noise, light, overharvesting) (Dehcho First Nations, 2011; SRRB, 2007; NWRRC, 2023).</p>	<p>A WMMP will be developed and implemented (Table 11.17).</p> <p>The GNWT will continue to implement existing wildlife monitoring programs consistent with its role as wildlife resource manager, recognizing that new programs and additional resources may be required to address issues specific to the Project.</p> <p>GNWT will continue to refine the WMMP throughout the environmental assessment process and is open to and interested in discussions with Indigenous Governments, Indigenous Organizations, and other specific affected parties on how best to incorporate their recommendations.</p>
<p>NWRRC (2023) and TRRC (2022) recommended monitoring wildlife and road use (before and after project construction and during operation) to identify changes.</p>	<p>A WMMP will be developed and implemented to mitigate, monitor, and manage effects of the Project on wildlife and wildlife habitat (Table 11.17).</p> <p>The GNWT will continue to refine the WMMP throughout the environmental assessment process and is open to and interested in discussions with Indigenous Governments, Indigenous Organizations, and other affected parties on how best to incorporate their recommendations.</p>
<p>Place speed limits on the highway to protect wildlife in the area and decrease potential wildlife fatalities due to increased vehicle traffic (TRRC, 2022).</p>	<p>Speed limits will be posted on the public highway (Table 11.24).</p> <p>Vehicle speeds will be limited to 50 kilometres per hour (km/h) on unfinished project road surfaces (Table 11.24).</p>
<p>It is recommended that the existing pipeline ROW be monitored by skidoo to identify and to prevent breaks and leaks and to prevent effects to receiving environment, including wildlife (NWRRC, 2023).</p>	<p>The Norman Wells Pipeline is managed by a third party and is not part of the Project.</p>
<p>Community members undertake monitoring (before, during, after the Project) and inform community members about upcoming projects, hazards, and potential project effects to the land, water, and wildlife, and how effects affect TLRU (NWRRC, 2023; TRRC, 2022).</p>	<p>A WMMP will be developed and implemented (Table 11.17).</p> <p>The GNWT is open to and interested in discussions with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, on how best to integrate community-based monitoring into the Project.</p>

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Recommendations	Commitment
<p>It is recommended that TK be integrated into wildlife monitoring practices with the involvement of an Elder/Wildlife Guardian, and that Indigenous Governments, Indigenous Organizations and renewable resource councils collaborate with the SRRB and the GNWT to develop monitoring programs (NWRRC, 2023).</p>	<p>A WMMP will be developed and implemented (Table 11.17).</p> <p>The GNWT is open to and interested in discussions with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, on how best to integrate community-based monitoring into the Project.</p> <p>The GNWT is open to further discussions with the Guardian Program to explore how best implement it for the Project. Environmental Monitors will be employed as part of the contracting of the Project.</p>
<p>Protect the environment and wildlife from contamination from vehicles or machinery on the highway, including:</p> <ul style="list-style-type: none"> • Monitor vehicle breakdowns, accidents along the highway • Fines for vehicle abandonment • Requirement of clean-up (NWRRC, 2023; TRRC, 2022) 	<p>The GNWT will implement a Spill Contingency Plan (SCP) for the Project. The SCP will include procedures to prevent and respond to spills (Table 11.17).</p> <p>There are existing mechanisms to deal with abandoned vehicles. The Royal Canadian Mounted Police (RCMP) should be contacted if an abandoned vehicle has been found. If there is a spill associated with the vehicle the NWT Spill hotline should be called.</p>
<p>Community engagement participants expressed concern about hunting rights and whether the highway will increase the amount of harvesting in the area (Engagement April to July 2022; Engagement; November to December 2022; Engagement November 2022 to February 2023).</p>	<p>Project personnel will be prohibited from hunting wildlife while housed in work camps for the Project (Table 11.22).</p> <p>The GNWT will continue to implement existing wildlife monitoring programs consistent with its role as wildlife resource manager, recognizing that new programs and additional resources may be required to address issues specific to the Project. GNWT will continue to refine the WMMP throughout the environmental assessment process and is open to and interested in discussions with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, on how best to incorporate their recommendations.</p>

11.4.2.2.2 Plants

Through the project-specific engagement programs and project-specific TLRU studies (TRRC, 2022), participants identified the following recommendations in Table 11.19.

Table 11.19 Recommended Mitigation Measures by Indigenous Governments, Indigenous Organizations, and Other Affected Parties

Recommendations	Commitment
The Project to provide timber from land clearing (slashing) to members of the local communities (project-specific engagement program; TRRC, 2022).	Merchantable timber will be limbed and decked in a dry area and made available to a receiver with an authorization (Timber Cutting Permit or Timber Cutting Licence) from the GNWT. Merchantable timber includes trees without defects with a diameter at breast height (dbh) of at least 14 centimetres (cm). Non-merchantable trees will be limbed and stacked for community use, where possible.
Allow for natural revegetation, because vegetation naturally grows back quickly, as observed on snowmobile trails (project-specific engagement program; TRRC, 2022).	Abandoned sections of MVWR ROW and access roads will be closed and reclaimed. Closure and reclamation will promote re-establishment of vegetation (Table 11.17, Table 11.22, Table 11.24).

11.4.2.2.3 Fish

Through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies, additional mitigation recommendations have been provided relative to the availability of fish and fish harvesting, in Table 11.20.

Table 11.20 Recommended Mitigations by Indigenous Governments, Indigenous Organizations and Other Affected Parties

Recommendations	Commitment
Sahtu Elders and land users have emphasized the importance of maintaining stream flows during and after the Project to provide fish habitat and access to spawning areas and recommended maintaining stream flows through natural drainage or drainage diversions (Golder, 2015).	Culverts will be designed and constructed to maintain water flow and fish passage. Water flow and fish passage will be maintained during construction. Drainage culverts will be constructed along the roadway to facilitate water movement and maintain drainage patterns.
Through the project-specific engagement programs, participants recommended monitoring harvested fish species (within the NWRR TLRU and TRRC TLRU Study Areas).	The GNWT is open to and interested in discussing with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, how best to integrate community-based monitoring into the Project.

11.4.2.2.4 Water

Through the Project-specific engagement program, a review of publicly available literature, and Project-specific TLRU studies, additional mitigation recommendations have been provided relative to water (quality and quantity) (Table 11.21).

Table 11.21 Recommended Mitigations by Indigenous Governments, Indigenous Organizations, and Other Affected Parties

Recommendations	Commitment
Relative to previous projects, Sahtu Dene and Métis recommend effects to water should be reduced and water quality monitoring should be conducted in all areas, including the smallest streams, and suggest more frequent communication with Indigenous Governments and Indigenous Organizations regarding water quality and fish health (Golder, 2015).	The GNWT is open to and interested in discussing with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, how best to integrate community-based monitoring into the Project.
Water monitoring to be undertaken by Indigenous community members, Indigenous Governments or Indigenous Organizations (i.e., local contract) (TRRC, 2022; NWRRC, 2023).	The GNWT is open to and interested in discussing with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, how best to integrate community-based monitoring into the Project.
It is requested that water in the NWRRC TLRU Study Area, particularly the creeks that are used as drinking water sources (i.e., Prohibition Creek, Canyon Creek, Vermillion Creek, Great Bear River), be monitored at a minimum of once every two months by community member to prevent potential project effects related to water quality and quantity (NWRRC, 2023).	The GNWT is open to and interested in discussing with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, how best to integrate community-based monitoring into the Project.
It is recommended that TK be integrated into water monitoring practices with the involvement of an Elder/Wildlife Guardian, and that Indigenous Governments, Indigenous Organizations and renewable resource councils collaborate with the SRRB and the GNWT to develop monitoring programs (NWRRC, 2023; TRRC, 2022).	The GNWT is open to further discussions with the Guardian Program to explore how best implement it for the Project. Environmental Monitors will be employed as part of the contracting of the Project. The GNWT is open to and interested in discussing with Indigenous Governments, Indigenous Organizations and other affected parties, such as renewable resources councils, how best to integrate community-based monitoring into the Project.
It is requested that water for the Project be taken from the Mackenzie River for construction and operation needs (most of the creeks in the NWRRC TLRU Study Area feed into the Mackenzie River) (NWRRC, 2023).	Water withdrawal for dust suppression will be completed from candidate sources identified in Chapter 5, and extraction volumes will be limited to amounts that will not affect the ecological function of the waterbody (Table 11.17, Table 11.22).

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Recommendations	Commitment
<p>It is requested that water for project construction and operation not be taken from Trout Lake (or any creek coming from the mountains) (NWRRC, 2023; TRRC, 2022).</p>	<p>Water withdrawal will be within the limits of water licences and in accordance with the DFO measures to protect fish and fish habitat (e.g., DFO, 2010, 2013) and other applicable guidance.</p> <p>Water is proposed to be taken from the Mackenzie River at access points where it is practical to do so.</p>
<p>It is recommended the vehicles and machinery be inspected prior to use to prevent potential project-related leaks and spills into the receiving environment, particularly open sources of water (NWRRC, 2023).</p>	<p>An SCP will be developed and Implemented (Table 11.17).</p> <p>Equipment originating outside of the NWT will be cleaned prior to mobilization to avoid introduction of invasive species (Table 11.17).</p> <p>Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m from the high-water mark and in a manner to prevent any deleterious substances from entering the water (Table 11.17).</p> <p>Machinery will not be left in any waterbody (Table 11.17).</p>
<p>It is requested that vehicles and machinery be used a safe distance from open sources of water to prevent project-related contamination of open water sources in the LAA and RAA (project-specific engagement program; NWRRC, 2023).</p>	<p>Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m from the high-water mark and in a manner to prevent any deleterious substances from entering the water (Table 11.17).</p> <p>Machinery will not be left in any waterbody (Table 11.17).</p>
<p>Avoid natural swamp areas and maintain natural drainage of swamp areas (project-specific engagement program).</p>	<p>Removal of vegetation will be limited to the width of the ROW and workspaces (Table 11.17).</p>

11.4.2.3 Residual Effects on Availability of Traditional Resources for Cultural Use

As noted in Section 11.2.3, Indigenous Governments and Indigenous Organizations engaged on the Project identified an interest in traditionally harvested resources, including caribou, moose, furbearers, fish, and waterbodies in the Dehcho and Sahtu regions, and have expressed concerns that project activities could affect the quality, quantity, and distribution of traditional resources. Residual project effects on the distribution, quality, and quantity of wildlife, fish, vegetation, and water could have a consequent effect on the availability of traditional resources for cultural use.

11.4.2.3.1 Wildlife

The wildlife and wildlife habitat assessment (see Chapter 19) considers effects on wildlife habitat and health through removal of terrestrial habitat, and to a lesser extent wetland habitat for wildlife. However, the effects of vegetation removal on availability of resources for cultural use will be reduced as some of the LAA is already subject to habitat alteration due to the existing MVWR. Wildlife species of interest to traditional land users most likely to be affected by a direct loss of habitat are those that inhabit forested and shrub habitats, such as furbearers (e.g., American marten [*Martes americana*] and black bear [*Ursus americanus*]). Aquatic species such as beaver may be temporarily affected if dam removal is required, but wetland habitat connectivity will remain during construction.

Construction and operations and maintenance of the Project has the potential to change the availability of traditionally harvested animals within the LAA due to changes in habitat (direct habitat loss, sensory disturbance) and movement and mortality risk as assessed in Chapter 19 (wildlife and wildlife habitat) and Chapter 10 (caribou and moose). Vehicle-related wildlife mortality during construction and operations and maintenance will affect a wide range of species. Species most likely to be involved in vehicle-wildlife collisions are small mammals (e.g., rodents) and large mammals attracted to the LAA that provides increased foraging opportunities (e.g., black bear, muskox).

The non-traditional land and resource use assessment (see Section 9.8) considers potential effects on culturally sensitive areas and land use, including recreational hunting and fishing.

11.4.2.3.2 Plants

The vegetation and wetlands assessment (see Chapter 18) considers potential effects on landscape diversity, community diversity, species diversity, and wetland function. As the Project largely follows the existing MVWR, effects on traditionally harvested plant species are anticipated to be relative to the remaining undisturbed landscape within the RAA. Although the spatial distribution of plant species of interest to Indigenous Governments, Indigenous Organizations, and renewable resource councils within forested and shrubland areas in the LAA is unknown, these species are expected to be abundant in the RAA and will remain abundant following project construction. Reclamation of the borrow sources and associated access has potential to have positive effects on

habitat and species availability; however, it is acknowledged that the process of clearing, and reclamation of these sites may change vegetation community distribution and abundance. Even if reclamation is successful, these sites may be unavailable for cultural use activities during the time required for traditionally harvested plants to become re-established.

11.4.2.3.3 Fish

The fish and fish habitat assessment (see Chapter 17) considers potential effects on fish habitat and fish health. Changes to fish habitat at each watercourse are anticipated to be small in relation to the overall watercourse and similar habitat is widely available elsewhere in the watercourse. No limiting habitat features will be lost that may result in reduced fish productivity. Fishing pressure may increase during project operations due to increased access to sport fish-bearing waters, potentially resulting in reduced stock levels. This effect would occur at larger watercourses which contain large-bodied fish, which would primarily be at watercourses crossed by bridges. Arctic grayling is the most common large-bodied fish found in watercourses crossed by the Project and the most likely to be affected by an increase in fishing pressure. New road access, however, may facilitate access to fishing lakes not previously accessible in summer.

11.4.2.3.4 Water

The water quantity assessment (see Chapter 15) considers potential effects on changes to stream flows and lake volume, and water sediment quality (see Chapter 16) assesses effects on water and sediment quality. The timing of water withdrawals has potential to effect stream-flows, particularly in the winter, which have the potential to affect water harvesting activities. With the implementation of mitigation measures, effects on water and sediment quality and quantity are not expected to affect cultural use. Water and sediment quality will be monitored during project activities, as required, to confirm effectiveness of mitigation measures and to facilitate adaptive management. Effects on cultural use of water for drinking and cooking is not anticipated.

The terrain, soils, and permafrost assessment (see Chapter 14) considers potential effects on permafrost, and states that changes to permafrost are expected but will be limited to areas of ice-rich, thaw-sensitive permafrost within the LAA. Road construction and the ancillary development of permanent borrow sources and quarries will result in the direct loss of soil but this will be confined to the PDA. The use of existing borrow sources and quarries (where applicable) will further reduce the need for disturbing new ground. Effects of direct loss of soil are restricted to the PDA.

11.4.2.3.5 Summary of Change in Availability of Traditional Resources

Residual effects on wildlife, fish, vegetation, and water have the potential to affect the activities that are supported by these resources, including hunting, trapping, fishing, plant harvesting, and cultural use of water. However, appropriate conditions for cultural use entail more than the availability of traditional resources and this assessment acknowledges that Indigenous Governments and Indigenous Organizations may choose not to pursue cultural use activities near the Project for a variety of personal, practical, aesthetic, and spiritual reasons. Various biophysical and socio-economic environmental conditions may also affect harvesting. For example, a change in air or water quality, noise, or altered visual aesthetics may deter individuals from harvesting traditional resources. Refer to noise (see Chapter 13), air quality (see Chapter 12), and non-traditional land and resource use (see Chapter 9) for further details on effects of noise and air emissions on land users in the assessment areas.

Overall, the residual effects of the Project on the availability of traditional resources for cultural use are predicted to be adverse and low to moderate in magnitude. Within the PDA, the Project aligns with the existing MVWR for much of its length, which will serve to avoid or reduce potential project effects. Potential sensory disturbances (such as noise) during construction may influence wildlife behaviour outside the PDA and within the LAA, which may create additional challenges for wildlife harvesting (i.e., increased wildlife movement, change in movement patterns). Where the Project does not follow the MVWR alignment, or in areas where the MVWR is widened, project activities may remove traditionally harvested plant species from the PDA and potentially affect the distribution and abundance of wildlife and fish species in the LAA; however, the direct and indirect loss of habitat is expected to be relatively small compared to the remaining habitat availability in the RAA.

During operations, public traffic resulting from the presence of the highway may increase wildlife risk; however, low daily traffic volumes, widening of the ROW, and improved visibility from the removal of dense brush along the highway ditches will serve to moderate this effect. Residual effects on vegetation, wildlife and fish will not pose a threat to the long-term persistence and viability of species in the RAA. Similarly, residual effects on vegetation will not result in the loss of vegetation communities in the LAA. With the application of mitigation, residual effects on water quality are negligible. Residual effects on soils, terrain, and permafrost are predicted to be primarily within the PDA, however there may be edge effects within the LAA.

Overall, during both construction and operations and maintenance, the residual effects of the Project on the availability of traditional resources for cultural use will be adverse, extend to the LAA, be low to moderate in magnitude, long-term in duration, and irreversible. Timing is seasonal based on wildlife movement, habitat availability, and preferred hunting times, as well as the seasonality of vegetation for traditional purposes.

11.4.3 Change in Access to Resources and Areas for Cultural Use

11.4.3.1 Project Pathways

Access to traditional resources or areas for current use can be affected through the direct loss or alteration of trails or travelways, restrictions on the ability to navigate to and through current use areas, or limitations on the ability to undertake current use activities in proximity to the Project. Loss and alteration can result from direct physical disturbance or destruction (e.g., destruction of a traditional trail), physical deterrents or obstructions (e.g., fences or gates) that prevent access or increase effort required either spatially or temporally, changes in the landscape (e.g., vegetation clearing) that make an aspect of a trail or travelway unrecognizable either partially or completely, or changes in the conditions (e.g., construction traffic) required for current use of trails and travelways. The construction and operations and maintenance of the Project will also contribute increased access to cultural use resources and areas for both Indigenous and public users, and the use of the Project as a travelway will increase from seasonal to all-season.

The Project has the potential to directly and indirectly affect access to traditional resources or areas during construction and operations and maintenance. Access to trails and travelways identified within the LAA and RAA (see Section 11.2.4, Figure 11.5, Table 11.12) have potential to be affected by the Project in the following ways:

- Construction activities can affect access to traditional resources through vegetation clearing for the establishment and operation of camps; clearing of the ROW, borrow source, and quarry development and operations; embankment and quarry access road construction; and closure and reclamation of the MVWR (adverse).
- During construction, access to harvesting will decrease during periods and locations of active construction and portions of trails that cross the Project may be damaged. Indirect effects of construction activities (noise and air quality) may deter some users from accessing traditional use areas (adverse).
- During operations, activities such as borrow and quarry operations, material haul, operations of camps, water withdrawal, and the presence of the Project have the potential to directly or indirectly adversely or positively affect access to traditional resources (adverse or positive).

Effects of access to traditional resources or areas during project construction and operations and maintenance can also be positive or adverse (5658 NWT Ltd. and GNWT, 2011 [PR#16]; Dehcho First Nations, 2011; IMG-Golder Corporation, 2006):

- Once the Project is constructed, access to traditional use areas will increase for both Indigenous and public users (positive and adverse).
- Use of the Project as a travelway will increase from seasonally to permanent, and the highway will facilitate all-season access to some harvesting areas (positive).

- During construction and operations and maintenance, indirect effects on the experience of Indigenous peoples will adversely alter the perceived value of access to traditional resources for current use or current use sites and area (adverse).
- During operation, increased access to harvesting by both local and non-local harvesters may consequently increase pressure on harvested resources (adverse).

The Project is predicted to reduce the number of travel routes, which is expected to localize project effects (5658 NWT Ltd. and GNWT, 2011 [PR#16]). In addition, the Project has potential to affect previously recorded trails and travelways and navigability identified by Pehdzéh Kì First Nation and Sahtu Dene and Métis. A total of 27 trails and access routes have been identified within the PDA, LAA, and RAA (see Figure 11.5, Table 11.12).

11.4.3.2 Mitigation

Mitigation measures that will be implemented during construction and operations and maintenance of the Project to address potential effects of the Project on culture and traditional land use and accessibility are presented in Table 11.22.

Table 11.22 Potential Effects and Mitigation Measures for Culture and Traditional Land Use – Change in Access to Resources and Areas for Cultural Use

Effect Name	Effect Pathway	Mitigation Measures
Change in access to traditional resources or areas for cultural use	<ul style="list-style-type: none"> • Construction and operations and maintenance could result in the restriction or alteration of access (including trails and travelways) to lands and resources used for traditional and cultural purposes • Indirect effects on the experience of Indigenous peoples, which adversely alter the perceived value of access to traditional resources for current use or current use sites and area 	<ul style="list-style-type: none"> • Access to borrow sources when active extraction and hauling is occurring will be limited to authorized personnel only. • Quarry design, development, and closure will take into account public safety. • Signage and physical barriers will be used to identify areas of active construction and to provide separation between workspaces and the MVWR for public safety and security. • Access to identified current use sites (located outside of the designated construction and project site limits) will be maintained during construction and operations and maintenance. • The area of direct ground disturbance will be limited by following the pre-existing winter road alignment to the extent possible. • Construction and quarry development activities will be reduced, where possible and where spatial overlap is expected, during sensitive periods for wildlife, in accordance with the WMMP.

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Effect Name	Effect Pathway	Mitigation Measures
Change in access to traditional resources or areas for cultural use (cont'd)		<ul style="list-style-type: none"> • Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP. • Caribou and moose will have the right of way on all project infrastructure. • Undisturbed areas will be avoided until they are scheduled for clearing/stripping to limit unnecessary soil degradation and compaction. • Abandoned sections of MVWR ROW and access roads will be closed and reclaimed. • The GNWT will notify communities of project activities and schedules, including provision of project maps and design components, and discuss key traditional harvesting periods. • Water withdrawal for dust suppression will be completed from candidate sources identified in Chapter 5, and extraction volumes will be limited to amounts that will not affect the ecological function of the waterbody. • Project personnel will be prohibited from hunting and fishing while housed in work camps for the job. • Pullouts will not be located near watercourses with sport fish.

In addition to the mitigation measures in Table 11.22, Table 11.23 includes recommendations provided by Dehcho First Nations for project design relative to access to resources and areas, including trails and travelways through project-specific engagement (Dessau, 2012 [PR#13]). In addition, Table 11.23 includes recommendations provided by Norman Wells, Tulita, and Wrigley Indigenous governments and organizations provided project-specific recommendations for project design relative to access to resources and areas, including trails and travelways through project-specific engagement (see Table 5.2).

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Table 11.23 Recommended Mitigations by Indigenous Governments and Indigenous Organizations

Recommendations	Commitment
Road signage is to be used to direct traffic along the highway (TRRC, 2022).	A Traffic Management Plan (TMP) will be implemented that includes provision for signage, lighting, and vehicle detours (Table 11.24).
Plane Lake can be used for float planes to charter people in and out of camps (if required); it is not recommended for fishing (TRRC, 2022).	The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations and other affected parties, such as renewable resources councils during advancement of project design and planning.
Requested that the communities of Tulita and Norman Wells be actively involved in the Project and regularly informed about project activities in the area; (i.e., radio announcements, informative posters, and information sheets were suggested as effective methods of communication) (NWRRC, 2023; TRRC, 2022).	The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations and other affected parties, such as renewable resources councils, during advancement of project design and planning.
Community engagement participants recommended using TK provided by locals when routing the highway because there is a steep area around Bear Rock (Petinazah) in the proposed routing area, about which local people are knowledgeable and can provide input.	The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations and other affected parties, such as renewable resources councils, during advancement of project design and planning.
It was recommended that the Project create a place along the highway where people can come and collect harvested wood. In addition, wood harvesters and monitors should be hired at the wood harvesting location, which will also create employment opportunities for community members (project-specific engagement).	Merchantable timber will be limbed and decked in a dry area and made available to a receiver with an authorization (Timber Cutting Permit or Timber Cutting Licence) from the GNWT. Merchantable timber includes trees without defects with a dbh of at least 14 cm. Non-merchantable trees will be limbed and stacked for community use, where possible. The GNWT is open to and interested in discussing with Indigenous Governments, Indigenous Organizations and other affected parties, such as renewable resources councils, how best to integrate community-based monitoring into the Project.
Engagement participants recommended access to Wrigley be avoided (project-specific engagement).	The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations and other affected parties, such as renewable resources councils, during advancement of project design and planning.
Engagement participants recommended moving the project alignment as far as possible from Mackenzie River (project-specific engagement).	The area of direct ground disturbance will be limited by following the pre-existing MVWR road alignment to the extent possible (Table 11.22); Additional design considerations are provided in Section 5.2.3.

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Recommendations	Commitment
Some engagement participants (in particular, Tulita community members) recommended locating camps away from community (project specific-engagement).	The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.
Engagement participants requested consideration Steep Creek overflow, which causes icy conditions (project-specific engagement).	The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.
Engagement participants recommended that public access to borrow sites and quarries and associated access routes will be restricted (project-specific engagement).	Access to borrow sources when active extraction and hauling is occurring will be limited to authorized personnel only (Table 11.22).
Engagement participants recommended that public access roads no longer needed (e.g., temporary burrow sites and quarries and associated access) will be decommissioned and reclaimed (project-specific engagement).	Temporary access roads, quarries and workspaces not needed after construction will be closed and reclaimed.

11.4.3.3 Residual Effects

As noted in Section 11.2.4 and Table 11.22, Indigenous Governments, Indigenous Organizations, and other affected parties engaged on the Project, such as renewable resources councils, have identified numerous trails and travelways within the LAA that have the potential to be affected by project activities conducted during construction, including vegetation clearing, road construction, culvert installation, water withdrawals, camps, maintenance areas, laydown areas, fuel storage areas, staging areas borrow and quarry extraction, and reclamation. Project activities conducted during operations include effects resulting from long-term presence and use of the road, as well as maintenance activities, operation of borrow/quarry sources, and material haul and stock piling.

Potential project effects will largely be mitigated through maintaining access to known cultural and traditional land use sites, aligning the Project with the existing MVWR for much of its length, limiting project activities to the PDA, and additional mitigation measures as noted in Table 11.22 and vegetation and wetlands (see Section 18.4).

Through the Project-specific engagement program, participants reported that the proposed Bear Rock (Petinīzah) route option, even with blasting (rock cut) to make it less steep, will be a good replacement for the gravel source (Source 7.109) and should not likely affect trapping in the area. While the construction of the Project may result in damage or destruction of small sections of traditionally used trails that intersect the PDA and LAA, it is not expected that additional rerouting will be necessary, and the use of the trails should not be substantively impeded. While the number of resource users or recreational hunters and fishers is not anticipated to change measurably in the foreseeable future, the locations in the RAA where resource use occurs may shift in response to changes in access (see Section 19.5.4).

The operation of the Project may result in both positive and adverse effects related to traffic. The Project is expected to increase access to resources and areas for cultural use for Indigenous land users as well as increase public traffic resulting from the presence of the highway. This may serve to enhance access to traditional resources and areas for Indigenous land users that may have been inaccessible when the MVWR was not operational. However, use of the highway by the public during operations may also create sensory disturbance and increase harvesting pressure on traditional resources. As stated in Section 5.2.2, the Project is expected to have low daily traffic volumes, on average 50 vehicles per day. Therefore, the number of resource users or recreational harvesters is not anticipated to change measurably in the foreseeable future as a result of the Project. Potential effects associated with air emissions or dust deposition from vehicular traffic are not expected to result in a change to the abundance or distribution of species of cultural importance in the RAA (see Sections 18.4.5.3, 19.4.5.3, and 20.6.1).

Overall, for construction, operations and maintenance, the residual effects following mitigation implemented during construction are characterized as adverse, low to moderate in magnitude, with moderate magnitude expected during active road construction and low magnitude during supporting activities and project use. For construction, operations and maintenance project effects will be restricted to the LAA, long-term, and irreversible. The residual effects on trails and travelways following mitigation implemented during operation remain the same, except the magnitude decreases to low based on project activities required during the operations and maintenance phase and will remain low during project use. Timing is not applicable because change in access to sites or areas for cultural use would occur regardless of time of day or season.

11.4.4 Change in Sites or Areas for Cultural Use

11.4.4.1 Project Pathways

The Project has the potential to both directly and indirectly affect cultural use sites or areas during construction, operations and maintenance, and use. Construction activities with potential to affect cultural use sites or areas include vegetation clearing for the establishment and operation of camps; clearing of the ROW, access, and workspaces; borrow source and quarry development and operations, including blasting, crushing, sorting, and stockpiling; embankment and quarry access road construction, including road cuts; and culvert installations. During operations, including use, direct or indirect effects on cultural use sites or areas may occur through activities such as borrow and quarry operations, including blasting, crushing, sorting, and stockpiling; material haul and stockpiling; operations of camps; water withdrawal; emission; and waste management; as well as long-term presence and use of the road. Indirect effects during construction and operations and maintenance include sensory disturbance (noise, light, dust) and may result in perceived decreased value or use of sites or areas.

Cultural use sites and areas identified by participating Indigenous Governments, Indigenous Organizations, and other affected parties within the RAA, such as renewable resources councils, include sites and areas of historical interest or use, hunting areas, fishing areas, medicinal plant locations, trapping areas, ceremonial sites, areas of cultural or spiritual importance, habitation sites, and current use areas. Cultural use also accounts for the conditions of use, seasonal cycles,

inter-generational knowledge transmission, landforms and named places, and other factors that provide context, setting, or understanding for the practice of cultural use activities. Cultural use sites and locations identified through the project-specific engagement program, review of publicly available literature, and project-specific TLRU studies are not considered an exhaustive list. Because of the historical occupation of the land by Indigenous governments and organizations, other cultural use sites or areas may occur in the PDA even if these sites have not been specifically identified by Indigenous Governments, Indigenous Organizations, or renewable resource councils. Known sites and areas located within the LAA and RAA are presented in Figure 11.5 (see also Table 11.14).

Through the project-specific engagement program, a review of publicly available literature, and project-specific TLRU studies, 44 locations of spiritual sites, heritage sites, and habitation sites, as well as potential effects on these sites resulting from the Project, were identified (see Figure 11.6, Table 11.13, Table 11.14, Table 11.15, and Appendix 11A [K’alo-Stantec, 2022a]; (Dessau, 2012 [PR#13]; Golder, 2015; TRRC, 2019). Of the 44 sites and areas, 22 are habitation sites in the PDA, LAA, and RAA (two overlap the LAA). Specific cabin locations within the LAA and RAA were identified along White Sand Creek (n=3), Dam Creek (n=4), at MVWR KM 772 to KM 774 (n=7), Prohibition Creek, Vermillion Creek, Birch Creek, Twelve Mile Point, Canyon Creek, and near Bluefish Creek. As well, a safety cabin is located at Vermillion Creek.

Cultural and spiritual sites and areas were also identified (n=27), primarily along watercourses. Of these, eight locations are within the LAA and include the specific locations of Bear Rock (Petnı́zah) and a burial area between highway marker 783 to 785. Some cultural and spiritual sites and areas are present within the LAA (n=6) and RAA (n=8), but no specific locations were identified (i.e., surrounding the proposed Great Bear River Bridge site, within the Great Bear River Watershed).

Heritage resource sites conservatively assumed to be of interest to Indigenous Governments and Indigenous Organizations have been identified within the RAA (n=133), with areas of particular site density identified at the confluences of the Mackenzie River and Ochre River, White Sand Creek, Hodgson Creek, Prohibition Creek, Blackwater River, Steep Creek, Saline River, Little Smith Creek, and Great Bear River (Krahulic, 2020) (see Heritage Resources Chapter 22 and associated Appendix 22A [K’alo-Stantec, 2022f]). Through the project-specific engagement program, participants also identified Bear Rock (Petnı́zah) as a culturally significant site, as well a culturally sacred site located in and surrounding Fish Lake³⁰.

Pehdzéh Kı́ First Nation previously stated that, given the importance of traditional practices in the areas surrounding the Project, the cultural value of these areas may be affected, resulting in a diminished historical and social identity for the Indigenous Organization. Pehdzéh Kı́ First Nation identified areas most likely to experience potential effects containing culturally significant sites, such as burial, spiritual, and ceremonial areas, the harvest of medicinal plants, as well as areas of concentrations of archaeological heritage sites.

³⁰ Fish Lake is a common lake name and may refer to Trout Lake; the location is not identified in this report.

Through the project-specific engagement program participants reported that the MVWR is too close to Mackenzie River to be replaced with an all-season road.

11.4.4.2 Mitigation

As discussed in Chapter 5, project routing and design have integrated the existing MVWR to the extent practicable, which will reduce, to some extent, the effects on the sites or areas for cultural use. In addition to project-specific management plans, including an archaeological chance find protocol that will be implemented during the construction and operations and maintenance phases, standard industry practices and mitigation measures will also be implemented and are summarized in Table 11.24.

Table 11.24 Potential Effects and Mitigation Measures for Culture and Traditional Land Use – Change in Sites or Areas for Cultural Use

Effect Name	Effect Pathway	Mitigation Measures
Change in sites or areas for cultural use	<ul style="list-style-type: none"> • Construction could result in a loss or alteration of identified cultural use harvesting sites, habitation areas, and cultural and sacred sites • Indirect effects on the experience of Indigenous peoples, which adversely alter the perceived value of access to traditional resources for current use of current use sites and areas 	<ul style="list-style-type: none"> • An Archaeological Impact Assessment (AIA) will be completed prior to construction in areas with known or suspected high archaeological potential. • Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented. • To the extent possible, the project highway alignment will be designed to avoid the base of Bear Rock (Petinīzah). • A HSPP will be developed and implemented. • A 30 m avoidance/setback from known archaeological resources will be implemented. • Site-specific mitigations required by the Prince of Wales Northern Heritage Centre (PWNHC) as based on AIAs will be implemented.

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Effect Name	Effect Pathway	Mitigation Measures
<p>Change in sites or areas for cultural use (cont'd)</p>		<ul style="list-style-type: none"> • Investigate and/or mitigate ‘known and suspected sites’ as identified by community members during Consultation and engagement and/or through TLRU studies • An archaeological chance find protocol will be implemented. Develop and maintain compliance with a chance find protocol (including worker education) for cultural materials and sites identified during construction. • In areas designated in the Sahtu Land Use Plan, land use activities must not be located within 500 m of known or suspected burial sites, or within 150 m of known or suspected archaeological sites, unless measures are developed in cooperation with the Prince of Wales Northern Heritage Centre, affected Indigenous Governments and Indigenous Organizations, or in the case of burial sites, with affected families where possible, to fully mitigate all effects on the site. • Known areas of collection of plants of interest to Indigenous Governments, Indigenous Organizations, and other affected parties will be avoided where possible. Clearing schedules will be communicated in advance of clearing to provide an opportunity to collect plant material from the PDA. Clearing will be limited to areas required for construction and safe operations. • Abandoned sections of MVWR ROW and access roads will be allowed to revegetate naturally. • Construction equipment will travel on designated winter roads or constructed embankment only. • Travel of vehicles will be confined to existing infrastructure roads and trails as much as possible to avoid disturbing vegetated areas. • Vehicles and equipment will be equipped with manufacturer recommended noise muffling equipment.

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Effect Name	Effect Pathway	Mitigation Measures
Change in sites or areas for cultural use (cont'd)		<ul style="list-style-type: none"> • Vehicle speeds will be limited to speeds of 50 km/h on unfinished surfaces. • Speed limits will be posted on the public highway. • A TMP will be implemented that includes provision for signage, lighting, and vehicle detours. • A project-specific PPP will be developed and implemented. • The GNWT will notify communities of project activities and schedules, including provision of project maps and design components, and discuss key traditional harvesting periods.

In addition to the mitigation measures in Table 11.24, Indigenous Governments, Indigenous Organizations, and renewable resource councils of Norman Wells, Tulita, and Wrigley provided project-specific recommendations relative to sites or areas of cultural use through the project-specific engagement program in Table 11.25 (see also Table 5.2) (Dessau, 2012 [PR#13]).

Table 11.25 Recommended Mitigations by Indigenous Governments, Indigenous Organizations, and Other Affected Parties

Recommendations	Commitment
Engagement participants recommended access to Wrigley be avoided (project-specific engagement).	<p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.</p> <p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p> <p>Travel of vehicles will be confined to existing infrastructure roads and trails as much as possible to avoid disturbing vegetated areas (Table 11.24).</p>
Engagement participants recommended moving the project alignment as far as possible from Mackenzie River (project-specific engagement).	<p>The area of direct ground disturbance will be limited by following the pre-existing MVWR road alignment to the extent possible (Table 11.22).</p> <p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p>

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Recommendations	Commitment
<p>Engagement participants requested avoidance of sensitive moose areas, including harvesting¹ (KM 709.5 to 711, Ochre River KM 724, White Sand Creek (KM 732), Vermillion Creek (KM 750.1), Bob’s Canyon Creek (KM 753.5), Dam Creek (KM 764) (project-specific engagement).</p>	<p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.</p> <p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p>
<p>Engagement participants requested avoidance of a traditional hunting ground (Vermillion Creek; KM 748 to 754) (project-specific engagement).</p>	<p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.</p> <p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24)</p>
<p>Engagement participants requested avoidance of cultural heritage site along the northern part of Blackwater River (project-specific engagement).</p>	<p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.</p> <p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p>
<p>Engagement participants recommended locating camps away from community (project-specific engagement).</p>	<p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.</p>
<p>Engagement participants requested that rivers, creeks and forests be protected for the future generations and protection of moose, caribou, and fish (Dessau, 2012 [PR#13]; TRRC, 2022; NWRRC, 2023).</p>	<p>An SCP, WMP, TMP, WMMP, as well as an Emergency Response Plan (ERP), and an ExMP will be developed and implemented to proactively protect wildlife and wildlife habitat, and help mitigate the effects of accidents or malfunctions should they occur (Table 11.17, Table 11.24).</p> <p>The GNWT is open to and interested in discussing with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, how best to integrate community-based monitoring into the Project.</p>

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Recommendations	Commitment
<p>Relocation of the project alignment 5 km inland (outside of the 5 km protection corridor) to increase distance from the Mackenzie River, and avoiding disturbing numerous traditional land use areas, traditional activities sites, and natural resources harvesting along the river (based on feedback provided on the optimized alignment of the Project proposed by Pehdzéh Kì First Nation) (Dessau, 2012 [PR#13]).</p>	<p>The project highway alignment route follows the MVWR as much as possible and ties into existing bridges at Ochre River, White Sand Creek, Strawberry Creek (culvert), Vermillion Creek South, Bob’s Canyon Creek, Dam Creek, and Blackwater Creek. The GNWT is not proposing to relocate existing bridges.</p> <p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.</p>
<p>Heritage places and sites within the Sahtu Dene and Métis settlement region require special protection and commemoration so that they remain pristine for the future (SHPSJWG, 2000).</p>	<p>An AIA will be completed prior to construction in areas with known or suspected high archaeological potential (Table 11.24).</p> <p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p>
<p>Participants requested respect for the traditional boundaries and sacred lands of the Sahtu Deh (Great Bear River), as well as Bear Rock (Petinı́zah); they requested that Bear Rock (Petinı́zah) and the areas of interest surrounding Bear Rock (Petinı́zah) be protected by a boundary and left alone (TRRC 2019, 2022; NWRRC, 2023).</p>	<p>An alignment routing option 2 km north of the MVWR at Bear Rock (Petinı́zah) has been identified.</p> <p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.</p> <p>An AIA will be completed prior to construction in areas with known or suspected high archaeological potential (Table 11.24)</p> <p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p> <p>To the extent possible, the project highway alignment will be designed to avoid the base of Bear Rock (Petinı́zah) (Table 11.24).</p>
<p>TK-based monitoring to include monitoring spiritual areas, such as Bear Rock (Petinı́zah) and Four Mile Creek (TRRC, 2022).</p>	<p>The GNWT is open to and interested in discussing with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, how best to integrate community-based monitoring into the Project.</p>

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Recommendations	Commitment
<p>Land use activity must not take place within 500 m of suspected or known burial sites, historical sites, or within 150 m of a known or suspected archaeological site, unless measures are developed in cooperation with the Prince of Wales Northern Heritage Centre (PWNHC), affected communities, or in the case of burial sites, with affected families where possible, to fully mitigate all effects to the site (SLUPB, 2023).</p>	<p>In areas designated in the Sahtu Land Use Plan, land use activities must not be located within 500 m of known or suspected burial sites, or within 150 m of known or suspected archaeological sites, unless measures are developed in cooperation with the Prince of Wales Northern Heritage Centre, affected Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, or in the case of burial sites, with affected families where possible, to fully mitigate all effects to the site (Table 11.24).</p>
<p>In areas where there is a high risk of effect to known or suspected archaeological sites, as determined by the PWNHC, an AIA must be conducted prior to commencement of the land use activity (SLUPB, 2023).</p>	<p>An AIA will be completed prior to construction in areas with known or suspected high archaeological potential (Table 11.24). Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p>
<p>Participants requested caution with all land uses to reduce environmental effects by re-using existing disturbed areas and concentrating land use in existing corridors (5658 NWT Ltd. and GNWT, 2011 [PR#16]).</p>	<p>The area of direct ground disturbance will be limited by following the pre-existing MVWR road alignment to the extent possible (Table 11.22). Removal of vegetation will be limited to the width of the ROW and workspaces (Table 11.17). Travel of vehicles will be confined to existing infrastructure, roads, and trails as much as possible to avoid disturbing vegetated areas (Table 11.24).</p>
<p>Existing camps and cabins should be left for Sahtu Region use and areas with cabins and camps should be avoided (5658 NWT Ltd. and GNWT, 2011 [PR#16]; TRRC, 2022).</p>	<p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24). The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.</p>

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Recommendations	Commitment
<p>Community engagement participants recommended that it is a priority to protect culturally important areas such as Bear Rock (Petınızah), known burial sites, and cabins, and to keep access to the MVWR available for traditional hunters and harvesters (August 2021 Engagement; April to July 2022 Engagement; November to December 2022 Engagement; November 2022 to February 2023 Engagement).</p>	<p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p> <p>An alignment routing option 2 km north of the MVWR at Bear Rock (Petınızah) has been identified.</p> <p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, during advancement of project design and planning.</p>
<p>Participants identified Fish Lake² as a sacred burial site that should not be disturbed (project specific-engagement).</p>	<p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p>
<p>Provide mitigation measures for existing culverts along the Mackenzie Highway that have blocked the passage of fish along rivers (project-specific engagement).</p>	<p>Rip rap repair and culvert construction will be timed to avoid restricted activity periods for fish, as applicable to the watercourse (Table 11.17).</p>
<p>Great Bear River not to be used as a gravel source (project-specific engagement).</p>	<p>Quarry operations will be located a minimum of 100 m from the ordinary high-water mark of any waterbody. Great Bear River is not proposed as a quarry or borrow source.</p> <p>To the extent possible, the project highway alignment will be designed to avoid the base of Bear Rock (Petınızah) (Table 11.24).</p>
<p>Study participants recommend archaeologists have a permit and be aware of the local socio-cultural policies and procedures, particularly with respect to archaeological artifacts and chance finds (project-specific engagement).</p>	<p>An archaeological chance find protocol will be implemented (Table 11.24).</p> <p>Requirements for protection of heritage resources, such as additional AIA, avoidance of known sites through project redesign or fencing during construction, mitigative archaeological excavation, surface collection of artifacts, historic structure recording, archival/documentary research, construction monitoring, will be implemented (Table 11.24).</p> <p>In areas designated in the Sahtu Land Use Plan, land use activities must not be located within 500 m of known or suspected burial sites, or within 150 m of known or suspected archaeological sites, unless measures are developed in cooperation with the Prince of Wales Northern Heritage Centre, affected Indigenous Governments and Indigenous Organizations, or in the case of burial sites, with affected families where possible, to fully mitigate all effects to the site (Table 11.24).</p>

Notes:

¹ Note KM are relative to MVWR

² Fish Lake is a common lake name, and is not identified in this report; it may be the lake known as “Trout Lake” located at the base of Bear Rock (Petınızah).

11.4.4.3 Residual Effects

As noted in Section 11.2.5 and Table 11.13, Table 11.14, and Table 11.15, Indigenous Governments, Indigenous Organizations, and renewable resource councils engaged on the Project have identified numerous sites or areas for cultural use within the PDA, LAA, and RAA that have the potential to be affected by the Project. These include current and historic camps and cabins, sacred areas and spiritual sites, landscape features and named places, heritage resources and archaeological sites, and conservation sites.

Heritage resources are spatially fixed and defined, non-renewable resources. Site-specific recommendations are typically formulated by a senior archaeologist and presented in Archaeological Overview Assessment (AOA)/AIA reports submitted to the Territorial regulator (PWNHC). As such, project-specific effects on sites and areas for cultural use are continually mitigated to the standards established by PWNHC. In this context, after implementation of the required mitigation measures issued by PWNHC, there is no residual effect from the Project on sites and areas for cultural use from a scientific perspective (see heritage resources [see Chapter 22 and associated Appendix 22A; K’alo-Stantec, 2022f]).

The terrain, soils, and permafrost assessment (see Chapter 14) considers potential effects on soil. Road construction and development of permanent borrow sources and quarries will result in the direct loss of soil, but this will be reduced as the Project will largely follow the existing MVWR. The use of existing borrow sources and quarries (where applicable) will further reduce the need for disturbing new ground. Effects of direct loss of soil, and consequent effects on sites or areas for cultural use, are restricted to the PDA.

Should sites and areas for cultural use, including heritage resources, be encountered during construction or operations and maintenance, work will cease immediately, and the chance find protocol will be implemented. The GNWT will follow all applicable territorial regulations regarding reporting and mitigation of archaeological sites (see heritage resources [see Chapter 22 and associated Appendix 22A; K’alo-Stantec, 2022f]).

Residual effects on soils, terrain, and permafrost and on heritage resources have the potential to affect sites and areas for current use. However, the appropriate conditions for cultural use entail more than preserving specific sites and areas and this assessment acknowledges that Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, may choose not to pursue cultural use activities near the Project for a variety of personal, practical, aesthetic, and spiritual reasons. Various biophysical and socio-economic environmental conditions may also affect sites and areas for cultural use. For example, a change in air or water quality, noise, or altered visual aesthetics may deter individuals from using sites located in proximity to the Project. Refer to noise (see Chapter 13), air quality assessment (see Chapter 12), and non-traditional land and resource use (see Chapter 26) for further details on effects of noise, light, and air emissions on land users in the assessment areas.

Overall, during construction, operations and maintenance, and use, residual effects on sites or areas for cultural use that may be within the PDA in areas of direct physical disturbance will be adverse and high in magnitude because these sites will be permanently removed. Consequently, the effects of the Project on these sites and areas for cultural use within areas of direct physical disturbance will be restricted to the PDA, and are possible, continuous, long-term, and irreversible. Timing is not applicable because the effects on sites or areas for cultural would occur regardless of time of day or season.

Residual effects sites or areas for cultural use outside areas of direct physical disturbance will be moderate during construction and low for operations and maintenance. It is anticipated that following construction, current use sites or areas would remain largely unchanged outside the PDA. The adverse effects of the Project on sites or areas for cultural use outside areas of direct physical disturbance is possible, restricted to the LAA, long-term, continuous, and irreversible. Timing is not applicable because the effects on sites or areas for cultural use would occur regardless of time of day or season.

11.4.5 Summary of Residual Effects

Table 11.26 summarizes the residual effects on cultural and traditional land use, including harvesting during the construction and operations and maintenance phases of the Project. With the implementation of the mitigation measures, the Project is anticipated to meet the SLUP conformity requirements related to engagement input and incorporation of TK.

The design of the Project will protect the rock formation of the Petinīzah (Bear Rock), as a sacred site. Mitigation measures for reducing the effects of the Project on cultural use respect the values of the Petinīzah (Bear Rock) CZ, Mio Lake CZ, Norman Range SMZ, K’ąłq Tué (Willow Lake Wetlands) SMZ, and Deh Cho (Mackenzie River) SMZ as areas with important ecological habitats. Mitigation measures take into account traditional land and resource use within these areas.

Table 11.26 Residual Effects on Culture and Traditional Land Use

Residual Effect	Residual Effects Characterization*							
	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in availability of resources for cultural and traditional land use	A	P	L-M	LAA	TS	LT	C	I
Change in access to resources and areas for cultural and traditional land use	A	P	L-M	LAA	NS	LT	C	I

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Residual Effect	Residual Effects Characterization*							
	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in sites or areas for cultural and traditional land use within areas of direct physical disturbance	A	P	H	PDA	NS	LT	C	I
Change in sites or areas for cultural and traditional land use outside areas of direct physical disturbance	A	P	L-M	LAA	NS	LT	C	I

KEY

*See Table 11.2 for detailed definitions

Direction:

A: Adverse
N: Neutral

Likelihood:

U: Unlikely
P: Possible
CE: Certain

Magnitude:

NMC: No Measurable Change
L: Low
M: Moderate
H: High

Geographic Extent:

PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Timing

TT: Time of day
TS: Seasonality
TR: Regulatory
NS: No sensitivity

Duration:

ST: Short-term
MT: Medium-term
LT: Long-term

N/A: Not applicable

Frequency:

S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:

R: Reversible
I: Irreversible

11.5 Assessment of Cumulative Effects on Culture and Traditional Land Use

Residual effects described in Section 11.4 that are likely to interact cumulatively with residual effects from other physical activities (past, present, and reasonably foreseeable) are identified and assessed. The effects of past and current projects contribute to baseline conditions upon which project effects on cultural use are assessed. Cumulative effects are described as those resulting from residual project effects combined with the effects of past, present, and reasonably foreseeable projects and activities.

Two conditions must be met to initiate an assessment of cumulative effects on a VC:

- The Project is assessed as having measurable adverse residual effects on a VC.
- The adverse residual effects from the Project overlap spatially or temporally with measurable residual effects of other physical activities on a VC.

If neither condition is met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities. Both conditions apply to the Project for cultural use and a cumulative effects assessment is presented in Section 11.5.1.

Dehcho First Nations have previously expressed concerns about the Project and cumulative effects of development in the region (Dehcho First Nations, 2011).

11.5.1 Residual Effects Likely to Interact Cumulatively

The project and activity inclusion list (Table 11.27) identifies a subset of known past, present, and reasonably foreseeable projects and physical activities whose effects could overlap spatially and temporally with the residual effects of the Project on cultural use. Chapter 4 presents the names, developers, use or activity, descriptions, status, and location of these projects and activities.

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Table 11.27 Projects with the Potential to Contribute to Cumulative Effects on Cultural Use in the RAA

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects on Cultural Use	Environmental Effects		
	Change in availability to resources for cultural and traditional land use	Change in access to resources for cultural and traditional land use	Change in sites or areas for cultural and traditional land use
Past and Present Physical Activities and Resource Use (Base Case)			
<i>Geotechnical</i>	-	-	-
<i>Oil, Gas & Seismic*</i>			
Tulita 2D Seismic Program	✓	-	✓
EL 466 Drilling Program	✓	-	✓
Windy Island Drilling Program	✓	✓	✓
Summit Creek Drilling Program	✓	-	✓
Slater River Project	✓	-	✓
Little Bear River Staging Area	✓	-	✓
Mackenzie River Dredging and Water Withdrawal (cooling)	✓	✓	✓
<i>Infrastructure</i>			
Mackenzie Valley Winter Road, including bridges and bridge-sized culverts	✓	✓	✓
Délįnę Winter Road	✓	✓	✓
Highway #1	✓	✓	✓
Canyon Creek All Season Access Road (CCASAR)	✓	✓	✓
Prohibition Creek Access Road (PCAR)	✓	✓	✓
Norman Wells Pipeline	✓	✓	✓
Mackenzie Valley Fibre Link	✓	✓	✓
<i>Quarries and Borrow Sources</i>			
HRN Quarry and Access Road (Source 7.083)	✓	✓	✓
Norman Wells Sand Bar Quarrying	✓	✓	✓
Little Bear River Quarry	✓	✓	✓
<i>Mining & Exploration</i>			
Wrigley Zinc Property Drilling Program	✓	✓	✓

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Other Projects and Physical Activities with Potential for Cumulative Environmental Effects on Cultural Use	Environmental Effects		
	Change in availability to resources for cultural and traditional land use	Change in access to resources for cultural and traditional land use	Change in sites or areas for cultural and traditional land use
Municipal Operations, including water, waste, power, and community development			
Wrigley Municipal Activities	✓	-	✓
Tulita Municipal Activities	✓	-	✓
Norman Wells Municipal Activities	✓	-	✓
Project-Related Physical Activities (Project Case)			
Mackenzie Valley Highway Project	✓	✓	✓
Reasonably Foreseeable Physical Activities (Reasonably Foreseeable Case)			
Quarries			
Dhu-1 Quarry	✓	✓	✓
Infrastructure			
Proposed Great Bear River Bridge	✓	✓	✓
Oil and Gas			
Enbridge Maintenance Camp	✓	✓	✓

Notes:

- ✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with project residual effects.
- = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
- * = Includes support activities such as: production, exploration, remediation, drilling, wells, associated infrastructure, facilities, camp, and staging areas.

Culture and traditional land use is not expected to interact cumulatively with geotechnical programs because the programs are located within the Hamlet of Tulita and therefore are not anticipated to overlap spatially with culture and traditional land use areas.

11.5.2 Change in Availability of Resources for Cultural and Traditional Land Use

11.5.2.1 Cumulative Effects Pathways

Residual effects arising from past, present, and reasonably foreseeable activities have similar pathways as those arising from the Project (Section 11.4.2.1) and have the potential to result in a cumulative effect on availability of resources for current use during the construction and operations and maintenance of the Project. These pathways include the direct loss of habitat through vegetation clearing, loss or alteration of fish habitat due to disturbance of water courses, change in diversity and abundance of harvested species, and indirect effects through sensory disturbance, as well as effects on the experience of land users that adversely alter the perceived value of resources available for cultural use.

Notable past and present activities and projects that contribute to cumulative effects on availability of resources for cultural use in the LAA and RAA are the Norman Wells Pipeline, Mackenzie Valley Fibre Link, the Slater River Project, the MVWR and other winter roads, CCASAR, PCAR, quarries and borrow sources as well as various drilling programs. Reasonably foreseeable activities and projects are the Dhu-1 Quarry, the Proposed Great Bear River Bridge and Enbridge Maintenance Camp that occur within the LAA and RAA. Although the effects from the Proposed Great Bear River Bridge and PCAR will be additive during the construction phase, these projects will connect to the Project to create a contiguous highway during the operations and maintenance phase. The timeline for the Enbridge Maintenance Camp is unknown, however will only be additive during the construction phase as this camp will support in project construction. These residual effects are already assessed. Compared to the long-term effects on cultural use from the Project during the operations and maintenance phase, the cumulative effects on cultural use from the PCAR, Great Bear River Bridge and Dhu-1 Quarry during the construction phase will be short in duration and lower in magnitude and comparatively small, involving limited clearing and vehicle traffic, and their respective residual effects are anticipated to be minor following the application of project-specific mitigation measures.

Through a review of publicly available literature, Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, engaged on the Project have identified related pathways for cumulative effects.

11.5.2.1.1 Dehcho Region

Dehcho First Nations have previously expressed concerns about the immediate and cumulative effects of development in the region, advising that boreal caribou are particularly sensitive to sensory disturbance and have been affected by sensory disturbance from oil and gas exploration, oil and contaminant spills, and use of seismic wire, which have all resulted in immediate affects to boreal caribou (Dehcho First Nations, 2011). Dehcho First Nations commented that animals were driven away from development activities and did not return to these areas for many years; some animals became entangled in wire and died (Dehcho First Nations, 2011). Dehcho First Nations observed that the construction of the Norman Wells Pipeline caused boreal caribou to leave the corridor area for a number of years before eventually returning. Dehcho First Nations indicated that harvesters know that seismic and other linear disturbances open corridors for wolves and can lead to an increase in predation of boreal caribou and other game animals and are concerned about this effect (Dehcho First Nations, 2011). Dehcho First Nations Elders have commented that where intensive three-dimensional (3D) seismic has continued, boreal caribou have become more wary and do not linger as long in open areas as they did prior to these disturbances (Dehcho First Nations, 2011). The potential effect of pending and future development remains a major concern (Dehcho First Nations, 2011).

Dehcho First Nations have observed overall warmer and wetter conditions, with more rainfall in August and September and even into October, has led to increased difficulty escaping predators at the end of summer. Dehcho First Nations report wetter conditions have also led to increased ice crusting along the ground, subsequently resulting in foraging difficulty for boreal caribou. In addition, Dehcho First Nations identified warmer temperatures, thawing permafrost, and other environmental changes create concerns related to the environment, including the thawing of frost which harbours and protects lichens and reduces the availability of lichen-rich habitats (Dehcho First Nations, 2011). Dehcho First Nations further report, wet summers and falls increase water levels on smaller rivers and streams, allowing more boat access into boreal caribou habitat areas (Dehcho First Nations, 2011; 5658 NWT Ltd. and GNWT, 2011 [PR#16]; McDonald, 2010).

11.5.2.1.2 Sahtu Region

Dene and Métis in the Sahtu Region have expressed concern for the negative effects of development to water, land, wildlife, and their lifestyle and stated that everything is connected (Golder, 2015). SRRB have stated that climate change, including change in ambient temperatures, can shift timing of caribou calving and reduce the availability of lichen-rich habitats, which is a primary source of caribou subsistence (SRRB, 2016). SRRB reports growing concern that change in ambient temperature will cause early green-ups, and off-set the timing in relation to caribou calving (SRRB, 2016). Indigenous Knowledge shared by Sahtu Dene and Métis stated that weather plays a significant role in the health and well-being of boreal caribou, noting that increasing extremes in annual temperatures and flooding negatively affect herds (McDonald, 2010). TRRC (2022) reported that weather in the Tulita area has changed over the last few years, which affects forest health and influences the flow of creeks.

Norman Wells Renewable Resources Council study participants observed that weather in the NWRRC TLRU Study Area has changed over the last few years, attributed to cumulative effects and warming temperatures, which affects the land and the permafrost and can influence the flow of creeks (NWRRC, 2023). Norman Wells Renewable Resources Council study participants explained that Elders of Norman Wells used to be able to predict weather patterns, but the recent fluctuations in weather have made predictions much more difficult (NWRRC, 2023). Local knowledge provided by TRRC (2022) described observable changes in permafrost in the Tulita area, which has created more boggy and sloughy areas. Norman Wells Renewable Resources Council (2023) explained that thawing permafrost creates wetter, boggy areas where the ground was previously hard, which makes traversing the landscape to practice TLRU more difficult. “The land doesn’t freeze as good as it used to” (NWRRC.8; NWRRC, 2023) and can influence lichen accessibility for caribou. NWRRC (2023) also reported that the water in the lakes and rivers are taking longer to freeze because the temperatures are warmer and changing every year.

Effects of a changing climate continue to affect residents in the NWT; GNWT (2018a) reported that changing ice conditions pose an increased risk to human safety, as well as effects on water quality and quantity; effects on forest, habitat and wildlife; introduction of invasive species; affects to food security, including decreased access to country foods; and loss of culturally significant sites and artifacts (SLUPB, 2022). Several NWRRC study participants communicated that in general, snow dries up faster in the NWRRC TLRU Study Area and receives less rain and less snow, which has caused surface water to dry up (NWRRC, 2023). An NWRRC participant commented that “some areas are drying out and other areas have pools of water” (NWRRC.12; NWRRC, 2023). NWRRC expressed concerns about the water in the NWRRC TLRU Study Area, especially the creeks that come down from the mountains that have traditionally been reliable sources of drinking water: “My knowledge tells me that, you know, it’s been warm for the past little while. I don’t know if all that water will dry up on the high ground... drinking water is important” (NWRRC.1; NWRRC, 2023).

Through the project-specific engagement program, participants also reported that climate change affects food security; more people will fish if wildlife moves away, which may potentially affect fish and fish habitat. Participants also raised concerns about existing permafrost issues along the current winter road and identified several eroded banks along the Mackenzie River surrounding Tulita. While these effects are caused by several contributing factors, such as wild forest fires, thawing permafrost, slumping ground, and shoreline erosion, effects of climate change pose additional safety risks to infrastructure, including roads and buildings, as well as risks to traditional economies and TLRU (SLUPB, 2022).

Norman Wells Renewable Resources Council study participants also expressed concern that the warming temperatures have affected the pipeline ROW in the NWRRC TLRU Study Area, because the thawing permafrost has contributed to the land sinking around the pipeline (NWRRC, 2023). The pipeline ROW is commonly accessed by land users on snowmobiles and has become more damaged overtime, in part due to the condition of landscape and thawing permafrost as well as use of the area as a ROW (NWRRC, 2023). Norman Wells Renewable Resources Council study participants explained that the sinking of the land on top of the pipeline ROW can create additional

pressure on the pipeline and increase the risk of the pipeline bursting and may have potential effect on the receiving environment (NWRRC, 2023).

Concerns about effects on wildlife if the pipeline breaks were raised by NWRRC study participants and potential project effects may include contribution to cumulative effects on permafrost and warming temperatures in the NWRRC TLRU Study Area (NWRRC, 2023).

Local knowledge provided by TRRC discussed changes observed in wildlife behaviour in the Tulita area; wolves, foxes, and bears are coming right into the community, which had not typically occurred in the past. As a result, there has been an increase in wildlife fatalities, especially bears and wolves at the community waste center (TRRC, 2022). Local knowledge from TRRC reported that Sahtu harvesters are unsure why there is more wildlife coming into the community. Tulita Renewable Resources Council reported that previous road construction and operation has caused noticeable effects on the abundance of resources in the Tulita area, as harvesters observed decreases in some plant and animal species and increases of abundance in others (TRRC, 2022). As discussed in Section 11.2.3.1, muskox populations throughout the region have increased, which local knowledge holders in Tulita have attributed to previous road construction and operation in the area (TRRC, 2022). Tulita Renewable Resources Council report that previous road construction and operation has provided easier access to wildlife and wildlife harvesting areas and may result in cumulative effects on wildlife resources (TRRC, 2022). Norman Wells Renewable Resources Council also raised concerns about potential project effects on wildlife over time due to increased hunting from non-resident hunters in the NWRRC TLRU Study Area (NWRRC, 2023).

Norman Wells Renewable Resources Council study participants reported changes in wildlife behaviour and abundance in the NWRRC TLRU Study Area due to the cumulative effects of sensory disturbance that drive wildlife away from the area; and shared concern of long-term project-related and cumulative effects on wildlife because of sensory disturbance (NWRRC, 2023). Sahtu land users already must travel further to access wildlife resources, and there is general concern that land users will have to travel even further to access resources once the Project is underway (NWRRC, 2023). Concerns were raised by Sahtu harvesters and land users in Tulita about effects at Four Mile Creek because of the increase in smoke in that area as well; the health of wildlife around Trout Lake³¹ was also of particular concern (TRRC, 2022).

11.5.2.1.3 Consideration of Other Existing Disturbances

As reported in Section 10.2.2.1, fire and existing anthropogenic disturbances (to which a 500 m buffer has been applied) have affected 52.2% of the boreal caribou habitat in the Caribou and Moose LAA, which exceeds the 35% conservation threshold identified in the by ECCC (2020). Effects of the Project and other reasonably foreseeable projects will further contribute to habitat disturbance, but the additional disturbance is relatively small (0.15 % of the Caribou and Moose LAA). Nevertheless, this may contribute to adverse effects on the availability of boreal caribou for cultural use.

³¹ The location of Trout Lake is not identified or disclosed in this report.

11.5.2.2 Mitigation

Implementation of the mitigation measures described in Section 11.4.2.2 are anticipated to reduce effects on availability of resources for cultural use. As well, mitigation designed to reduce effects on wildlife (see Section 19.4), vegetation (see Section 18.4), and fish (see Section 17.4) are anticipated to also mitigate effects on availability of resources for cultural use. These mitigation measures are also applicable to the effects of identified future physical activities.

11.5.2.3 Cumulative Effects

The adverse residual effects of the Project are anticipated to act cumulatively with past, present, and reasonably foreseeable projects and activities on the availability of resources for cultural use. However, during construction and operations and maintenance, the Project will contribute a small, incremental increase in loss of habitat for plants, animals, and fish harvested by Indigenous Governments and Indigenous Organizations. Additionally, the cumulative effects have potential to contribute to change in diversity and abundance of harvested species, including the potential project effects of a permanent road leading to increased access for non-Indigenous hunters.

Cumulative effects, through sensory disturbance, on the availability of resources for cultural use are not anticipated. The conclusions in the cumulative effects assessments for air quality (see Section 12.4.5) and water and sediment quality (see Section 16.5) indicate that there is no potential for cumulative effects on air quality or surface water quality. The cumulative effects assessment for noise (see Section 13.5.2) concludes that the Project will result in a negligible change in baseline that will be below Health Canada Noise Guidance thresholds and that the Project’s contribution to cumulative effects on noise is not expected to be substantial. Therefore, cumulative effects on the availability of resources for cultural use through sensory disturbances are not anticipated and will not be further assessed.

The assessment of cumulative effects on wildlife and wildlife habitat (see Section 19.5.2) concluded that following construction of the Project and considering past, present, and reasonably foreseeable projects, the RAA will continue to be relatively undisturbed and contain many large patches of undisturbed habitats for wildlife, except for boreal caribou, for which existing disturbed habitat already exceeds the conservation threshold. The Project will increase the amount of habitat disturbance within the RAA; however, it is not anticipated to result in the alteration of wildlife movement patterns or movement corridors and is unlikely to interact cumulatively with any past, present, or reasonably foreseeable projects or activities. The Project will not result in a measurable effect on wildlife health; therefore, cumulative effects are not discussed further.

The assessment of cumulative effects on vegetation and wetlands (see Section 18.5) concluded that fragmentation of the landscape will be reduced by aligning the Project with the MVWR along most of its length and patches of many sizes and shapes of all landcover types are expected to continue to be abundant in the RAA. Plant species of interest to Indigenous Governments and Indigenous Organizations and renewable resource councils are expected to persist in the LAA and RAA because all landcover types will remain common in the LAA and RAA.

The assessment of cumulative effects on fish and fish habitat (see Section 17.6) concluded that increased access to fishing due to the Project and its connection with other transportation corridors in the RAA can be expected to result in increased fishing pressure on some fish populations. The application of mitigation will reduce the cumulative effects but not necessarily negate them. Fish species of interest to Indigenous Governments and Indigenous Organizations and renewable resource councils are expected to persist in the LAA and RAA, however fisheries management initiatives may need to be implemented to maintain current populations (see Section 17.6.4).

Cumulative residual effects on the availability of resources for cultural use are expected to be adverse and low to moderate in magnitude as plant, animal, and fish species harvested by Indigenous Governments and Indigenous Organizations are expected to continue to be available throughout the LAA and RAA. Loss of wildlife and vegetation habitat in the PDA will be mitigated by aligning the Project with the MVWR along most of its length and the Project is not expected to result in changes to the distribution, diversity, and abundance of traditionally harvested species. Cumulative residual effects will extend to the RAA and are predicted to be long-term and irreversible while the Project is in operation. Timing is not applicable.

11.5.3 Change in Access to Resources or Areas for Cultural and Traditional Land Use

11.5.3.1 Cumulative Effects Pathways

Residual effects arising from past, present, and reasonably foreseeable activities have similar pathways as those arising from the Project (Section 11.4.3.1) and have the potential to result in a cumulative effect on access to resources or areas for cultural use during the construction and operations and maintenance of the Project. These pathways include restriction or alteration of access (including trails and travelways) to traditional lands and resources. Indirect effects include the project-related increase in access to harvesting areas as well as effects on the experience of Indigenous peoples that adversely alter the perceived value of access to areas for cultural use.

Notable past and present activities and projects that contribute to cumulative effects access to resources or areas for cultural use in the LAA and RAA are the Norman Wells Pipeline, the MVWR and other winter roads, and quarries and borrow sources. Reasonably foreseeable activities and projects are the Dhu-1 Quarry, the Great Bear River Bridge, and the PCAR Project that occur within the LAA and RAA. Although additive, the reasonably foreseeable projects are comparatively small, involving limited amounts of clearing and vehicle traffic, and their respective residual effects on culturally used trails and travelways are anticipated to be minor following the application of project-specific mitigation measures. Cumulatively, the Project, the Great Bear River Bridge, and the PCAR contribute to permanent, all-season access for harvesters.

Through a review of publicly available literature, Indigenous Governments, Indigenous Organizations, and renewable resource councils engaged on the Project have identified related pathways for cumulative effects. Dehcho First Nations have previously expressed concerns about the immediate and cumulative effects of development in the region (Dehcho First Nations, 2011).

Sahtu Dene and Métis previously indicated that both winter road and boat access to the Sahtu Region by non-resident hunters may affect game populations. Pehdzéh Kì First Nation remarked that the development of linear infrastructure in the region has provided industry with increased access (Dessau, 2012 [PR#13]). Dehcho First Nations observed that there has been a slow increase in non-Indigenous hunters coming into a few reasonably accessible habitat areas in the Dehcho Region during the fall and winter months (Dehcho First Nations, 2011).

11.5.3.2 Mitigation

Implementation of the mitigation measures described in Section 11.4.2.2 are predicted to avoid or reduce adverse effects on access to resources or areas for cultural use.

11.5.3.3 Cumulative Effects

The residual effects of the Project are anticipated to act cumulatively with past, present, and reasonably foreseeable projects and activities on access to resources or areas for cultural use. The construction and operations and maintenance of the Project will allow year-round access to harvesting areas; however, aligning the Project with the MVWR along most of its length will reduce the amount of new access created.

Cumulative effects, through sensory disturbance, on the availability of resources for cultural use are not anticipated. The conclusions in the cumulative effects assessments for air quality (see Section 12.4.5) and water and sediment quality (see Section 16.5) indicate that there is no potential for cumulative effects on air quality or surface water quality. The cumulative effects assessment for noise (see Section 13.5.2) concludes that the Project will result in a negligible change in baseline that will be below Health Canada Noise Guidance thresholds and the Project’s contribution to cumulative effects on noise is not expected to be substantial. Therefore, cumulative effects on the availability of resources for cultural use through sensory disturbances are not anticipated and will not be further assessed.

The Project is expected to act cumulatively with the MVWR, the Canyon Creek All Season Access Road, the Great Bear River Bridge, and the PCAR Project to increase accessibility to harvesting areas. Traditional land and resource use, along with recreational hunting, are activities that will continue to influence wildlife mortality risk in the RAA without the Project. While the number of resource users or recreational hunters and fishers is not anticipated to change measurably in the foreseeable future, the locations in the RAA where resource use occurs may shift in response to changes in access (see Section 19.5.4). Effects on trails will be localized and restricted to the PDA, therefore cumulative effects are not expected. Following construction, the Project is not anticipated to impede the use of the Mackenzie River or other navigable waterways as travel routes.

The cumulative residual effect on access to resources and areas for cultural use is predicted to be adverse and low in magnitude. The Project will permit increased all-season access to harvesting areas to both local residents as well as non-residents and recreational hunters and fishers; however, local harvesters recognized that increased access may also result in positive effects

(5658 NWT Ltd. and GNWT, 2011 [PR#16]). Land users from Norman Wells and Tulita are able to easily travel back and forth between Norman Wells and Tulita and are able to access areas and undertake cultural activities year-round, when previously this may have been very difficult or not possible. However, increased use from Indigenous and non-Indigenous harvesters may add pressure on harvested resources, and potentially diminish resources due to overharvesting. Increased access to sites and areas for cultural use by non-Indigenous land users may result in decreased use by Indigenous land users due to effects created by non-Indigenous land users or perceived effects due to their presence. Cumulative residual effects will extend to the RAA and are predicted to be long-term and irreversible while the Project is in operation. Timing is not applicable.

11.5.4 Change in Sites or Areas for Cultural and Traditional Land Use

Cumulative effects on sites or areas for cultural use are not anticipated. As noted in Section 11.4.4, direct residual effects from the Project to sites or areas for cultural use are expected to occur only within areas of direct physical disturbance in the PDA; cultural use sites or areas outside the PDA are expected to remain unchanged. Therefore, the localized residual effects of the Project on cultural use sites and areas are not anticipated to act cumulatively with residual effects of past, present, and reasonably foreseeable activities in the RAA.

With respect to indirect effects on sites or areas for cultural use, the conclusions in the cumulative effects assessments for air quality (see Section 12.4.5) and water and sediment quality (see Section 16.5) indicate that there is no potential for cumulative effects on air quality or surface water quality. The cumulative effects assessment for noise (see Section 13.5.2) concludes that the Project will result in a negligible change in baseline that will be below Health Canada Noise Guidance thresholds and the Project’s contribution to cumulative effects on noise is not expected to be substantial. Therefore, effects from sensory disturbances on sites or areas for cultural use are not expected to act cumulatively with residual effects of past, present, and reasonably foreseeable activities.

Consequently, cumulative effects on sites or areas for cultural use will not be further assessed.

11.5.5 Summary of Cumulative Effects

Table 11.28 summarizes the residual effects on Cultural and Traditional use during project construction and operations and maintenance.

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Table 11.28 Summary of Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Residual Cumulative effects on availability of traditional resources	A	P	L-M	RAA	S	LT	C	I
Contribution from the Project to the residual cumulative effect	The Project will result in the loss of habitat for plant, animal, and fish species harvested by Indigenous Governments and Indigenous Organizations. The Project will increase the amount of habitat disturbance within the RAA; however, it is not anticipated to result in the alteration of wildlife movement patterns or movement corridors. Similarly, all landcover types and plant species will remain common in the LAA and RAA. Loss of wildlife and vegetation habitat will be mitigated by aligning the Project with the MVWR along most of its length; the RAA will continue to be relatively undisturbed and contain many large patches of undisturbed habitats for wildlife. The Project is not expected to result in changes to the distribution, diversity, and abundance of traditionally harvested species.							
Residual Cumulative effect on access to traditional resources	A	P	L	RAA	N/A	LT	C	I
Contribution from the Project to the residual cumulative effect	The creation of an all-season highway will provide all-season access to Indigenous Governments and Indigenous Organizations affected by the Project. Construction and operations and maintenance of the Project will contribute increased access to cultural use resources and areas for both Indigenous and public users. The highway will allow all-season access to harvesting areas, however aligning the Project with the MVWR along most of its length will reduce the amount of new access created. Following construction of the Project, the RAA will remain relatively undisturbed and the number of Indigenous harvesters or recreational hunters and fishers is not anticipated to change measurably in the foreseeable future. Effects on trails will be localized and restricted to the PDA, and following construction the Project is not anticipated to impede the use of the Mackenzie River or other navigable waterways as travel routes.							

Residual Cumulative Effect	Residual Cumulative Effects Characterization						
	Direction	Likelihood	Magnitude	Geographic Extent	Timing	Duration	Frequency

KEY

*See Table 11.2 for detailed definitions

Direction:

A: Adverse

N: Neutral

Likelihood:

U: Unlikely

P: Possible

CE: Certain

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Timing

T: Time of day

S: Seasonality

R: Regulatory

NA: Not Applicable

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

11.6 Determination of Significance

11.6.1 Significance of Residual Effects

The definition of significant adverse effects on cultural use is provided in Section 11.1.6. The determination of significance for assessment of residual effects on cultural use provided here considers information about cultural use information shared by Indigenous participants during project engagement, information contained in other reports and studies commissioned by the GNWT, and a review of publicly available literature containing information about cultural use by affected Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils. Significance determinations for related biophysical and socio-economic VC assessments, the ecological and socio-economic context of the RAA, past project experience, and professional judgment are also considered.

The Project will remove habitat for plants, animals, and fish harvested by Indigenous Governments, Indigenous Organizations, and renewable resource councils and has the potential to hinder the movement of traditionally harvested animals within the LAA due to physical barriers. However, the Project is not expected to result in an appreciable change in the distribution, diversity, and abundance of traditionally harvested species in the RAA. The Project may result in damage or destruction of small sections of traditionally used trails that intersect the PDA, but it is

not expected that rerouting will be necessary, and the use of the trails should not be materially impeded.

While the number of resource users or recreational hunters and fishers is not anticipated to change measurably in the foreseeable future, the locations in the RAA where resource use occurs may shift in response to changes in access, although local harvesters recognized that increased access may also result in positive effects (5658 NWT Ltd. and GNWT, 2011 [PR#16]). Any sites or areas for cultural use that may be within the PDA in areas of direct physical disturbance sites will be permanently removed. Effects on these sites was conservatively considered to be high magnitude even though information on the location, frequency, and nature of use of these sites is unavailable. It is anticipated that sites or areas for cultural use, including Bear Rock (Petınızah), which has a proposed routing 2 km north of Bear Rock (Petınızah), outside areas of direct physical disturbance would remain largely unchanged outside the PDA.

With the described application of mitigation measures, the effects of the Project on cultural and traditional land use will not result in the long-term loss of availability of traditional resources for cultural use or access to traditional resources or areas, such that cultural use is critically reduced or eliminated within the RAA. As a result, overall effects on cultural use are predicted to be not significant.

11.6.2 Significance of Cumulative Effects

Although the Project will contribute a small, incremental increase in loss of habitat for plants, wildlife, and fish harvested by Indigenous Governments, Indigenous Organizations, and renewable resource councils. Plant, animal, and fish species harvested by Indigenous Governments, Indigenous Organizations, and renewable resource councils are expected to continue to be available throughout the LAA and RAA. The Project will permit increased all-season access to harvesting areas to both local residents as well as non-residents and recreational hunters and fishers, but the number of resource users or recreational hunters and fishers is not anticipated to change measurably in the foreseeable future and local harvesters recognized that increased access may also result in positive effects (5658 NWT Ltd. and GNWT, 2011 [PR#16]). The GNWT will work with SRRB and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the RAA. This will include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management operation (see wildlife and wildlife habitat Section 19.5.2). Cumulative effects on sites or areas for cultural use are not anticipated.

With mitigation and environmental protection measures, the residual cumulative environmental effects on cultural and traditional land use are not significant as they will not result in the long-term loss of availability of cultural use resources or access to lands relied on for cultural use practices or sites and areas for cultural use such that these activities will be substantially diminished or lost from the RAA.

11.6.3 Project Contribution to Cumulative Effects

The Project will contribute to the loss of habitat for plants, animals, and fish harvested by Indigenous Governments and Indigenous Organizations and renewable resource councils and may contribute to change movement patterns of wildlife by creating physical barriers. However, plant, animal, and fish species harvested by Indigenous Governments and Indigenous Organizations and renewable resource councils are expected to continue to be available throughout the LAA and RAA. Increased access for fishing opportunities due to the Project and its connection with other transportation corridors in the RAA can be expected to result in increased fishing pressure of some fish populations (e.g., Arctic grayling). The duration is long-term, but the frequency is irregular (e.g., when people fish). The effect can be reversible with fisheries management initiatives (see fish and fish habitat Section 17.6.4). The Project will contribute to increased access to cultural use resources and areas for both Indigenous and public users, and the use of the Project as a travelway will increase from seasonal to permanent, although local harvesters recognized that increased access may also result in positive effects (5658 NWT Ltd. and GNWT, 2011 [PR#16]).

11.7 Prediction Confidence

Prediction confidence in the assessment of effects on cultural use is low to moderate. This prediction confidence assignment reflects the available information regarding cultural and traditional land use by Indigenous governments and organizations; knowledge holders and land users information shared by Indigenous participants during the project-specific engagement program; a review of publicly available literature containing information about cultural and traditional land use by affected Indigenous Governments and Indigenous Organizations, knowledge holders, and land users; and collected through project-specific TLRU studies.

As noted in Section 11.2.1, the GNWT is confident that the information obtained through the publicly available sources is valid and reliable and adequate for purposes of this assessment but acknowledges gaps and uncertainties (see Section 11.7.1.1). Prediction confidence also takes into account that NWRRC and Pehdzéh Kì First Nation Project-specific TLRU studies commissioned by the GNWT were unavailable at the time the assessment was completed. As Project-specific TLRU studies become available, they will be reviewed against the results of the DAR and incorporated in the regulatory process and project planning as appropriate. Prediction confidence also reflects the understanding of applicable mitigation measures and reliance on assessments of other VCs of relevance to cultural use. Given the qualitative and subjective nature of assessing cultural use, the views of Indigenous Governments and Indigenous Organizations and renewable resource councils may differ from the findings of this assessment.

11.7.1 Assumptions

This assessment conservatively assumes that cultural use activities have the potential to occur within the RAA even if Indigenous Governments, Indigenous Organizations, and renewable resource councils did not specifically identify cultural use activities or site-specific uses as occurring there. In assessing potential effects on cultural use, this assessment uses a conservative approach that recognises that a lack of cultural use information for a specific area or activity does not necessarily represent a lack of cultural use for that location or activity, especially where no project-specific TLRU information is available. The assessment also assumes that traditionally used species identified as being present in the RAA could be hunted, trapped, fished, or gathered by Indigenous Governments, Indigenous Organizations, and renewable resource councils.

11.7.1.1 Gaps and Uncertainties

The GNWT acknowledges that the best source of information regarding cultural and traditional land use is information provided directly by affected Indigenous Governments and Indigenous Organizations. The GNWT received a confidential TLRU report from TRRC and NWRRC, but as stated in Section 11.1, the GNWT has offered opportunities for Pehdzéh Kì First Nation to complete project-specific TLRU studies; however, this has not been completed prior to the submission of the DAR. As additional TLRU information becomes available, it will be reviewed against the results of the DAR and relevant information will be incorporated into the regulatory process and project planning, as appropriate.

The GNWT acknowledges that the information in this assessment regarding cultural and traditional land use is not comprehensive and that project-specific TLRU studies remain incomplete. However, no Indigenous Knowledge study process would be fully able to capture the complex and interrelated lived experience of land use and knowledge systems of an individual Indigenous government or organization in their entirety. The GNWT has compensated for this limitation by adopting the conservative approach described in Section 11.7.1.

11.8 Follow-up and Monitoring

Follow-up and monitoring is intended to verify the accuracy of the DAR, assess the implementation and effectiveness of mitigation and the nature of the residual effects, and to manage adaptively if required. The project-specific management plans stipulate mitigation measures and monitoring required during construction, operations and maintenance, and decommissioning/closure activities. As part of an adaptive management plan for follow-up and monitoring, these mitigation measures will be regularly reviewed and updated by the GNWT to verify and enhance their effectiveness. In the event that an unexpected deterioration of the environment is observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process.

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The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, to better understand how the Project may affect cultural and traditional land use and to identify practical and feasible mitigation measures.

11.9 References

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