Dempster Fibre Line Wildlife Management and Monitoring Plan (WMMP)

Photo Credit: Hemmera Envirochem Inc.

Prepared for:

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EXECUTIVE SUMMARY

This document will act as the Wildlife Management and Monitoring Plan (WMMP) for the Dempster Fibre Line project being conducted by ROHL Global Networks. The WMMP addresses primarily concerns with the construction phase of the project, which involves the installation of a fibre optic cable from Dawson City, Yukon, to Inuvik, Northwest Territories. The installation of this cable will occur alongside the Dempster Highway, mostly via burying the cable within the right-of-way of the highway, but occasionally via overhead cable methods. This WMMP identifies the wildlife species with which this Project will interact – specifying species of concern as at-risk species and species protected under legislation. Potential impacts upon wildlife and wildlife habitat are described, and mitigation measures are presented for potential impacts. Terms and conditions specified by regulators pertaining to mitigation of potential wildlife impacts have been included.

Due to the construction methods restricting activities to within the Dempster and Klondike Highways rights-of-way, with a few exceptions (pre-existing access roads to maintenance camps or microwave towers), very minimal impact is anticipated upon local wildlife and wildlife habitat. The primary concern for this Project regarding wildlife is that of potential disturbance of raptor and migratory bird nests. Mitigation measures include minimizing vegetation clearing, avoiding vegetation clearing during the breeding bird season, and conducting routine bird nest sweeps prior to required brushing and clearing.

Although wetland habitats will be encountered frequently - particularly in the Northwest Territories portion of the Project – the use of horizontal directional drilling will minimize the potential for impacts. No water withdrawal will be undertaken for wetlands. Therefore, the primary concern regarding wildlife habitat is permafrost thaw since the Project will require extensive digging and trenching to bury the fibre optic cable. Project-specific mitigation measures have been outlined to mitigate permafrost thaw and therefore mitigate potential impacts upon wildlife habitat.

CONFORMITY TABLES

Permit / License Required	Required By:
Type A Land Use Permit	MVLWB
Type B Water License	MVLWB
YESAB Decision Document	Yukon Government
IFC	Yukon Government

CONFORMITY TABLES - REVISIONS

ID	Recommendation	Revision	Section of Plan
1	Add contact information for the GNWT-ENR Regional Biologist (Beaufort Delta region) to Table 2.	Table 2 updated to include GNWT-ENR Regional Biologist's contact information.	Table 2, page 4
2	Add sensitive periods for Northern Mountain Caribou, Boreal Caribou, and Porcupine / Forty-Mile populations of Barren-ground Caribou and describe when and where each of these types of caribou is most likely to interact with the project.	Section 2.0 updated to include when and where caribou populations may interact with the Project.	Section 2.0, page 14
3	Add reference to the NWT Wildlife Act in Sections 3.2.1 and 3.2.2.	References to the NWT Wildlife Act included in Sections 3.2.1 and 3.2.2.	Section 3.2.1, page 20 Section 3.2.2, page 21
4	Update the WMMP to remove "other" from the Incident Report Form and instead list all acceptable deterrent methods as determined by the proponent. Update section 3.1.4 "Wildlife Deterrent Measures" to say that they will use deterrent methods from least to most invasive.	Appendix D Incident Report Form updated to remove "other". Section 3.1.4 states that humane deterrent methods will be used, starting with the least invasive method to most invasive method if the situation requires.	Appendix D Section 3.1.4, page 20
5	Update section 3.1.2.1 "Birds" to lengthen the critical bird breeding	Section 3.1.2.1 updated to length the critical bird breeding period, acknowledge the requirement to protect unoccupied	Section 3.1.2.1, page 17

	period from May-August to April-September. Add text to section 3.1.2.1 to acknowledge that, in the NWT, unoccupied raptor nests must also be protected from damage or destruction, or a permit from ENR must be obtained to damage/destroy them. Update section 3.1.2.1 “Birds” to include a larger buffer zone (as recommended in the Northern Land Use Guidelines)	raptor nests, and to include a larger buffer zone for raptor nests.	
6	Add text to Section 3.2.4 to specify that wildlife-vehicle collisions must be reported to ENR within 24 hours after the incident.	Section 3.2.4 updated to specify reporting requirements for wildlife-vehicle collisions.	Section 3.2.4, page 21
7	Section 1.2 indicates that the Tetlit Gwich’in Council in Fort McPherson was consulted. We encourage the proponent to also consult with the Gwichya Gwich’in Council in Tsiigehtchic and the Nihtat Gwich’in Council in Inuvik.	Section 1.2 updated to reflect that the Gwichya Gwich’in Council and Nihtat Gwich’in Council were consulted during initial project engagement activities, and to clarify that engagement activities will be ongoing throughout the construction and operation stages of the project.	Section 1.2, page 4
8	In Section 2.0, Table 5 we note that “Deleterious alteration of aquatic and riparian habitat” and “Spills of hazardous materials” are listed as two potential effects of the project but there are no corresponding mitigation measures listed. We encourage the proponent to identify appropriate mitigations.	Table 5 “Deleterious alteration of aquatic and riparian habitat” updated to reflect additional mitigation measures.	Table 5, page 11
9	Community members often hunt caribou along the Dempster Highway. Caribou is a significant part of many people's diets and is important for their food security. Please consult with the local Renewable Resources Councils to	Section 1.2 updated to reflect that local Renewable Resources councils will be consulted.	Section 1.2, page 4

	find a time for your work that will minimize any disruption to hunting.		
10	During nesting season, aggregate pits should be examined regularly for bank swallow nests. If active nests are found, mitigation measures should be put in place to avoid disturbing them.	Section 3.1.2.1 updated to reflect that aggregate pits will be examined for nests during nesting season.	Section 3.1.2.1, page 17.
11	If machinery is brought in from outside the Mackenzie Delta, clean any soil from it before arriving to minimize the risk of spreading weeds and invasive species.	Section 2.0 “Potential Project Effects to General Wildlife Habitat” updated to include text describing cleaning of equipment.	Section 2.0, page 15
12	Bears along the Dempster Highway near the Yukon/NWT boarder and in the surrounding mountains are known to be quite aggressive. There are also reports of bears in this area that move towards the sound of gunfire because they associate it with food. Be aware that noise-based bear deterrents like bear bangers may actually draw bears to you. Please be very cautious. Do not travel alone in this area.	Section 3.1.2.3 updated to reflect recommendations for bear deterrents and avoidance of travelling alone.	Section 3.1.2.3, page 18
13	If re-seeding vegetation, ensure that native seed mixes appropriate to the location and habitat are used. Please be sure that mixes are free of weeds and invasive species.	Section 1.3.7 updated to specify that native seed mix will be appropriate to the location and habitat and will be free from invasive species and weeds.	Section 1.3.7, page 6
14	Temporarily suspend operations if caribou, moose, sheep, bears, or muskoxen are spotted within 500 metres of any work site or camp. Work can resume once the animals have left the area.	Section 3.1.2.2 outlines a stop work policy for caribou spotted within 1km of a work site. Section 3.1.2.3 outlines a stop work policy for bears spotted within 200m of a work site. Section 3.1.2.4 outlines a stop work policy for moose spotted within 500m of a work site.	Section 3.1.2.2, page 18 3.1.2.3, page 18 Section 3.1.2.4, page 19 Section 3.1.2.5, page 19

		Section 3.1.2.5 outlines a stop work policy for sheep spotted within 500m of a work site. Section 3.1.2.7 outlines a stop work policy for muskoxen spotted within 500m of a work site.	Section 3.1.2.7, page 19
15	Store fuel at least 100 metres beyond the ordinary high-water mark. Put in place mitigation procedures to avoid spills, such as refueling only in designated areas (100 metres beyond normal high water). Have a spill response plan and ensure that all staff are familiar with it.	Section 3.1.1 updated to outline 100 m distance from ordinary high-water mark for fuel storage and refueling; mitigation measures for spill contingency, and to include reference to the Project Spill Contingency Plan.	Section 3.1.1, page 16
16	Please do not allow fuel or lubricants to contaminate the land or water. Repair leaky equipment promptly. Use drip trays to catch oil when vehicles or machinery will be stored for extended periods.	Section 3.1.1 updated to outline 100 m distance from ordinary high-water mark for fuel storage and refueling; mitigation measures for spill contingency, and to include reference to the Project Spill Contingency Plan.	Section 3.1.1, page 16
17	Immediately report spills of any hazardous substances to NWT Environment and Natural Resources (867-920-8130, spills@gov.nt.ca, enr.gov.nt.ca/en/services/report-spill). This includes fuel, lubricants, coolants, and chemicals.	Section 3.1.1 updated to include the GNWT Spill Report Line.	Section 3.1.1, page 16
18	If there is potential for runoff to carry sediment into streams or lakes, ensure that silt fencing is put in place. Avoid working during heavy rain. When possible, leave vegetation roots in place to help hold the soil together.	Section 1.3.7 updated to incorporate text relating to the use of silt fences.	Section 1.3.7, page 6
19	Properly dispose of all horizontal directional drilling waste and ensure that it does not contaminate the surrounding land or water.	Section 1.3.5 updated to include reference to Project's Waste Management Plan for disposal of drilling waste.	Section 1.3.5, page 5

20	If erosion is observed, appropriate mitigation measures should be put in place promptly.	Section 1.3.7 updated to include reference to the Project's Erosion and Sediment Control Plan for all erosion and sediment control activities.	Section 1.3.7, page 6

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
AVC	Animal-Vehicle Collision
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ECCC	Environment and Climate Change Canada
ENR	Department of Environment and Natural Resources (Northwest Territories)
GNWT	Government of the Northwest Territories
GNWT-ENR	Government of the Northwest Territories – Environment and Natural Resources
Hemmera	Hemmera Envirochem Inc.
HDD	Horizontal Directional Drilling
MBCA	*Migratory Birds Convention Act* 1994
Project	Dempster Fibre Line Project
ROHL	ROHL Global Networks
ROW	Right-Of-Way
SARA	Federal *Species at Risk Act*
WMIS	Wildlife Management Information System (Northwest Territories)
WMMP	Wildlife Management and Monitoring Plan
YESAB	Yukon Environmental and Socio-economic Assessment Board

LIST OF SYMBOLS AND UNITS OF MEASURE

Symbol / Unit of Measure	Definition
km	Kilometre

1.0 INTRODUCTION

The Dempster Fibre Line Project (the Project) is an approximately 800-kilometre (km) fibre line which will extend from Dawson City, Yukon, to Inuvik, Northwest Territories (**Figure 1**). Built primarily along the Klondike and Dempster highways, this fibre line will provide multiple remote northern communities – who currently rely on a single fibre optic line - a backup line in the event of any future service disruptions. The Project will offer these communities more reliable internet and cellular services and increase their connectivity to the digital world. Additionally, the line will connect the Yukon to the Mackenzie Valley Fibre Link in the Northwest Territories, creating a continuous network running through Yukon, Northwest Territories, and northern British Columbia.

The Dempster Highway extends 735 km from the Dempster Highway Junction (east of Dawson City) to Inuvik. Between the starting point and end point, there are two communities adjacent to the Dempster Highway – Tsiigehtchic and Fort McPherson – which are both located in the Northwest Territories. The highway is located within a 60-metre-wide right-of-way (ROW), within which the majority of the fibre line is planned to be buried. The Government of Yukon Department of Highways and Public Works and the Government of Northwest Territories (GNWT) Department of Infrastructure exercise authority over the operation and maintenance of the Dempster Highway in the Yukon and the Northwest Territories, respectively. Construction activities for the Project began on the Dempster Highway during the summer season of 2021 and are expected to continue for approximately five years from the start date. Installation will resume in summer 2022 and continue north-east up the Dempster Highway towards the Northwest Territories.

Hemmera was contracted to develop a Wildlife Management and Monitoring Plan (WMMP) for the Project, as required by the Government of Northwest Territories and Government of Yukon. The WMMP describes the mitigation, monitoring and adaptive management methods and responses that will be used to address commitments and regulatory requirements regarding interactions with wildlife in the Northwest Territories and the Yukon Territory. The purpose of this WMMP is to provide a detailed methodology on how Project personnel will avoid, minimize and monitor impacts to wildlife and wildlife habitat throughout the remainder of the Project.

The objectives of the Dempster Fiber Line WMMP are to:

- Ensure construction activities meet regulatory requirements and guidelines
- Outline mitigation strategies to be used to minimize impacts on wildlife and wildlife habitat
- Describe monitoring efforts which will assess the effectiveness of mitigation strategies
- Explain the adaptive management procedures that would be applied if needed.

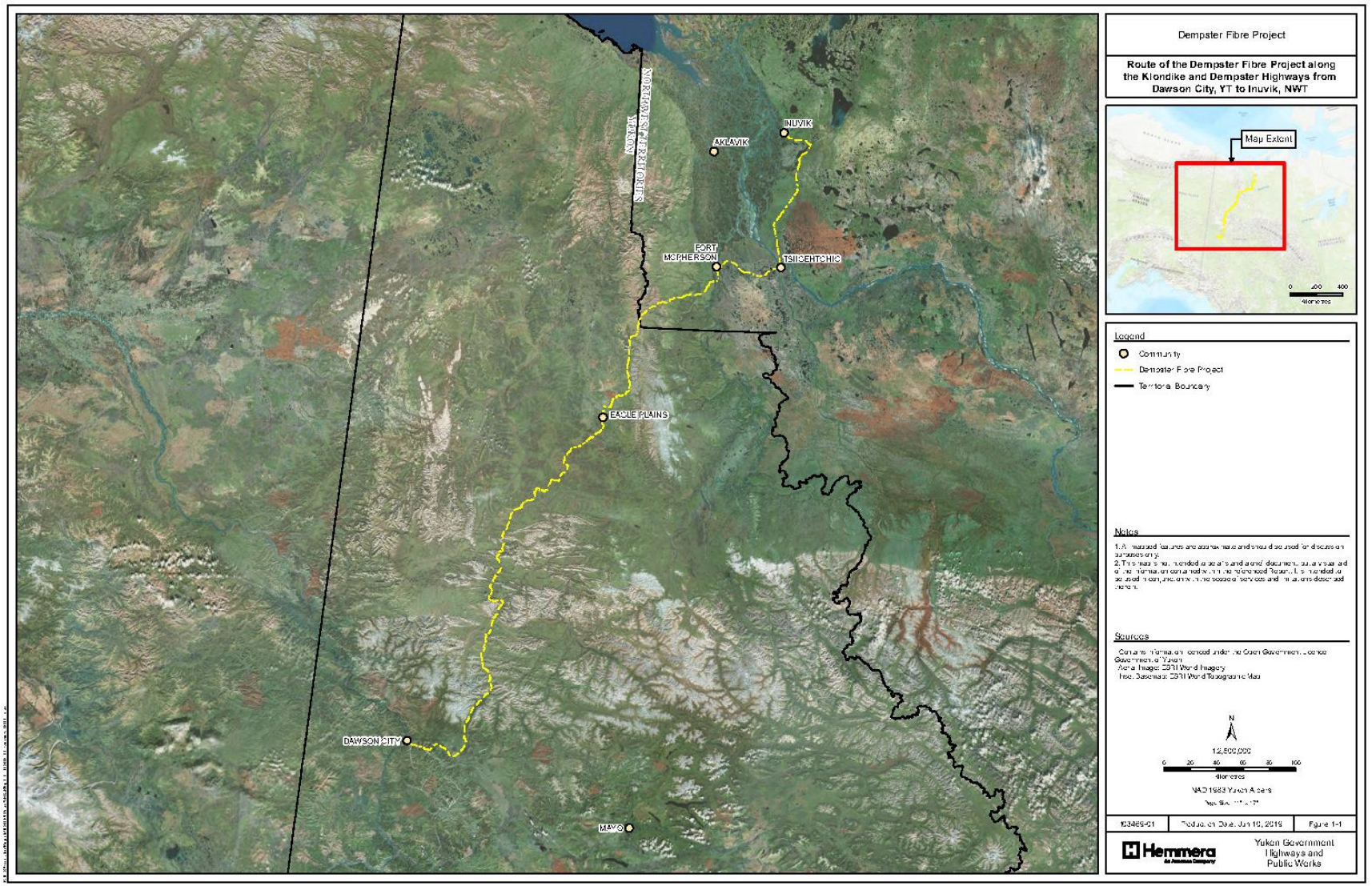

Figure 1 Construction path of the Dempster Fibre Line, extending from Dawson City, Yukon, to Inuvik, Northwest Territories.

1.1 Project Team

Below are the names, roles, affiliations, and contact information for key personnel within the project team (**Table 1**) and authorities (**Table 2**) relevant to the Project.

Table 1 Project Team Roles and Contact Information

Role	Name	Organization	Telephone Number
Project Owner	Darryl Froese	Yukon Government	(867) 667-3089
Project Director	Rick Seys	ROHL	Office: (780) 569-5300 Cell: (519) 870-5841
Project Manager – Field Operations	Gary Seed	ROHL	(867) 332-8124
Field Superintendent	Ben Price	ROHL	(204) 768-0275
Environmental Monitoring Field Staff	Richard Francis	ROHL	(867) 678-0669
Drilling / Plowing Contractor	Graham Putland	Dagoo Services	(867) 333-0484
Stantec Senior Project Leader	Warren McLeod	Stantec	(867) 445-2881
Stantec On-Site Engineer	TBD	Stantec	TBD
Geotechnical	Chad Cowan	Tetra Tech	(867) 668-9214
Brushing Crew	Cory Magnuson	Dagoo Services	(867) 335-0244
Environmental Monitoring Project Manager	Devon Yacura	Hemmera	(867) 456-4865 ext. 718
Environmental Monitoring Field Staff	Alex Therriault Aidan Allen	Hemmera	(867) 332-0024 (867) 336-2167
Development Partnership Manager	Shari Borgford	Tr'ondek Hwech'in	(867) 993-7100 ext. 219

Table 2 Regulatory Contacts

Role	Name	Organization	Telephone Number
Yukon Spill Response Line	Environmental Compliance Officer	Yukon Government – Department of Environment	(867) 667-7244
Northwest Territories Spill Response Line	N/A	Government of the Northwest Territories – Environmental & Natural Resources	(867) 920-8130
YG Heritage Resource Contact	Ty Heffner	Yukon Government – Heritage Resources Unit	(867) 667-3771
NWT Culture and Heritage Contact	N/A	Government of the Northwest Territories – Culture and Heritage	(867) 767-9347 ext. 71474
YG Regional Biologist	Mark O'Donoghue - Northern Regional Biologist Mike Suitor – North Slope and Migratory Caribou Biologist	Yukon Government – Department of Environment	(867) 996-2162 (867) 993-6461

Role	Name	Organization	Telephone Number
GNWT-ENR Regional Biologist	Steve Baryluk	Wildlife Management, Beaufort Delta Region, GNWT-ENR	(867) 777-4002 ext. 1008
NWT Wildlife Sighting or Emergency Contact – Inuvik Region	N/A	Government of the Northwest Territories – Environmental & Natural Resources	867-678-0289
NWT Big Game Collision Reporting Contact	N/A	Government of the Northwest Territories – Environmental & Natural Resources	866-629-6438
NWT Annual Wildlife Reporting	N/A	Government of the Northwest Territories – Environmental & Natural Resources	WMISTeam@gov.nt.ca

1.2 Engagement

This WMMP will be provided to the Mackenzie Valley Land and Water Board for review and feedback. First Nations consulted prior to the project start included the Tr'ondëk Hwëch'in, Vuntut Gwitchin First Nation, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, Tetlit Gwich'in Council, Gwichya Gwich'in Council, and the Nihtat Gwich'in Council. A summary of the issues raised by each First Nation is available in **Section 4.0** of the Yukon Environmental and Socio-economic Assessment Board (YESAB) Project Proposal, provided in **Appendix B**.

In accordance with MVLWB policy, engagement activities will continue during the construction of the Project as well as the operation and maintenance of the fibre line. Additionally, Local Renewable Resource Councils will be engaged to discuss hunting and trapping considerations to ensure that construction activities do not inhibit or cause disruption to local hunters. Yukon Environment - Department of Natural Resources and any interested affected First Nations will be provided regular updates from Yukon Government (YG) regarding planned project activities within Traditional Territories, wildlife observations from the environmental monitor, and to solicit advice for project activities occurring in identified caribou Wildlife Key Areas (as specified in the YESAB Decision Document, provided in **Appendix E**).

1.3 Project Activities Relevant to the Plan

This WMMP addresses project activities which have potential impacts on local wildlife and wildlife habitat. The installation of the Dempster Fibre Line involves a variety of construction methods, including cable burying, water removal for HDD activities, clearing, horizontal directional drilling (HDD), handholes, and aerial installation (detailed descriptions of construction activities can be found in the Environmental Management Plan) and are briefly summarized here. Potential impacts to wildlife and wildlife habitat for this project are addressed within **Section 2.0**.

1.3.1 Mobilization and Staging

All equipment and materials needed for construction of the Project will be mobilized to site by trucks on the Klondike and Dempster highways. Temporary staging areas for personnel and equipment will be located along the project route within the highway ROW at existing quarry and road maintenance depot sites, to the extent possible. Minimal vegetation clearing is expected for preparation and use of the staging areas.

1.3.2 Clearing and Brushing

The cable alignment corridor and temporary access trails between the highway and the cable alignment will be cleared during installation. Clearing requirements will depend on the current status of vegetation control in the ROW (part of regular highways maintenance).

1.3.3 Aerial Cable Installation

Approximately 14 km of aerial installation will occur on existing Yukon Energy power transmission line poles along the Klondike Highway and approximately 1.3 km of aerial installation will occur on existing light poles and/or transmission line poles within Dawson City municipal boundaries. New aerial poles will be installed only where the surface-laid, shallow buried, or HDD is too risky, impractical or costly due to the length of the crossing required or the ground geology (e.g., a large ravine or gorge, washout areas, high erosion areas, or large standing water crossings). New aerial sections will be limited as much as possible.

New aerial pole construction requires new wooden poles, augured in place in most mineral soils. In sensitive permafrost areas, grillage foundations may be required for the pole bases. These structures are built up from a grid of timber, metal or fibreglass members, placed on a layer of aggregate covering the natural ground and loaded with stone.

1.3.4 Buried Cable

Buried cable will be installed by plowing or trenching, depending on permafrost conditions and ground stability. Shallow burial involves laying the cable along the base of a thin, shallow (~150 mm) “slice” into the surface organics at the top of the active layer of permafrost, where permafrost is shallow and continuous.

Plowing installs conduit or cable via equipment affixed with a cable plow behind or just off to one side of the equipment or vehicle and towing large conduit reels on trailers. Trenching involves digging a trench with a backhoe or trencher, laying the cable and then filling the trench.

1.3.5 Horizontal Directional Drilling

Horizontal directional drilling (HDD) is used when fibre optic cables and pipelines cross roads, watercourses, wetlands and other environmentally sensitive areas. HDD will be used when:

- Crossing watercourses.
- Road crossings (e.g., when changing from one side of highway to the other, or to cross vehicle pull-outs or intersecting roads).
- Rock outcrops which cannot be avoided.
- Areas where there’s significant risk of permafrost damage, or other options aren’t practical.

HDD will be used for all major river crossings, and any watercourses with flowing water and fish habitat where aerial crossings are unsuitable. HDD will also be used on all road prism crossings across the Dempster Highway and any significant road turnouts or highway access roads along the route. All HDD waste will be disposed of following the Project’s Waste Management Plan.

Up to five small drill rigs are expected to be operating during the 2022/2023 construction season, with a large drill rig operating at the major river crossings in the NWT during 2022.

1.3.6 Surface Laid Cable

Surface lay of the fibre optic cable can be accomplished with or without conduit, depending on the circumstances. Especially where conduit is used, reasonable efforts will be made to clear obstacles from the path of the cable and lay it flat on the ground. Where required, and to counteract the tendency of the conduit to coil, the crew may pin the conduit down with weights (e.g., a geotextile sandbag) to ensure the cable remains below the organic layer surface.

Minimal vegetation clearing will be required to allow surface placement of the cable as the crew will need regular access to the alignment during installation, and for movement of cable and reels to the cable alignment, as needed. These access points will be established approximately 500 m to 1,000 m apart, and natural clearings will be utilized wherever possible. Offset plows with boom extensions will be used to either lift the cable into place or spool off cable as the surface-laid process travels along the highway.

1.3.7 Site Reclamation

Site reclamation will be undertaken on a progressive basis as work is completed at each worksite, as follows:

- Remove construction materials and supplies from the site following construction completion.
- Restore disturbed soils (including drill entry and exit points) as soon as possible to prevent erosion and potential sedimentation into adjacent watercourses. Silt fences will be used in areas where there is potential for runoff to carry sediment into water courses. All erosion and sediment control activities will be carried out following the Project's Erosion and Sediment Control plan.
- Areas where natural revegetation has not established will be re-seeded using a mix of native endemic plants that are appropriate to the location and habitat, or in riparian areas, with native grasses, shrubs, and/or trees. Seed mixes will be free of invasive species and weeds to prevent the spread of these plants.

1.4 Environmental Setting

The Dempster Fibre Line will pass through large expanses of boreal, taiga, and tundra ecosystems, many of which have experienced very minimal human development to date. The majority of the Project interacts with tundra, which consists of dense shrubs, wetlands, and permafrost-rich soils. Tundra ecosystems are known for having low biological diversity and abundance; these are highly variable depending on time of year and migration paths of various wildlife species. The few species that inhabit tundra ecosystems are often specialized to such environments, and therefore are reliant on these ecosystems for survival and reproductive success. For the Dempster Fibre Line Project, thorough consideration of construction activities and their effects upon local wildlife, as well as effective monitoring and reporting, are necessary to a successful WMMP.

1.5 Statutory Requirements, Commitments, And Guidelines

This WMMP follows the statutory requirements, commitments, and guidelines set by territorial and federal authorities. These are listed in **Table 3** and shown in greater detail in the **Appendix A**.

Table 3 Applicable Federal and Territorial Legislation

Regulator	Regulation	Applicability
Federal Legislation		
Environment and Climate Change Canada (ECCC)	*Species at Risk Act* (SARA)	*SARA* protects and manages the recovery of extirpated, endangered, or threatened wildlife or species of special concern. Once a species is listed under SARA, development of recovery plans is legally required to secure key habitat and population protections (Government of Canada, 2022d).
ECCC	*Migratory Birds Convention Act* 1994 (MBCA)	*MBCA* and its regulations provide protection for migratory birds and their nests and regulate hunting of migratory game birds. The Act and its regulations prohibit disturbing or harming migratory birds, their eggs, or nests. The general nesting period for migratory birds in the Yukon is between May 1 and August 31 (ECCC, 2019). The general nesting period for migratory birds in the NWT is late April to mid September (Government of Canada, 2018). Under the MBCA, breeding birds are not to be disturbed (Government of Canada, 2022c).
Yukon Territory Legislation		
Government of Yukon	*Yukon Environmental and Socio-Economic Assessment Act*	The *Yukon Environmental and Socio-Economic Assessment Act* outlines the assessment processes of the territory regarding activities with potential environmental and/or socio-economic impact (Government of Canada, 2022a).
Government of Yukon	*Yukon Wildlife Act*	The *Yukon Wildlife Act* regulates hunting and trapping, outfitting and guiding, licensing, enforcement, and habitat protection. Regulations under this Act include designating specific protections for wildlife species, key habitat areas and protected areas. Habitat Protection Areas are administered by the Yukon Government under this Act (Yukon Government, 2022).
Government of Yukon	*Yukon Environment Act*	The *Yukon Environment Act* provides protection of land, water, and air. It applies on lands throughout Yukon and regulations to this Act set standards for air quality, waste, recycling, and spills (Yukon Government, 2022a).
Northwest Territories Legislation		
GNWT - ENR	Northwest Territories *Wildlife Act*	The Northwest Territories *Wildlife Act* supports the conservation of wildlife in the NWT and represent best practices for managing wildlife, while respecting Indigenous and treaty rights (Government of Northwest Territories, 2022b).
GNWT - ENR	*Species at Risk (NWT) Act*	The *Species at Risk (NWT) Act* (SARA (NWT)) integrates co-management principles included in land-claims agreements and management authorities to conserve species at risk in the NWT (Government of Northwest Territories, 2022a).
Regional Regulations		
Mackenzie Valley Land & Water Board	Mackenzie Valley Resource Management Act	The Mackenzie Valley Resource Management Act (MVRMA) regulates decisions on transboundary projects within the Mackenzie Valley, ensures consistent application of the MVRMA, and issues required permits and licenses within their jurisdiction.

1.6 Guidelines And Other Relevant Documents

Guidelines and other relevant documents considered while developing this WMMP include:

- *Wildlife Management and Monitoring Plan (WMMP) Process and Guidelines* (GNWT, 2021)
- *Dempster Fibre Line Environmental Management Plan*
- *Dempster Fibre Line Spill Contingency Plan*
- *Dempster Fibre Line Waste Management Plan*
- *Dempster Fibre Line Permafrost Protection Plan*
- *Yukon Environment and Socio-economic Assessment Board (YESAB) Project Proposal*
- *YESAB Decision Document*
- *Dempster Fibre Line Riparian Zone Remediation Strategy*
- *Mackenzie Valley Land & Water Board* **(***MVLWB) Type A Land Use Permit*
- *MVLWB Type B Water License.*

Full versions of the documents can be found in **Appendices A** and **B**.

Additionally, the Decision Document from YESAB contained 32 terms and conditions which the project must address for approval to continue construction within the Yukon territory. The Decision Document can be viewed in full in **Appendix E**, and the terms and conditions in that document (if relevant to wildlife or wildlife habitat) are included within this WMMP in their appropriate sections.

1.7 Species of Concern

Table 4 lists the species of concern whose range also overlaps with the construction path of the Dempster Fibre Line (specifically along the Dempster and Klondike Highways). The status of each species of concern was sourced from Schedule 1 of SARA and from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Species of concern for the Project include species at risk, defined as species listed as at risk on Schedule 1 of SARA (Government of Canada, 2022d) or by COSEWIC, and whose ranges overlapped with the project. Wildlife species of interest or management concern to the territorial governments, local First Nations, or the general population, and the legislation under which they are protected are also listed in **Table 4**.

Table 4 Species of Concern along the Dempster and Klondike Highways

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Status	Protected under Listed Legislation
Wildlife Species at Risk				
Bank Swallow	*Riparia riparia*	Threatened	Special Concern	SARA, MBCA
Barn Swallow	*Hirundo rustica*	Threatened	Special Concern	SARA. MBCA
Boreal Woodland Caribou (Hart River population)	*Rangifer tarandus caribou*	Threatened	Threatened	SARA, SARA (NWT)
Barren-ground Caribou (Porcupine & Forty Mile populations)	*Rangifer tarandus groenlandicus* OR *Rangifer tarandus granti*	Threatened	Threatened	SARA, SARA (NWT)

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Status	Protected under Listed Legislation
Buff-breasted Sandpiper	*Tryngites subruficollis*	Special Concern	Special Concern	SARA, MBCA
Collared Pika	*Ochotona collaris*	Special Concern	Special Concern	SARA
Common Nighthawk	*Chordeiles minor*	Threatened	Special Concern	SARA, MBCA
Grizzly Bear	*Ursus arctos*	Special Concern	Special Concern	SARA
Horned Grebe	*Podiceps auritus*	Special Concern	Special Concern	SARA, MBCA
Little Brown Myotis	*Myotis lucifugus*	Endangered	Endangered	SARA, SARA (NWT)
Northern Mountain Caribou	*Rangifer tarandus caribou*	Special Concern	Special Concern	SARA, SARA (NWT)
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Special Concern	SARA, MBCA
Peregrine Falcon *anatum/tundrius* complex	*Falco peregrinus anatum/tundrius*	Special Concern	Not at Risk	SARA, *Yukon Wildlife Act*
Red-necked Phalarope	*Phalaropus lobatus*	Special Concern	Special Concern	SARA, MBCA
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Special Concern	SARA
Short-eared Owl	*Asio flammeus*	Special Concern	Threatened	SARA
Wolverine	*Gulo gulo*	Special Concern	Special Concern	SARA
Other Wildlife Species of Concern				
Cougar	*Puma concolor*	Not at Risk	Not at Risk	*Yukon Wildlife Act,* NWT *Wildlife Act*
Gyrfalcon	*Falco rusticolus*	Not at Risk	Not at Risk	*Yukon Wildlife Act,* NWT *Wildlife Act*
Trumpeter Swan	*Cygnus buccinator*	No Status	Not at Risk	*Yukon Wildlife Act*, MBCA
Moose	*Alces alces*	No Status	No Status	*Yukon Wildlife Act,* NWT *Wildlife Act*
Black Bear	*Ursus americanus*	N/A	N/A	*Yukon Wildlife Act,* NWT *Wildlife Act*
Grey Wolf	*Canis lupus.*	N/A	N/A	*Yukon Wildlife Act,* NWT *Wildlife Act*
Sharp-tailed Grouse	*Tympanuchus phasianellus*	No Status	No Status	*Yukon Wildlife Act,* NWT *Wildlife Act*
Sheep	*Ovis* sp.	No Status	No Status	*Yukon Wildlife Act,* NWT *Wildlife Act*
Raptor Species	N/A	N/A	N/A	*Yukon Wildlife Act,* NWT *Wildlife Act*
Migratory Birds	N/A	N/A	N/A	MBCA

Sources: GNWT 2022a, Government of Yukon 2022, Government of Canada 2021.

2.0 POTENTIAL IMPACTS ON WILDLIFE AND WILDLIFE HABITAT

Construction activities associated with the Project have the potential to affect wildlife and wildlife habitat. These interactions are more likely to occur at certain times of the year and at certain locations along the route of the Dempster Fibre Line. An Environmental Field Assessment was conducted in 2018, completed by a senior biologist who drove the route of the Dempster Fibre Line (except for the short sections where the fibre line will deviate from the Klondike and Dempster Highways along existing access roads to service existing microwave tower sites or similar, see YESAB proposal, **Appendix B**). The assessment found very minimal potential impacts for wildlife and wildlife habitat along the construction route, with the exception of a few concerns as described below.

Potential project effects on wildlife and wildlife habitat, as identified in the project applications to the YESAB process and to the MVLWB process (**Appendix A**, **Appendix B** and **Appendix E**), are:

- Habitat Loss
- Sensory Disturbance
- Mortality or Injury.

Table 5 identifies which potential effects could result from specific construction activities; these potential effects are summarized in more detail below. Mitigation measures are described more extensively and by wildlife species/species-grouping in **Section 3.0**.

Table 5 Summary of Potential Effects from the Dempster Fibre Line Project on Wildlife and Wildlife Habitat, and Mitigations to these Effects

Project Activity	Potential Effects on Wildlife and Wildlife Habitat	Mitigation Measure
Clearing and Brushing	• Wildlife mortality and harm: ▫ Destruction of active raptor or migratory bird nests, causing loss of eggs or injury/death of adults or nestlings. ▫ Destruction of wildlife denning sites, and adults or juveniles. ▫ Equipment strikes to wildlife. • Habitat loss and alteration: ▫ Loss of active or potential specific use habitat (ex., nest locations, den locations, leks, mineral licks). ▫ Loss general habitat such as resting, foraging or cover. • Sensory disturbance: ▫ Reducing wildlife use of the project area and nearby areas due to noise or activity. ▫ Driving away or reducing wildlife use of specific use habitat, causing unnecessary energy expenditure or preventing wildlife from accessing that specific resource (ex. mineral licks or lekking locations).	• Pre-disturbance wildlife and bird nest sweeps if during the nesting period. • Stop-work procedure for caribou. • Avoidance of known den, lek and mineral lick locations (see KMxKM spreadsheet or **Appendix E** for KM locations). • Minimize areas cleared of vegetation as much as possible and employ hand-clearing in sensitive riparian areas.
HDD and Water Withdrawal	• Sensory disturbance: same as above • Habitat loss and alteration: ▫ Deleterious alteration of aquatic and riparian habitat. ▫ Spills of hazardous materials decreasing aquatic and riparian habitat value.	• HDD will be completed as quickly as possible to minimize noise duration. • No more than 10% of the available flow for a watercourse will be withdrawn, in accordance with the terms and conditions of the MVLWB Type B water license. • No machinery will enter wetland vegetation and riparian habitat zones. QEPs will provide training to environmental monitors on the proper delineation of wetlands and riparian zones, and buffer zones will be marked to prevent the encroachment of equipment into these areas. • Spill kits will be located in all vehicles used on the Project. In the event of a spill, response and reporting procedures will be followed as per the Spill Contingency Plan.
Plowing/Trenching	• Wildlife mortality and harm: same as above • Sensory disturbance: same as above.	• Pre-disturbance bird nest sweeps if during the nesting period (if not already conducted for clearing & brushing, or if an extended period of time has passed since clearing and brushing)
Increased Vehicle Traffic	• Wildlife mortality and harm: ▫ Vehicle strikes to wildlife.	• Report Wildlife Observations to the Environmental Monitor promptly • Stop-work procedure for Caribou • Abide by speed limits • Drive only within limits of visibility
Camps and Increased Human Presence	• Wildlife mortality and harm: ▫ Wildlife attracted to food waste or hazardous chemicals may become human-habituated and aggressive. ▫ Wildlife consuming food waste or hazardous chemicals may become sick or die from inappropriate food items ▫ Wildlife congregating in unusual densities more easily spread communicable diseases.	• Follow Waste Management Plan to minimize wildlife attractants • Report Wildlife Observations to the Environmental Monitor promptly • Consult the KMxKM spreadsheet, the YESAB Decision Document, and the MVLWB permits and licenses when planning locations for temporary camps and laydowns

Potential Project Effects to Birds

Construction may affect nesting raptors since some nesting habit overlaps with the construction route. In the Yukon portion of the project, several Key Wildlife Areas (as defined under the *Yukon Wildlife Act*) for Peregrine Falcon (*Falco peregrinus*), and nesting areas for Gyrfalcon (*Falco rusticolus*), Bald Eagle (*Haliaeetus leucocephalus*), and Golden Eagle (*Aquila chrysaetos*) are located along the Dempster Highway (shown in **Figure 2**) . The Short-eared Owl is also known to occur near or in the project and is listed on Schedule 1 of SARA (**Table 4**) as a species of Special Concern. In the Northwest Territories, all raptors and their nests and eggs are protected by legislation.

A known sharp-tailed grouse (*Tympanuchus phasianellus)* lek location is present near the route. A lek is a dancing ground where male sharp-tailed grouse display for females. Females then disperse from the lek to nest and brood the young. Leks are typically located in herbaceous or grassland environments and are sensitive to disturbance.

In addition to raptor species, migratory birds, their nests and their eggs are protected under the federal *MBCA*. Migratory birds and their habitats may also be adversely affected due to vegetation clearing and project activities (e.g., avoidance due to noise and human presence) within the highway ROWs.

Overall, project activities most likely to interact with birds and bird habitat are those involving vegetation clearing, loud noises and vehicle use (impact-related injury/mortality).

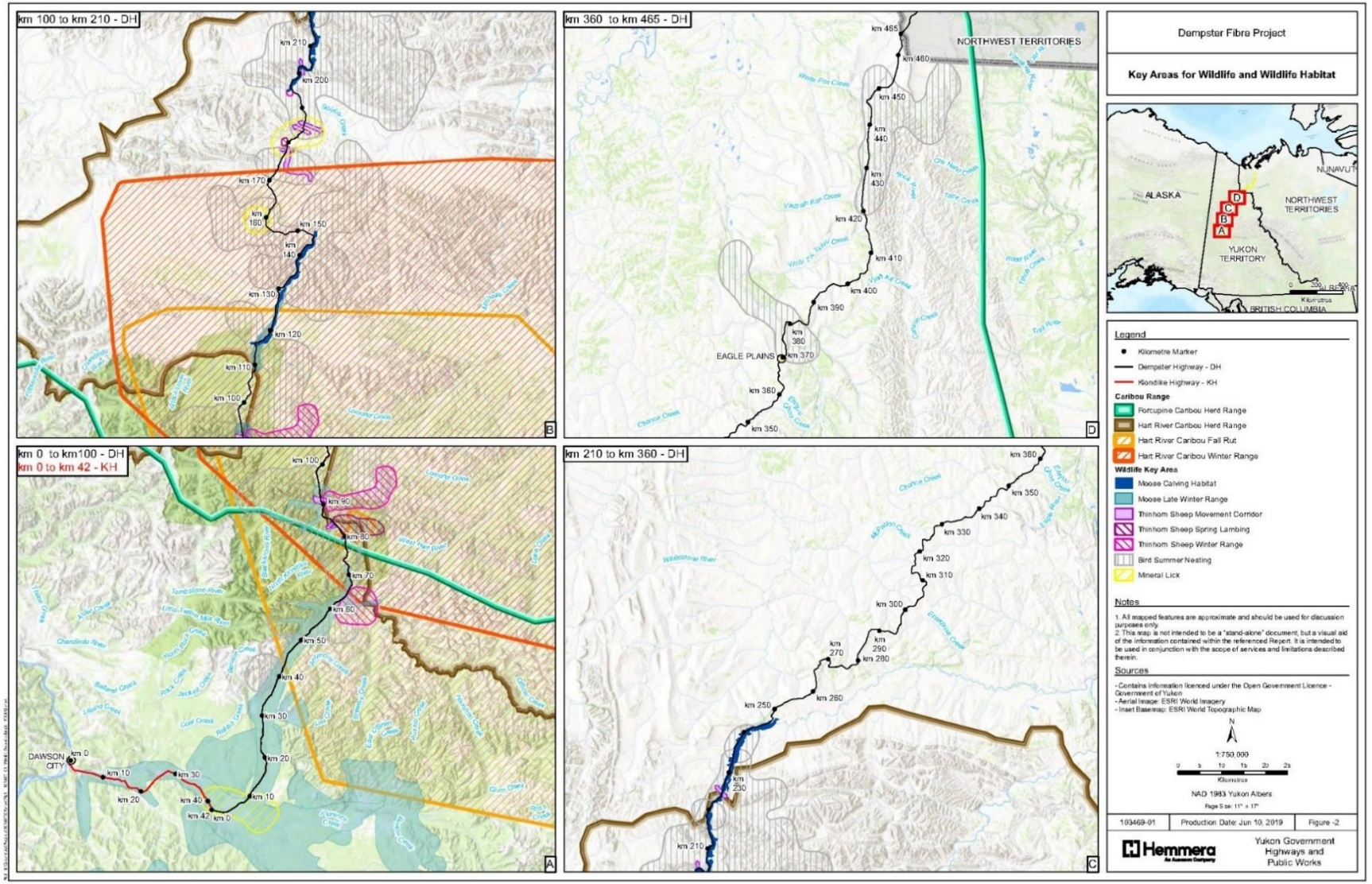

Figure 2 Key Areas for Wildlife and Wildlife Habitat Overlapping the Dempster Highway (Yukon)

Potential Project Effects to Caribou, Moose and Sheep

Caribou (*Rangifer tarandus*), Moose (*Alces alces*) and Thinhorn Sheep (*Ovis dalli dalli*) are known to occur along the Dempster Highway during certain times of the year; therefore, potential effects are only expected when there is spatial and temporal overlap between the project activities and the wildlife species. Caribou, moose and sheep are sensitive to land use disturbances and human presence, particularly during landing/calving season for moose and sheep. Loud activities and prolonged presence in one area of HDD operations or the noise of plowing may pose a particular barrier to movement for all three species.

- Caribou
  - Calving season: Spring
  - Porcupine Caribou habitat: August to May, KM 80 to 456 of Dempster Highway
  - Forty-Mile Caribou habitat: September to May, Lower portion of Dempster Highway
  - Boreal Caribou habitat: May to July, Northern Yukon portion of Dempster Highway to Inuvik
  - Northern Mountain Caribou habitat: May to June, Southern Yukon Region and Western NWT Region
- Moose
  - Calving season: May
  - Primary calving habitat: riparian zones of the Ogilvie and Blackstone rivers (**Figure 2**).
- Sheep
  - Lambing season: May and June
  - Movement periods between habitats: early spring, fall
  - Habitat: mountains on either side of the Dempster Highway (**Figure 2**).

Additional potential project effects to these species include direct loss of habitat via vegetation clearing and injury or death due to vehicle or equipment collisions.

Potential Project Effects to Wolves and Grizzlies

An increased risk of mortality to grizzly bears *(Ursus arctos*) may occur as a result of the establishment and operation of temporary camps and staging areas with increased presence of food waste and garbage, resulting in habituation and individual bears becoming aggressive and dangerous. Grizzly bears' denning/hibernation period extends from November to March, reducing the likelihood of bear encounters for temporary camps operated within this window.

Known wolf (*Canis lupus*) dens occur around Engineer Creek and the Blackstone River bridge are active annually during the spring and summer months, April to September. Sensory disturbance, including HDD, temporary camps or staging areas, and/or vegetation removal during this time period could cause the wolves to abandon their dens. Physical disturbance of the dens via HDD, trenching/plowing, etc. at any time could damage the dens.

Additional potential project effects to both of these species include direct loss of habitat via vegetation clearing and injury or death due to vehicle or equipment collisions. Additionally, if roadkill is left along the verges of the highway, it may attract these and other predatory species, increasing the likelihood of additional vehicle strikes.

Potential Project Effects to General Wildlife Habitat

The extensive plowing required in order to install the fibre optic cable has the potential to initiate or accelerate permafrost thaw. The extent of permafrost thaw caused by construction, as well as the effects upon wildlife or wildlife habitat, will be impossible to quantify within the timeline of this project due to the slow, inter-annual pace of permafrost thaw. Therefore, mitigation measures directed at minimizing effects on permafrost are also expected to minimize effects on wildlife habitat over the long term.

Wetlands dominate the Northwest Territories portion of the project and are considered sensitive habitat. Installing the cable through wetlands could result in disturbance or damage to wetland vegetation and/or wildlife, via ground and vegetation clearing, compaction of herbaceous vegetation, and soil disturbance in drier wetlands. Wetlands characterized as forested bogs are often associated with permafrost and are particularly sensitive to ground disturbance, which could lead to permafrost melting.

Habitat alteration or temporary loss of wildlife habitat due to vegetation clearing is also a potential project effect to general wildlife habitat, as is introduction of invasive plant species into habitat disturbed by project activities. Therefore, mitigation measures directed at minimizing the spread of invasive plants due to project activities are also expected to minimize effects on wildlife habitat. Equipment will be inspected and cleaned before mobilization to site and before moving to new areas, particularly when leaving areas where invasive plants are known to occur. Designated wash stations for cleaning equipment will be identified prior to moving to a new site. These areas will not be located near water sources.

Overall wildlife habitat loss is expected to be temporary, short in duration and localized; with the implementation of the mitigation measures described in **section 3.0** and avoidance of the sensitive locations as per the YESAB Decision Document (**Appendix E**), the impact is not expected to be significant on any specific wildlife species.

3.0 WILDLIFE MITIGATION MEASURES AND MONITORING

3.1 Wildlife-Specific Mitigation Measures

ROHL is committed to avoiding and limiting the effects upon wildlife and wildlife habitat during the construction of the Dempster Fibre Line Project by implementing effective mitigation strategies (**Table 5**).

3.1.1 Direct and Indirect Habitat Loss Mitigation Measures

The following are general measures to be used to mitigate impacts on wildlife and wildlife habitat:

- All staff, contractors and visitors will be given an orientation prior to or upon arrival to site, which will include general wildlife education, management of wildlife attractants, how to avoid or limit human-wildlife encounters, and mitigation measures specific to this WMMP.
- The measures to minimize project effects on wildlife and wildlife habitat, as well as on other environmental components, included in the Environmental Management Plan, the Permafrost Protection Plan, the WMMP and the Erosion and Sediment Control Plan will be implemented as appropriate.
- The environmental monitor will perform regular wildlife monitoring during all construction activities, and wildlife sightings will be recorded in the Wildlife Observation Log (**Appendix C**)

- Construction activities will minimize the volume levels, duration, and frequency of noise sources, to the extent possible by minimizing idling, checking that mufflers on all construction vehicles are functioning effectively.
- The potential for leaks and spills will be minimized according to the measures described in the Project's Spill Contingency Plan. Mitigation measures will be in place to prevent spills, including drip trays, and spill kits will be present in every Project vehicle. Any equipment or vehicles that are leaking will be promptly repaired. Spills will be immediately reported to GNWT-ENR Spill Report Line, 867-920-8130.
- Fuel storage and refueling stations will not be established within 100m of the ordinary high-water mark of any water course.
- Vegetation clearing will be minimized to the extent possible and staging areas will be located on existing cleared sites to minimize additional impacts to potential wildlife habitat.
- Surveys for bird nests, wildlife and wildlife features will be performed prior to any clearing activities.
- If active nests are encountered during the course of operations, a no-disturbance buffer of a size appropriate to the bird species and habitat, as per *Guidelines to Reduce Risk to Migratory Birds* (ECCC 2019) which shall remain in place until the young have fledged and left the nest area.
- Wildlife trees supporting stick and/or cavity nests will not be cleared.
- In ponds where beaver or muskrat lodges are present; water withdrawal will be monitored by the environmental monitor to ensure that water levels do not drop more than 5 cm.
- Camps and staging areas will not be placed within 1 km of known mineral licks or wolf dens (see **Appendix E**, the KmxKm spreadsheet or the Environmental Management Plan for details on locations).
- No personnel shall carry or discharge firearms for the purpose of hunting wildlife.
- Personnel are prohibited from feeding wildlife and must properly dispose of all waste, as per the project Waste Management Plan.
- Heavy equipment will not leave the ROW or cleared areas.
- Riparian and wetland areas will not be used as equipment staging areas.
- In sensitive areas (e.g., riparian areas or wetlands) vegetation will be cut by hand.
- Except where specified in the application, vegetation will not be removed and heavy equipment will not be operated within 100 metres of the Ordinary High Water Mark of any Watercourse (as per the NWT Type A Land Use Permit).
- Cutting of mature trees will be avoided to the greatest extent practical.

3.1.2 Wildlife Injury Mitigation Measures

Mitigation measures for reducing the occurrence of wildlife injury and/or mortality include:

- All staff are required to report wildlife sightings through the Wildlife Observation Log sheet throughout the duration of construction activities.
- The environmental monitor will perform regular wildlife monitoring during all construction activities, and sightings will be recorded in the Wildlife Observation Log (**Appendix C**).
- Personnel will observe posted speed limits when traveling to and from work sites.
- No personnel shall carry or discharge firearms for the purpose of hunting wildlife.

- The fibre optic trench will be backfilled immediately to avoid wildlife injury. If for some reason the trenches are not backfilled immediately, the trench should be visually inspected to confirm it is free of wildlife prior to backfilling.
- In areas where the cable is shallow buried, sandbags or cable weights will be used to ensure the cable remains on the ground to reduce potential for animal tripping.
- All applicable project activities will be suspended temporarily if wildlife dens, raptor nests, and/or bat hibernacula may be destroyed. Construction will resume when the appropriate authorities have been contacted and Wildlife Incident investigation **(Appendix D**) has been completed.

The following sections address specific mitigation strategies for different wildlife types.

3.1.2.1 Birds

- In the Yukon, no construction activities shall take place within 300 m of an active raptor nest from April 15 to August 15. Any identified raptor nest will be flagged and buffered by the environmental monitor(s) (as per the Territorial *Wildlife Act).* In NWT, no construction activities shall take place within 1.5 km of an active raptor nest during critical breeding periods, and 0.5 km buffers should be used outside of critical breeding periods (as per the *Northern Land Use Guidelines*). The critical breeding period for NWT raptors is April 1 to September 31. In NWT, unoccupied raptor nests must also be protected from damage or destruction, or a permit from GNWT-ENR must be obtained for destruction or removal of the nest(s).
- Breeding birds are known to nest between May 1 and August 31 (ECCC 2019) in the Yukon, and April 1 to September 31 in NWT. Where possible, clearing vegetation will occur outside the migratory bird nesting season. If clearing takes place during these periods, then nest surveys shall be conducted by trained personnel prior to clearing. Nest surveys should also be conducted in aggregate pits during breeding and nesting periods as Bank Swallows are known to nest in gravel pits along the Dempster Highway. If active nests of migratory birds are discovered, activities in the nesting area will be postponed until nesting is complete.
- Project activities shall be avoided within 500 m of known Sharp-tailed Grouse lek DH001 from April 1 - April 20 between 5 am - 10 am, and within 2 km of leks during the peak attendance period, from 5 am- 10 am between April 20 and May 4. The Proponent shall contact the Dawson Regional Biologist (867-332-4273) to obtain information on known lek locations as this information is confidential (specified in the YESAB Decision Document, term/condition 4, **Appendix E**).
- If the Proponent identifies additional leks, activities shall be avoided within 500 m of the lek from April 1 - April 20 between 5 am- 10 am, and within 2 km of leks during the peak attendance period, from 5 am-10 am between April 20 and May 4. The Proponent shall notify the Dawson Regional Biologist (867-332-4273) of any newly identified lek locations (specified in the YESAB Decision Document, term/condition 5, **Appendix E**).
- If a sharp-tailed grouse nesting site is identified and active, the Proponent shall avoid stripping and clearing activities within 2 km of the nest location during the sharp-tailed grouse nesting period (May 7 to June 8) (specified in the YESAB Decision Document, term/condition 6, **Appendix E**).

3.1.2.2 Caribou

- Project activities will not disturb, block, or cause substantial diversion to migrating caribou

- Project activities will not alter caribou migration habitat in a way that will prevent caribou from using it in the future
- If any caribou are observed within a 1-km radius of a work site, all work activities will cease until the caribou have moved safely beyond the 1-km buffer. The Dawson City regional biologist in the Yukon and the GNWT-ENR regional biologist in NWT (**Table 2**) will be contacted to discuss mitigation options if the caribou presence persists
- The Project Manager, Site Supervisor or Environmental Monitor shall contact the Regional Biologist (**Table 2**) weekly between October 1 and November 30 and between February 1 and April 30 to obtain fall and spring migration updates on the relevant caribou herds. Additionally, when conducting project activities north of the Eagle River, the Proponent shall consult the Porcupine Caribou Management board website weekly and contact the Regional Biologist if the herd location overlaps the area of active construction. If the Regional Biologist anticipates caribou to migrate through the project area, the Regional Biologist shall provide written guidance to the Government of Yukon, Highways and Public Works, Property Management Division to enable advanced planning of project activities.
- Copies of the Stop Work Policy: "All work activities will cease if any caribou are observed within a 1-km radius of a work site, until caribou have moved beyond the 1 km buffer." shall be provided to all contractors and their staff to ensure this occurs. All affected First Nations will be updated by the Project Owner if the Stop-Work Policy is implemented in sensitive caribou locations.
- The Project Owner shall provide updates monthly, or more frequently if activities progress rapidly, to the Department of Natural Resources of the affected First Nation government to communicate planned project activities within their Traditional Territory, observations from the environmental monitor, and solicit advice for Project activities occurring in identified caribou Wildlife Key Areas.
- The Project Owner shall engage in a dialogue annually with the Porcupine Caribou Management Board, the Dawson Regional Biologist, and affected First Nations to communicate planned project activities and solicit advice for project activities occurring in identified caribou Wildlife Key Areas (YESAB Decision Document, **Appendix E**).

3.1.2.3 Bears

- Bear safety training will be provided to all on-site personnel
- All waste will be managed in order to mitigate attracting bears (see **Section 3.1.3** for more detail).
- If bears are present near camp, an environmental monitor will monitor the bear and notify all camp occupants of the bear's presence.
- Electric fences will be installed around all camps from April to October to avoid human-bear conflict.
- If bears are present within 200 metres of the work area, work will cease until the bears have moved safely out of the area.
- Noise-based bear deterrents like bear bangers may draw bears closer. The primary method of deterrence in the event of a bear encounter should be bear spray.
- Avoid travelling alone in areas where bears are likely to be encountered.

3.1.2.4 Moose

Temporary camps will not be placed within 1 km of the Ogilvie or Blackstone Rivers in May, as these river corridors are known for moose calving.

In NWT, all work activities will cease if any moose are observed within a 500 m radius of a work site, until moose have moved beyond the 500 m buffer.

3.1.2.5 Sheep

Construction activities, including the establishment of camps, will be avoided within a 5-km radius of Angelcomb Mountain and Km 180 of Dempster Highway during May and June, as these are sites of known sheep (*Ovis dalli*) lambing.

In NWT, all work activities will cease if any sheep are observed within a 500 m radius of a work site, until sheep have moved beyond the 500 m buffer.

3.1.2.6 Wolves

The fibre optic cable will be installed on the west side of the Dempster Highway near Km 170, to avoid disturbance to an active wolf (*Canis lupus*) den near the highway ROW. No drilling will occur from mid-April to mid-June in the area near Km 170 and the Blackstone River bridge crossing to avoid disturbing known wolf dens.

3.1.2.7 Muskoxen

In NWT, all work activities will cease if any muskoxen are observed within a 500 m radius of a work site, until muskoxen have moved beyond the 500 m buffer.

3.1.3 Attractant Management

Managing potential attractants during the construction phase of the project is an extremely important aspect of mitigating impacts upon wildlife. Negligence regarding management of waste can lead to wildlife being attracted to the construction site, and potentially result in a wildlife conflict. Such an incident poses danger to both the project team and to wildlife. For the Dempster Fibre Line project, following the protocols established within the Waste Management Plan will help significantly in this issue. The Waste Management Plan outlines the types of waste associated with construction, the appropriate methods of packaging and storing waste, the proper disposal locations, and ways to minimize waste production.

For this project, the waste types with the highest potential of attracting wildlife are food waste, sewage, greywater, and oils/fuels. To minimize wildlife attraction and conflict, all waste will be stored in bear-proof designated temporary collection areas until relocated to its proper disposal location. Transport of solid waste materials to community disposal locations will occur on a routine basis every one to two weeks. Sewage will be regularly disposed of at pre-approved community disposal locations. Greywater will also be regularly transported to pre-approved community disposal locations, unless determined impractical due to distance, in which case greywater will be treated, discharged to a sump or natural depression, and monitored to mitigate pooling, erosion, or attraction of wildlife.

When necessary, additions and/or revisions to the Waste Management Plan and Spill Contingency Plan should be made in order to improve these protocols and increase the effectiveness of wildlife attractant management for this project.

3.1.4 Wildlife Deterrent Measures

Wildlife deterrent actions may be required in situations where there is a risk to either humans or wildlife. Humane deterrent methods will be used, starting with the least invasive method to most invasive method if the situation requires. Deterrent actions will cease when the animal moves away from the potentially hazardous site or situation and no longer poses a threat to humans or the animal itself. Any required deterrent actions will be documented and reported to the Yukon Government Department of Environment or GNWT-ENR as a wildlife incident using the Wildlife Incident Investigation protocol (**Section 3.2.4**).

3.1.5 Exposure to Contaminants

The following are mitigation policies and procedures that will decrease the risk to wildlife from exposure to toxic substances or encounters with toxic spills during construction activities:

- Follow the Waste Management Plan to prevent spills, and if spills occur as a result of an accident, it will be controlled to minimize the area affected
- Adhere to, and update, if necessary, the Spill Contingency Plan, specifically ensuring basic spill kits are available within every vehicle and piece of equipment at the construction site
- Use appropriate deterrents (e.g., fencing, noise makers) to discourage wildlife from entering an affected area.

3.2 Wildlife Monitoring Activities

Wildlife monitoring includes programs designed to verify that mitigation measures are carried out and working as intended. Wildlife monitoring for the Dempster Fibre Line project will focus on:

- Pre-disturbance Bird Nest Surveys
- Wildlife Observations Log
- Animal-Vehicle Collision Risk
- Wildlife Incident Investigation Log.

3.2.1 Pre-Disturbance Wildlife Sweep

Early identification of wildlife or wildlife habitat at the construction site can help mitigate and avoid potential impacts. Raptor nests, mammal dens, beaver dams and lodges are protected by the Yukon *Wildlife Act* and the *NWT Wildlife Act*. Migratory bird nests are protected under the *MBCA* and some bird nests are also protected under the federal SARA. Pre-disturbance wildlife sweeps must be completed whenever activities such as clearing vegetation or water removal are required. If these activities are to be completed during the migratory bird nesting period, the Bird Nest Survey should also be initiated (see following section).

Any bird nesting, mammal denning, or beaver dams observed during the survey should be immediately reported. Actions should include immediately establishing a no-disturbance buffer around the nest/den/feature and contacting Environmental and Climate Change Canada for species protected

under the MBCA and the federal SARA, and GNWT-ENR or Yukon Government Environmental Division for other species and raptor nests.

3.2.2 Bird Nest Surveys

Migratory bird nests are protected by the *MBCA* and those of some other bird species may be protected by SARA or the Yukon *Wildlife Act* and *NWT Wildlife Act* (**Table 4**). As such, specific monitoring will be completed for bird nests where nests are at risk of disturbance or destruction. Early identification of birds showing nesting activity can help to avoid conflicts.

A non-intrusive survey should be initiated for nesting activity during the migratory bird nesting period (early May to the end of August for migratory birds, and April 15th to August 15th for raptors), prior to clearing vegetation, surface disturbance, and ground works. The non-intrusive nest sweeps will follow guidelines outlined in ECCC (2019).

Any bird nesting observed during the survey should be immediately reported. Actions should include immediately establishing a buffer around the nest and contacting federal (ECCC) authorities for species protected under the *MBCA* or SARA, and territorial authorities (GNWT-ENR) for other species.

3.2.3 Wildlife Observations Log

The Wildlife Observations Log provides a simple means for the Environmental Monitoring Project Manager or any environmental monitoring field staff to track wildlife activity during construction. All personnel (environmental monitors or otherwise) should report observations of wildlife to the Environmental Monitoring Project Manager so they can be included in the Wildlife Observations Log. Staff should be made aware of which species are a priority to report (i.e., Species of Concern, **Section 2.0**). All personnel are required to report their observations, including the species, number of animals, location, date of the observation and a photo, if possible. The Wildlife Observations Log data sheet is presented in **Appendix C**. The value of the Wildlife Observations Log data is limited as observations are not systematically collected and may include repeated observations, but it can still provide an indication of the potential for wildlife incidents or problem wildlife and areas of concern.

3.2.4 Wildlife Incident Investigation Log

As per the *Wildlife Act*, any defense of life and property kills must be reported without delay to GNWT-ENR. Any wildlife-vehicle collisions must be reported within 24 hours of the incident to GNWT-ENR. All reasonable efforts must be made to ensure the hide and other valuable parts do not spoil and that these are turned over to a GNWT-ENR Officer to avoid any wastage. Wildlife incidents refer to a range of possible occurrences, some of which are reportable under the *Wildlife Act*. Examples of wildlife incidents include:

- Human-wildlife interactions that present a risk to either people or animals
- Wildlife-caused damage to property or delay in operations
- Wildlife deterrent actions
- Wildlife injury or mortality or situations likely to cause injury or mortality, including any vehicle collisions with wildlife
- Wildlife in hazardous areas or hazardous situations.

The Environmental Monitors will document all such incidents and report to the GNWT-ENR Wildlife Emergency phone (**Table 2**) ECCC can be contacted during regular business hours at 867-445-5088. The Wildlife Enforcement Division can be reached at ec.dalfnordwednorth.ec@canada.ca and the Canadian Wildlife Service can be contacted at ec.eenordrpntnoeanorthpnrnwt.ec@canada.ca.

The appropriate documentation for a Wildlife Incident Investigation should include photographs, names of individuals involved, a description of the incident, the time, date, location, and follow-up actions that occurred. Any encounters with bears should follow the guidance provided in the Bear Occurrence Procedures Manual (GNWT, 2014). All wildlife incidents require a follow-up to determine strategies to prevent a similar incident from occurring in the future. See the Wildlife Incident Data Sheets in **Appendix D**.

3.2.5 Animal-Vehicle Collision Risk

An increased amount of road traffic and congestion may be caused by construction activities of the Dempster Fibre Line project, with a potential for increasing animal-vehicle collision (AVC) risk. Animal-vehicle collisions can cause injuries or fatalities of both wildlife and project personnel. Monitoring for AVC risk will assist in mitigating and avoiding such risks. An AVC risk assessment should encompass the construction site and the direction of travel. The appropriate time to conduct an AVC risk assessment would be prior to equipment or vehicles being moved a significant distance or at a speed in which – if wildlife were present – an AVC would be unavoidable and dangerous (depends on weather and road conditions, vehicle /equipment type, etc.). If an AVC risk assessment is conducted and wildlife with potential to cause an AVC is detected, then driving speed will be decreased or suspended until the wildlife is no longer posing a risk. Wildlife deterrent methods may be required in some cases.

3.3 Contingencies

Contingencies are additional events which may occur during construction and trigger an adaptive management strategy. In the event of a major spill or contaminant release, a report must be made to the appropriate 24-hour spill response line (**Table 2**). Increased wildlife monitoring efforts may be required to mitigate or avoid any impacts on wildlife or wildlife habitats. A revision to the Spill Contingency Plan may be required if the spill is determined to have been preventable, occurred as a result of negligence or has the potential to occur again.

3.4 Adaptive Management

Adaptive management is an approach that links monitoring to management actions. Adaptive management for the Dempster Fibre Line project will combine knowledge collected from mitigation and effects monitoring, Indigenous Knowledge, and input from regulatory agencies to continuously improve management practices that protect wildlife and wildlife habitat from potential effects of the Dempster Fibre Line Project.

Wildlife monitoring procedures and mitigation measures will be reviewed by regulatory agencies and Indigenous groups. This WMMP will be updated to incorporate any modifications and/or additions to mitigation and monitoring programs. Adaptive management strategies will be triggered when pre-defined, project-specific levels of change occur, which can be defined as action levels. Action levels will provide an early warning system which will incur adaptive management strategies prior to impacts on wildlife or wildlife habitat becoming unacceptable. Action levels can be categorized by low, moderate, and high action

– and in this WMMP – into mitigation and wildlife effects monitoring. Please refer to **Figure 3** for a visualization of the proposed adaptive management process for this WMMP.

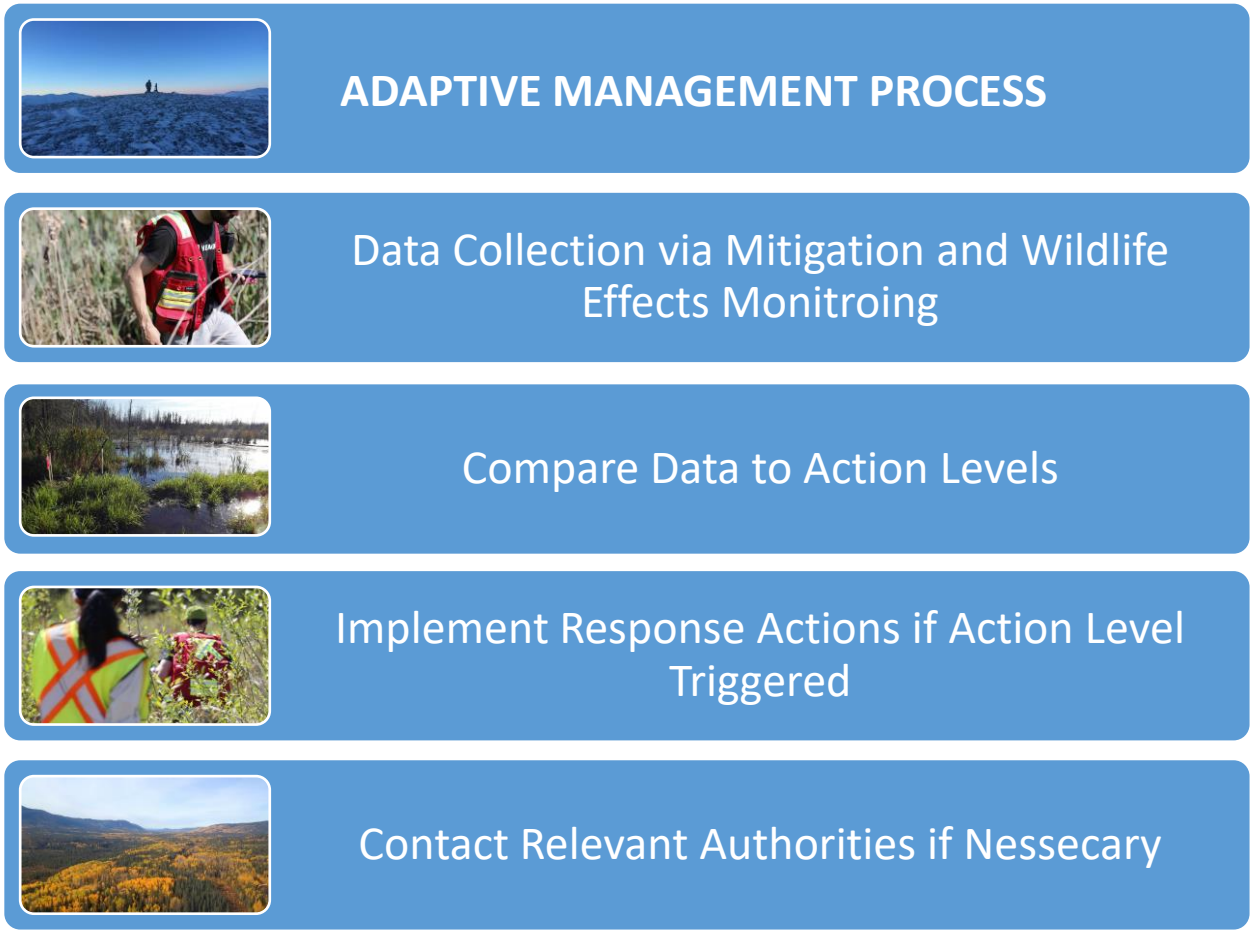

Figure 3 Framework for the adaptive management process regarding wildlife and wildlife habitat management on the Dempster Fibre Line project (adapted from WLWB, 2010).

3.4.1 Adaptive Management Monitoring

Action levels to trigger adaptive management action are:

- **Low Action Triggers:**
  - a) a den, lodge/dam, nest, or bat hibernaculum is detected outside the construction path and applicable setback distance during pre-disturbance wildlife sweeps or bird nest surveys.
  - b) a wildlife species is observed outside the construction path and setback distance.
  - c) a wildlife species is detected during an AVC risk assessment.
- **Low Action Responses:**
  - a) make relevant Project and site personnel aware of sighting and maintain current construction path.
  - b) make relevant Project personnel aware and record observation in relevant log.

- c) make relevant personnel aware of AVC risk and take appropriate actions to mitigate risk (i.e., reduce vehicle speed, delay movements, use wildlife deterrents if necessary).

- **Moderate Action Triggers:**
  - a) a den, lodge/dam, nest, or bat hibernaculum is detected inside the construction path during pre-disturbance wildlife sweeps or bird nest surveys.
  - b) a wildlife species is detected within the setback distance and reported in the wildlife observation logs **OR** a listed species at risk is detected outside the setback distances.
  - c) a Species at Risk is detected during an AVC risk assessment.
- **Moderate Action Responses:**
  - a) an appropriate setback distance should be maintained, appropriate authorities should be contacted, and proper instructions followed regarding alternative construction activities.
  - b) relevant Project and site personnel should be notified potential delay of construction activities or deterrent methods may be required.
  - c) notify appropriate authorities of Species at Risk sighting and AVC risk, employ immediate mitigation strategies as needed, and follow instructions given by authorities if risk continues.
- **High Action Triggers:**
  - a) a den, lodge/dam, nest, or bat hibernaculum of a Species at risk is detected inside the construction path during pre-disturbance wildlife sweeps or bird nest surveys.
  - b) a wildlife species listed as a Species at Risk is observed within the construction path and reported in the wildlife observation logs.
  - c) any AVC near-miss or incident.
- **High Action Responses:**
  - a) immediately employ mitigation strategies (maintain applicable setback distance), notify relevant authorities and Project/site personnel, follow instructions given by authorities for alternative construction activities.
  - b) immediately employ mitigation strategies (temporarily delay or modify construction activities), record observation in relevant log, notify appropriate authorities and Project/site personnel, follow instructions given by authorities for alternative construction methods or deterrent actions.
  - c) report AVC near-miss or incident to the relevant authorities, and follow given instructions regarding modified vehicle movement procedures, and/or handling of wildlife remains.

3.4.2 Wildlife Effects Monitoring

- **Low Action Triggers:**
  - a) wildlife incident occurs in which no injury/death is incurred on wildlife or project personnel.
  - b) minor spill/contaminant release occurs, easily controlled with little to no chance of affecting local wildlife.
- **Low Action Responses:**
  - a) relevant Project/site personnel should be notified, a wildlife incident investigation should be conducted, the appropriate authorities contacted, and the ensuing instructions followed.
  - b) immediate spill response/clean-up conducted, and relevant Project/site personnel notified.

- **Moderate Action Triggers:**
  - a) wildlife incident occurs with a listed Species at Risk in which no injury/death is incurred on wildlife or project personnel.
  - b) minor spill/contaminant release occurs, easily controlled but has potential to affect local wildlife.
- **Moderate Action Responses:**
  - a) all relevant Project/site personnel should be notified, a wildlife incident investigation should be conducted, the appropriate authorities contacted, and the ensuing instructions followed.
  - b) immediate spill response/clean-up conducted, and relevant Project/site personnel notified.
- **High Action Triggers:**
  - a) a wildlife incident occurs in which injury/death is incurred on either wildlife or project personnel.
  - b) a major spill occurs, with a strong potential to affect wildlife.
- **High Action Responses:**
  - a) all relevant Project/site personnel should be notified, a wildlife incident investigation should be conducted, the appropriate authorities contacted, and the ensuing instructions followed.
  - b) immediate spill response/clean-up conducted, relevant Project/site personnel notified, an immediate spill report to the relevant authority, and subsequent responses follow the instructions given by authorities.

4.0 REPORTING AND PLAN REVIEW

All reports identified in this section are required by and will be submitted to the GNWT-ENR, except as specifically indicated otherwise.

4.1 Annual Report

Annual reports are needed for long-term developments (>5 years). Annual reports are not needed for the Dempster Fibre Line Project considering the current schedule; however, they may be needed if the Project timeline becomes extended past the 5-year threshold. If the Project timeline is changed, review the WMMP reporting requirements and consider reaching out to GNWT-ENR (Government of Northwest Territories, 2021).

4.2 Summary Report

Short-term developments (≤5 years) are expected to provide a summary WMMP report at the end of the Project. More frequent reporting may be required by GNWT if concerns about impact magnitude, mitigation effectiveness or non-compliance with wildlife regulations arise (Government of Northwest Territories, 2021).

4.3 Wildlife Sightings

Wildlife sightings (recorded in the Wildlife Observation Log) should be reported to the ENR Wildlife Management Information System (WMIS) at least once annually (**Table 2**). (Government of Northwest Territories, 2021).

4.4 Wildlife Incidents

Report to regional environment and natural resource office immediately (**Table 2**).

4.5 Spatial Data

Developers for all types and sizes of project must submit geospatial data files of their project footprint and report on annual changes and final footprint size to contribute to the understanding of disturbance on the land. These data should be provided at the end of the Project for short-term projects (≤5 years) and on an annual basis for long-term projects (>5 years). With the current project timeline, spatial data must be provided at the closure of the project.

4.6 Review and Evaluation of the Wildlife Management and Monitoring Plan

The WMMP will be reviewed by GNWT-ENR and the Mackenzie Valley Land and Water Board.

5.0 CLOSURE

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

Report prepared by:
Hemmera Envirochem Inc.

ORIGINAL SIGNED

Jessie Bowser, B.Sc. (Honours), BIT
Biologist

Report prepared by:
Hemmera Envirochem Inc.

ORIGININAL SIGNED

William Richmond, B.Sc., Dipl.Tech., BIT
Environmental Scientist

Report reviewed by:
Hemmera Envirochem Inc.

ORIGINAL SIGNED

Lorraine Andrusiak, M.Sc., R.P.Bio.
Senior Terrestrial Biologist

6.0 REFERENCES

ECCC. 2019. Guidelines to reduce risk to migratory birds. Available at https://www.canada.ca/en/environmentclimate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html. Accessed January 2022.

Government of Canada. 2018. Nesting periods. Available at https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html. Accessed January 2022.

Government of Canada. 2021. Species at Risk Public Registry. Available at Species search - Species at risk registry (canada.ca). Accessed March 23, 2022.

Government of Canada. 2022a. Yukon Environmental and Socio-economic Assessment Act. Available at https://laws-lois.justice.gc.ca/eng/acts/y-2.2/FullText.html. Accessed January 2022.

Government of Canada. 2022b. Canada National Parks Act. Available at https://laws-lois.justice.gc.ca/eng/acts/n-14.01/. Accessed January 2022.

Government of Canada. 2022c. Migratory Birds Convention Act. Available at https://laws.justice.gc.ca/eng/acts/M-7.01/. Accessed January 2022.

Government of Canada. 2022d. Species at Risk Act and Schedule 1Available at https://laws.justice.gc.ca/eng/acts/S-15.3/. Accessed January 2022.

Government of Northwest Territories (GNWT). 2022a. Species at Risk. Available at https://www.enr.gov.nt.ca/en/services/species-risk. Accessed at January 2022.

Government of Northwest Territories (GNWT). 2022b. Wildlife Management. Available at https://www.enr.gov.nt.ca/en/services/wildlife-management#:~:text=The%20Wildlife%20Act%20applies%20to%20all%20species%20of,small%20game%20and%20furbearers%2C%20birds%2C%20reptiles%20and%20amphibians. Accessed January 2022.

Government of Northwest Territories, 2021. Wildlife Management and Monitoring Plans, compiled procedures, 2019. Available at https://www.enr.gov.nt.ca/sites/enr/files/resources/sample_procedural_manual_and_reporting_templates_june_2019.pdf.Yukon Government. 2022a. Environment Act. Available at https://laws.yukon.ca/cms/images/LEGISLATION/PRINCIPAL/2002/2002-0076/2002-0076.pdf. Accessed January 2022.

Government of Yukon. 2022. Yukon Species at Risk. Available at https://yukon.ca/en/species-risk. Accessed March 2022.

Wek'èezhìi Land and Water Board (WLWB). 2010. Draft Guidelines for Adaptive Management – A Response Framework for Aquatics Effects Monitoring. Available at https://wlwb.ca/sites/default/files/documents/Final-Draft-Response-Framework-for-Aquatic-Effects-Monitoring.pdf. Accessed March 2022.

Yukon Government. 2022b. Wildlife Act. Available at https://laws.yukon.ca/cms/images/LEGISLATION/PRINCIPAL/2002/2002-0229/2002-0229_1.pdf?zoom_highlight=wildlife+act#search=%22wildlife%20act%22. Accessed January 2022.

APPENDIX A
Permits and Licenses

APPENDIX B

YESAB Project Proposal

APPENDIX C

Wildlife Sightings Log Data Sheet

Dempster Fibre Project - Wildlife Observation Log

Date	Species	# Observed	Location	Age	Behaviour	Other Comments

APPENDIX D

Wildlife Incident Investigation Form

APPENDIX E

YESAB Decision Document

APPENDIX A
Permits and Licences

Mackenzie Valley Land and Water Board

7th Floor - 4922 48th Street,
P.O. Box 2130, Yellowknife NT X1A 2P6

Tel: 867-669-0506 Fax: 867-873-6610
www.mvlwb.com

August 31, 2020 File: MV2019L8-0013

Darryl Froese
Government of Yukon
Department of Highways and Public Works
Box 2703 (W-5)
Whitehorse YT Y1A2C6 Sent via email

Dear Darryl Froese,

Issuance of Type B Water Licence
Dempster Fibre Project

Attached is Water Licence MV2019L8-0013 granted by the Mackenzie Valley Land and Water Board (MVLWB or the Board) in accordance with the *Mackenzie Valley Resource Management Act* and *Waters Act*. This Licence has been approved for a period of seven (7) years effective August 31, 2020 and expiring August 30, 2027.

Conditions and General Procedures
Please read all the conditions carefully. For the purpose of submitting plans in accordance with this Licence, the date of this letter August 31, 2020, is the date of issuance. Also attached is a copy of the General Procedures for the Administration of Licences in the Northwest Territories. Please review these carefully and address any questions to the Board's office.

Management Plans – Resubmission and Additional Plans Required
The Board hereby requires that Government of Yukon Department of Highways and Public Works (GY-DHPW) to submit the below management plans in accordance with comments made during this review.

Table 1: Plans Requiring Submission

Part	Item	Date
B	Annual Water Licence Report	• March 31,2021 • Annually on each March 31
B	Engagement Plan	• Within 90 days following the effective date of this Licence, the Licensee shall submit to the Board, for approval, a revised **Engagement Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
B	Engagement Plan	• Annual Review

…/2

B	Inspection and Maintenance Plan	• A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, an **Inspection and Maintenance Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan
B	Wildlife Management and Mitigation Plan	• A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Wildlife Management and Mitigation Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
B	Heritage Resource Protection Plan	• A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Heritage Resource Protection Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
B	Permafrost Protection Plan	• A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Permafrost Protection Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
C	Security	• According to the timeline set out in Schedule 2, condition 1
D	Water Use Fees	• Each year, prior to August 31 and in advance of any Water use, the Licensee shall pay the Water Use Fee in accordance with the MVLWB's Water Use Fee Policy.
E	Construction Environmental Management Plan	• A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Construction Environmental Management Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
F	Waste Management Plan	• Within 90 days of the issuance of this Licence, the Licensee shall submit to the Board, for approval, a revised **Waste Management Plan**.
F	Waste Management Plan	• The Licensee shall comply with the **Waste Management Plan**, once approved, and shall annually review the plan and make any necessary revision to reflect changes in operations, technology, chemicals, or fuels, or as directed by the Board. Revision to the plan shall be submitted to the Board for approval.
F	Sediment and Erosion Control Plan	• A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval a **Sediment and Erosion Control Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
F	Sediment and Erosion Control Plan	• The Licensee shall comply with the **Sediment and Erosion Control Plan**, once approved, and shall annually review the plan and make necessary revisions to reflect changes in operations or as directed by the Board. Revisions to the plan shall be submitted to the Board for approval.
G	Spill Contingency Plan	• Within 90 days of the issuance of this Licence, the Licensee shall submit to the Board, for approval, a revised **Spill Contingency Plan**.
G	Emergency Frac-out Response Plan	• A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, an **Emergency Frac-out Response Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.

G	Emergency Frac-out Response Plan	• The Licensee shall comply with the **Emergency Frac-out Response Plan** once approved and shall annually review the plan and make necessary revisions to reflect changes in operations or as directed by the Board. Revisions to the plan shall be submitted to the Board for approval.
I	Interim Closure and Reclamation Plan	• A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, an **Interim Closure and Reclamation Plan**.
I	Final Closure and Reclamation Plan	• Three years prior to the expiration of this Licence, or a minimum of two years prior to the end of project activities, whichever occurs first, the Licensee shall submit to the Board, for approval, a **Final Closure and Reclamation Plan**.

Reclamation Security

In accordance with Water Licence condition [enter condition # related to security], a security deposit in the amount of $91,350 shall be posted with the Minister and copied to the Board prior to the start of the operation pursuant to section 35 of the *Waters Act*. Submit payment of the security, made out to the **Government of the Northwest Territories**, in the amount of [Enter amount of security], to: Government of the Northwest Territories, Box 1320, Yellowknife, NT, X1A 2L9, Attention: Director, Water Resources. Please provide a copy of the receipt of security to the MVLWB office prior to the start of your operation.

Water Use Fees

As outlined in Part C, Condition D water use fees shall be paid annually as per subsection 8(1) of the *Waters Regulations*. This fee must be paid annually hereafter for the duration of the Licence on or before its anniversary date. Based on the water use fee calculator (attached), GY-DHPW's water use fee for the period of August 31, 2020 through to August 30, 2021 is $1,022.00 Submit payment of the water use fee, made out to the **Government of the Northwest Territories**, in the amount of $1,022.00, to: Mackenzie Valley Land and Water Board, Box 2130, Yellowknife, NT, X1A 2P6.

Public Registry

A copy of this Licence has been filed on the Public Registry at the MVLWB office. Please be advised that this letter, with attached procedures, all inspection reports, and correspondence related thereto, is part of the Public Registry and is intended to keep all interested parties informed of the manner in which the Licence's requirements are being met. All Public Registry material will be considered if an amendment to the Licence is requested.

The full cooperation of Government of Yukon Department of Highways and Public Works is anticipated and appreciated. If you have any questions or concerns, please contact AlecSandra Macdonald by email or at 867-777-4954.

Yours sincerely,

Mavis Cli-Michaud
MVLWB, Chair

Copied to: Distribution List

Attached: Water Licence MV2019L8-0003
Reasons for Decision
General Procedures for the Administration of Licences in the Northwest Territories

Mackenzie Valley Land and Water Board
Water Licence

Pursuant to the *Mackenzie Valley Resource Management Act, Waters Act,* and Waters Regulations, the Mackenzie Valley Land and Water Board, hereinafter referred to as the Board, hereby grants to:

Government of Yukon – Department of Highways and Public Works
(Licensee)

of P.O. BOX 2703 (W-5) Whitehorse, Yukon Y1A 2C6
(Mailing Address)

hereinafter called the Licensee, the right to alter, divert, or otherwise use water subject to the restrictions and conditions contained in the *Waters Act* and Regulations made thereunder and subject to and in accordance with the conditions specified in this Licence.

Licence Number:	MV2019L8-0013
Licence Type:	B
Water Management Area:	Northwest Territories 03
Location:	67°2'50'' to 68°21'38'' N and 133°43'22'' to 136°12'31" W
Purpose:	To use water and dispose of waste
Description:	Miscellaneous – telecommunication
Quantity of Water **not to be exceeded**:	280 m^3/day
Effective date of licence:	August 31, 2020
Expiry date of licence:	August 30, 2027

This Licence issued and recorded at Yellowknife includes and is subject to the annexed conditions.

Mackenzie Valley Land and Water Board

Mavis Cli-Michaud, Chair

Amanda Gauthier, Witness

Part A: Scope and Definitions

Scope

1. This Licence entitles the Government of the Yukon, Department of Highways and Public Works to use water and deposit Waste in conjunction with the development of a high speed fibre optic telecommunications cable system, along the Dempster Highway #8, from the Yukon Border to Inuvik, NT.

   The scope of this Licence includes the following:

   a) Withdrawal of Water

   b) Deposit of Waste

   c) Construction, operation and maintenance of temporary camps

   d) Construction, operation and maintenance of the Dempster Fibre Project; and

   e) Progressive Reclamation and associated Closure and Reclamation activities.

2. This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of Waste of any type in any waters or in any place under any conditions where such Waste or any other Waste that results from the deposit of such Waste may enter any waters. Whenever new Regulations are made or existing Regulations are amended by the Commissioner in Executive Council under the Waters Act, or other statutes imposing more stringent conditions relating to the quantity or type of Waste that may be so deposited or under which any such Waste may be so deposited, this Licence shall be deemed, upon promulgation of such Regulations, to be automatically amended to conform with such Regulations.

3. Compliance with the defined terms and conditions of this Licence does not relieve the Licensee from responsibility for compliance with the requirements of any applicable federal, territorial, or municipal legislation.

1.2 Definitions:

Board – the Mackenzie Valley Land and Water Board established under subsection 99(1) of the *Mackenzie Valley Resource Management Act*.

Closure Cost Estimate – has the same meaning as that in the Mackenzie Valley Land and Water Board, Government of the Northwest Territories, and Aboriginal Affairs and Northern Development Canada's *Guidelines for Closure and Reclamation Cost Estimates for Mines*.

Closure and Reclamation – the process and activities that facilitate the return of areas affected by the Project to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment, human activities, and the surrounding environment.

Closure and Reclamation Plan – a document, developed in accordance with this Licence, that clearly describes the Closure and Reclamation for the Project.

Construction – any activities undertaken during any phase of the Project to construct or build any structures, facilities or components of, or associated with, the development of the Project.

Discharge – a direct or indirect release of any Waters or Waste to the Receiving Environment.

Effluent – a Wastewater Discharge.

Engagement Plan – a document, developed in accordance with the Mackenzie Valley Land and Water Board's *Engagement and Consultation Policy* and the *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits*, that clearly describes how, when and which engagement activities will occur with an affected party during the life of the Project.

Inspector – an Inspector designated by the Minister under subsection 65(1) of the *Waters Act*.

Licensee – the holder of this Licence.

Minister – the Minister of the Government of the Northwest Territories – Environment and Natural Resources.

Ordinary High Water Mark – the usual or average level to which a Watercourse rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing Watercourses (rivers, streams), this refers to an active channel/bank-full level, which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments, it refers to those parts of the Watercourse bed and banks that are frequently flooded by Water so as to leave a mark on the land and where the natural vegetation changes from predominantly aquatic vegetation to terrestrial vegetation (excepting Water tolerant species). For reservoirs, this refers to normal high operating levels (full supply level).

Progressive Reclamation – Closure and Reclamation activities conducted during the operating period of the Project.

Project – the undertaking described in Part A, condition 1.

Receiving Environment – the natural environment that, directly or indirectly, receives any deposit of Waste from the Project.

RECLAIM – the Government of the Northwest Territories' model for estimating Closure and Reclamation costs.

Remediation – the removal, reduction or neutralization of substances, Wastes or hazardous materials from a site in order to prevent or minimize any adverse effects on the environment and public safety now or in the future.

Spill Contingency Plan – a document, developed in accordance with Aboriginal Affairs and Northern Development Canada's *Guidelines for Spill Contingency Planning.*

Sump – a human-made pit, trench, hollow, or natural depression used for the purpose of depositing Water and/or Waste.

Traditional Knowledge – the cumulative, collective body of knowledge, experience and values built up by a group of people through generations of living in close contact with nature. It builds upon the historic experiences of a people and adapts to social, economic, environmental, spiritual, and political change.

Unauthorized Discharge – a release or Discharge of any Waters or Waste not authorized under this Licence

Waste – any substance defined as Waste by section 1 of the *Waters Act.*

Waste Management Plan – a document, developed in accordance with the Mackenzie Valley Land and Water Board's *Guidelines for Developing a Waste Management Plan,* that describes the methods of Waste management from Waste generation to final disposal.

Wastewater – any Water that is generated by Project activities or originates on-site, and which contains Waste, and may include, but is not limited to, Runoff, leachate, Seepage, Sewage, hydrocarbon-contaminated snow and Water received from third parties, and Effluent.

Water(s) – any Water as per section 1 of the *Waters Act*.

Watercourse – a natural watercourse, body of Water or Water supply, whether usually containing Water or not, and includes Groundwater, springs, swamps, and gulches.

Water Management Area – a geographical area of the Northwest Territories established by section 2 and Schedule A of the Waters Regulations.

Waters Regulations – the regulations proclaimed pursuant to section 63 of the *Waters Act*.

Water Supply Facilities – the area(s) and structures designated to collect, and supply Water for the Project.

Water Use – a use of Water as per section 1 of the *Waters Act*.

Wastewater – any Water that is generated by Project activities or originates on-site, and which contains Waste, and may include, but is not limited to, Runoff, leachate, Seepage, Sewage, hydrocarbon-contaminated snow and Water received from third parties, and Effluent.

Water(s) – any Water as per section 1 of the *Waters Act*.

Watercourse – a natural watercourse, body of Water or Water supply, whether usually containing Water or not, and includes Groundwater, springs, swamps, and gulches.

Water Management Area – a geographical area of the Northwest Territories established by section 2 and Schedule A of the Waters Regulations.

Waters Regulations – the regulations proclaimed pursuant to section 63 of the *Waters Act*.

Water Use – a use of Water as per section 1 of the *Waters Act*.

Part B: General Conditions

1. The Licensee shall ensure a copy of this Licence is maintained on-site at all times.

2. The Licensee shall take every reasonable precaution to protect the environment.

3. In conducting its activities under this Licence, the Licensee shall make every reasonable effort to consider and incorporate any scientific information and Traditional Knowledge that is made available to the Licensee.

4. In each submission required by this Licence or any directive from the Board, the Licensee shall identify all recommendations based on Traditional Knowledge received, describe how the recommendations were incorporated into the submission, and provide justification for any recommendation not adopted.

5. All references to policies, guidelines, codes of practice, statutes, regulations, or other authorities shall be read as a reference to the most recent versions, unless otherwise denoted.

6. The Licensee shall ensure all submissions to the Board:
   a) Are in accordance with the Mackenzie Valley Land and Water Board's *Document Submission Standards*;
   b) Include a conformity statement or table which identifies where the pertinent requirements of this Licence, or other direction from the Board, are addressed; and
   c) Include any additional information requested by the Board.

7. The Licensee shall ensure management plans are submitted to the Board in a format consistent with the Mackenzie Valley Land and Water Board's *Standard Outline for Management Plans*, unless otherwise specified.

8. The Licensee shall comply with all plans approved as per the conditions of this Licence, including such revisions made as per the conditions of this Licence, and as approved by the Board.

9. The Licensee shall conduct an annual review of all plans and make any revisions necessary to reflect changes in operations, contact information, or other details. No later than March 31 each year, the Licensee shall send a notification letter to the Board, listing the documents that have been reviewed and do not require revisions.

10. The Licensee may propose revisions at any time by submitting a revised plan to the Board for approval. Unless otherwise specified, a minimum of 90 days prior to implementing any proposed updates or changes in the plan, the Licensee shall submit all revisions to the Board, for approval. The Licensee shall not implement revisions until approved by the Board.

11. The Licensee shall revise any submission as per the Board's direction and resubmit it for approval.

12. If any date for any submission falls on a weekend or holiday, the Licensee may submit the item on the following business day.

13. The Licensee shall comply with the **Schedules**, which are annexed to and form part of this Licence, and any changes to the Schedules as may be made by the Board.

17. The Licensee shall install, operate, and maintain meters, devices, or other such methods used for measuring the volumes of Water used and Waste discharged to the satisfaction of an Inspector.

18. Beginning March 31, 2020 and no later than every March 31 thereafter, the Licensee shall submit an **Annual Water Licence Report** to the Board and an Inspector**.** The Report shall be in accordance with the requirements of Schedule 1.

19. The Licensee shall comply with **the Engagement Plan**, once approved.

20. Within 90 days following the effective date of this Licence, the Licensee shall submit to the Board, for approval, a revised **Engagement Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.

21. A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, an **Inspection and Maintenance Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.

22. A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Wildlife Management and Mitigation Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.

23. A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Heritage Resource Protection Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.

24 A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Permafrost Protection Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.

Part C: Conditions Applying to Security Deposits

1. The Licensee shall post and maintain a security deposit with the Minister in accordance with Schedule 2.

2. Upon request of the Board, the Licensee shall submit an updated Closure Cost Estimate utilizing the current version of RECLAIM or another method acceptable to the Board.

3. The amount of the security deposit required by Part C, condition 1 may be adjusted by the Board:

   a) Based on updated Closure Cost Estimates referred to in Part C, condition 2; or
   b) Based on such other information as may become available to the Board.

4. If the amount of the security deposit is adjusted by the Board as per Part C, condition 3, the Licensee shall post the adjusted amount with the Minister within 90 days of the Board giving notice of the adjusted amount, or as otherwise directed by the Board.

Part D: Conditions Applying to Water Use

1. The Licensee may only obtain fresh Water from the sources identified in Schedule 3.

2. The daily quantity of fresh Water withdrawn shall not exceed 280 m^3.

3. The Licensee shall construct and maintain the water intake(s) with a fish screen designed to prevent impingement and/or entrainment of fish.

4. The Licensee shall only withdraw Water using the Water Supply Facilities, unless otherwise authorized temporarily in writing by an Inspector.

5. Prior to obtaining Water from a licensed Water source, the Licensee shall post sign(s) to identify the intake for the Water Supply Facilities. All sign(s) shall be located and maintained to the satisfaction of an Inspector.

6. In any single ice-covered season, the Licensee shall not withdraw greater than 10% of the available Water volume of any Watercourse, as calculated using the appropriate maximum expected ice thickness.

7. The Licensee shall ensure that the withdrawal of water from any Watercourse does not exceed 10% of its instantaneous flow.

8. The Licensee shall provide to the Board and Inspector a weekly Water Withdrawal Summary Report. This report shall include the following:

    a) The coordinates of each water withdrawal source used;
    b) the instantaneous flow of each water course;
    c) the rate of water withdrawal from each source; and
    d) the total volume of water withdrawn from each source.

9. Each year, prior to August 31 and in advance of any Water use, the Licensee shall pay the Water Use Fee in accordance with the MVLWB's Water Use Fee Policy.

Part E: Conditions Applying to Construction

1. The Licensee shall ensure that all Project activities are performed to prevent escape of Waste to the Receiving Environment.

2. A minimum of 10 days prior to seasonal commencement of Construction, the Licensee shall provide written notification to the Board and an Inspector.

3. A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Construction Environmental Management Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.

Part F: Conditions Applying to Water and Waste Management

1. The Licensee shall manage Water and Waste with the objective of minimizing the impacts of the Project on the quantity and quality of Water in the Receiving Environment through the use of appropriate mitigation measures, monitoring, and follow-up actions.

2. Within 90 days of the issuance of this Licence, the Licensee shall submit to the Board, for approval, a revised **Waste Management Plan**.

3. The Licensee shall comply with the **Waste Management Plan**, once approved, and shall annually review the plan and make any necessary revision to reflect changes in operations, technology, chemicals, or fuels, or as directed by the Board. Revision to the plan shall be submitted to the Board for approval.

4. The Licensee shall dispose of all Sewage as identified in the **Waste Management Plan**, or as otherwise approved by the Board.

5. Prior to the deposit of Waste into the Town of Inuvik Waste Disposal Facilities, the Licensee shall obtain written authorization from an Inspector.

6. The Licensee shall not deposit waste, including wastewater, to any Watercourse, or to the ground surface within 100 metres of the Ordinary High-Water Mark of any Watercourse.

7. All Discharge outflow structures shall be located so as to minimize erosion.

8. During Discharge, daily erosion inspections of the Discharge points shall be carried out and records of these inspections shall be kept for review upon the request of an Inspector. If any erosion is observed, the Licensee shall notify an Inspector within 48 hours and shall take the necessary corrective action to mitigate the erosion/sedimentation problem, to the satisfaction of an Inspector.

9. A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval a **Sediment and Erosion Control Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.

10. The Licensee shall comply with the **Sediment and Erosion Control Plan**, once approved, and shall annually review the plan and make necessary revisions to reflect changes in operations or as directed by the Board. Revisions to the plan shall be submitted to the Board for approval.

PART G: Conditions Applying to Contingency Planning

1. The Licensee shall ensure that Unauthorized Discharges associated with the Project do not enter any Waters.

2. The Licensee shall comply with the **Spill Contingency Plan**, once approved.

3. Within 90 days of the issuance of this Licence, the Licensee shall submit to the Board, for approval, a revised **Spill Contingency Plan**.

4.. During the period of this Licence, if a spill or an Unauthorized Discharge occurs or is foreseeable, the Licensee shall:

   a) Implement the approved Spill Contingency Plan referred to in Part G, condition 2;

   b) Report it immediately using the NU-NT Spill Report Form by one of the following methods:

      - Telephone: (867) 920-8130
      - Fax: (867) 873-6924
      - E-mail: spills@gov.nt.ca
      - Online: Spill Reporting and Tracking Database

   c) Within 24 hours, notify the Board and an Inspector; and

   d) Within 30 days of initially reporting the incident, submit a detailed report to the Board and an Inspector, including descriptions of causes, response actions, and any changes to procedures to prevent similar occurrences in the future. Any updates to this report shall be provided to the Board and an Inspector in writing as changes occur.

5. The Licensee shall ensure that spill prevention infrastructure and spill response equipment is in place.

6. The Licensee shall restore all areas affected by spills and Unauthorized Discharges to the satisfaction of an Inspector.

7. The Licensee shall not establish any fuel storage facilities or refueling stations, or store chemical or deleterious substances within 100 metres of the Ordinary High Water Mark of any Watercourse, unless otherwise authorized in writing by an Inspector.

8. A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, an **Emergency Frac-out Response Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.

9 The Licensee shall comply with the **Emergency Frac-out Response Plan** once approved, and shall annually review the plan and make necessary revisions to reflect changes in operations or as directed by the Board. Revisions to the plan shall be submitted to the Board for approval.

PART H: Conditions Applying to Aquatic Effects Monitoring

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PART I: Conditions Applying to Closure and Reclamation

1. A minimum of 90 days prior to the commencement of Project activities , the Licensee shall submit to the Board, for approval, an **Interim Closure and Reclamation Plan**.

2. Three years prior to the expiration of this Licence, or a minimum of two years prior to the end of project activities, whichever occurs first, the Licensee shall submit to the Board, for approval, a **Final Closure and Reclamation Plan**.

3. The Licensee shall endeavor to carry out Progressive Reclamation as soon as is reasonably practicable.

4. The Licensee shall conduct Progressive Reclamation in accordance with the most-recently approved Closure and Reclamation Plan, or as otherwise approved by the Board.

5. A minimum of ten days prior to the commencement of any Progressive Reclamation, the Licensee shall provide written notification to the Board and an Inspector. Notification shall include the name and contact information for the Construction superintendent.

Signed on behalf of the Mackenzie Valley Land and Water Board

Mavis Cli-Michaud, Chair

Amanda Gauthier, Witness

Schedule 1: Annual Water Licence Report

1. The Annual Water Licence Report referred to in Part B, Item 18 of this Licence shall include, but not be limited to the following:
    a. The monthly and annual quantities in cubic metres of fresh Water obtained from all sources;
    b. The monthly and annual quantities in cubic metres of each and all Waste discharged;
    c. A list of unauthorized discharges;
    d. An outline of any spill training and communications exercises carried out;
    e. A summary of any Closure and Reclamation work completed during the year and an outline of any work anticipated for the next year;
    f. A summary of any studies requested by the Board that relate to Waste disposal, Water Use, or reclamation and a brief description of any future studies planned;
    g. Any other details on Water Use or Waste disposal requested by the Board by November 1 of the year being reported; and
    h. Details of work completed.

Schedule 2: Security Requirements

1. Pursuant to Part C, condition 1, a Reclamation security deposit of $91,350.00 is required by this Licence.

Schedule 3

Part D – Item 1 – Conditions applying to Water Use

1. The Licensee shall only withdraw water from the listed sources below
2. The Licensee shall not exceed 40 m^3/ day nor 120 m^3/ year from each of the following watercourses to be crossed using small HDD drilling:

SHDD #	Northing	Easting	Highway #8 km
1	7443549	452621	9
2	7444719	453002	10
3	7445390	453311	11
4	7445924	454033	11.5
5	7446371	454679	12.5
6	7446611	455301	13
7	7447102	456106	14
8	7447346	456816	15
9	7448407	460039	19
10	7451309	468460	29
11	7460295	495538	59.5
12	7461473	496904	61
13	7468985	505090	76.5
14	7482900	510422	93
15	7483313	510797	95
16	7484357	511748	99.5
17	7483631	517285	101
18	7483380	518217	102
19	7483061	519190	105
20	7481074	520427	105.5
21	7480557	520635	105.8
22	7480122	521006	111
23	7476772	525483	112.3
24	7477043	526499	115
25	7476770	529260	119
26	7475105	533729	126
27	7480940	553059	142.5
28	7487913	552627	149
29	7491279	551923	153

	Northing	Easting	Highway #8 km
30	7492657	551635	154.1
31	7495987	550938	157
32	7498197	550471	159.8
33	7500693	549944	162.3
34	7515447	547921	177.8
35	7525849	554894	190.5
36	7527641	556077	192.5
37	7529476	557286	194.5
38	7530040	557657	195.5
39	7531379	558541	197
40	7531852	558853	197.5
41	7533535	559965	199.5
42	7535404	561196	201.9
43	7537606	562644	204.5
44	7541131	563970	208.4
45	7541714	564177	209
46	7551414	562396	221
47	7555106	563257	223.7
48	7555809	563441	230
49	7561930	564929	235.5
50	7569364	569534	242.5
51	7571208	571029	244.5
52	7572921	571705	245.5
53	7574010	572121	247
54	7574819	572429	247.2
55	7575754	572271	249
56	7576493	570839	251
57	7580845	555467	267
58	7582906	553775	269.6

3. The Licensee shall not exceed the daily withdrawal limit from the following sources.

Water Source	UTM – WGS84 – Zone 8		Max Daily Withdrawal
ID #	Easting	Northing	m^3/day
1. (Borrow Pit)	447742	7434987	80
2. (Creek)	452608	7443548	80
3. (Borrow Pit)	506035	7475128	80
4. (Lake)	505924	7479135	160
5. (Borrow Pit)	536426	7474195	80
6. (Lake)	546107	7478629	160
7. (Lake)	546108	7478629	160
8. (Borrow Pit)	547368	7512221	80
9. (Borrow Pit)	548886	7504834	80
10. (Creek)	554904	7525930	80
11. (Creek)	556059	7527675	80
12. (Borrow Pit)	563951	7544176	80
13. (Borrow Pit)	563036	7548409	80
14. Caribou Crk.	562819	7553517	80
15. (Creek)	571666	7573060	80
16. (River)	572159	7575773	80
17. (Lake)	570814	7576556	160
18. Peel River	505136	7469040	120
19. Arctic Red River	553401	7481216	120
20. Mackenzie River	553045	7481797	120

Annex A: Table of Items Requiring Submission

Attached to Water Licence MV2019L8-0013

Supplemental information to be submitted by Licensee as required through Water Licence conditions.

Part	Item	Date
B	Annual Water Licence Report	• March 31,2021 • Annually on each March 31
B	Engagement Plan	Within 90 days following the effective date of this Licence, the Licensee shall submit to the Board, for approval, a revised **Engagement Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
B	Engagement Plan	Annual Review
B	Inspection and Maintenance Plan	A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, an **Inspection and Maintenance Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan
B	Wildlife Management and Mitigation Plan	A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Wildlife Management and Mitigation Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
B	Heritage Resource Protection Plan	A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Heritage Resource Protection Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
B	Permafrost Protection Plan	A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Permafrost Protection Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
C	Security	According to the timeline set out in Schedule 2, condition 1
D	Water Use Fees	Each year, prior to August 31 and in advance of any Water use, the Licensee shall pay the Water Use Fee in accordance with the MVLWB's Water Use Fee Policy.
E	Construction Environmental Management Plan	A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, a **Construction Environmental Management Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
F	Waste Management Plan	Within 90 days of the issuance of this Licence, the Licensee shall submit to the Board, for approval, a revised **Waste Management Plan**.
F	Waste Management Plan	The Licensee shall comply with the **Waste Management Plan**, once approved, and shall annually review the plan and make any necessary revision to reflect changes in operations,

		technology, chemicals, or fuels, or as directed by the Board. Revision to the plan shall be submitted to the Board for approval.
F	Sediment and Erosion Control Plan	A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval a **Sediment and Erosion Control Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
F	Sediment and Erosion Control Plan	The Licensee shall comply with the **Sediment and Erosion Control Plan**, once approved, and shall annually review the plan and make necessary revisions to reflect changes in operations or as directed by the Board. Revisions to the plan shall be submitted to the Board for approval.
G	Spill Contingency Plan	Within 90 days of the issuance of this Licence, the Licensee shall submit to the Board, for approval, a revised **Spill Contingency Plan**.
G	Emergency Frac-out Response Plan	A minimum of 90 days prior to the commencement of Project activities, the Licensee shall submit to the Board, for approval, an **Emergency Frac-out Response Plan**. The Licensee shall not commence Project activities prior to Board approval of the Plan.
G	Emergency Frac-out Response Plan	The Licensee shall comply with the **Emergency Frac-out Response Plan** once approved and shall annually review the plan and make necessary revisions to reflect changes in operations or as directed by the Board. Revisions to the plan shall be submitted to the Board for approval.
I	Interim Closure and Reclamation Plan	A minimum of 90 days prior to the commencement of Project activities , the Licensee shall submit to the Board, for approval, an **Interim Closure and Reclamation Plan**.
I	Final Closure and Reclamation Plan	Three years prior to the expiration of this Licence, or a minimum of two years prior to the end of project activities, whichever occurs first, the Licensee shall submit to the Board, for approval, a **Final Closure and Reclamation Plan**.

Annex B: Revisions to Water Licence MV2019L8-0013

Attached to Water Licence MV2019L8-0013

List of changes that have been made to the Water Licence since issuance.

Date	Location of Change	What has changed
-	-	-

Mackenzie Valley Land and Water Board
7th Floor - 4922 48th Street
P.O. Box 2130
YELLOWKNIFE NT X1A 2P6
Phone (867) 669-0506
FAX (867) 873-6610

Reasons for Decision

Issued pursuant to paragraph 40(2)(c) of the Mackenzie Valley Land Use Regulations (MVLUR) and Sections 72.25 and 121 of the *Mackenzie Valley Resource Management Act* (MVRMA) and sections 36 of the *Waters Act*

Water Licence and Land Use Permit Applications	
Preliminary Screener	MVLWB
File Number	MV2019X0027 and MV2019L8-0013
Company	Government of Yukon – Department of Highways and Public Works
Project	Miscellaneous (Dempster Fiber Project)
Date of Decision	August 20, 2020

These Reasons for Decision set out the Mackenzie Valley Land and Water Board's (the MVLWB/Board) regulatory process and decisions on Applications made by Government of Yukon – Department of Highways and Public Works (GY-DHPW) to the Board on October 9, 2019 for Water Licence (Licence) MV2019L8-0013 and Land Use Permit (Permit) MV2019X0018 for the Dempster Fiber Project.

1.0 Summary of Applications

On October 9, 2019 GY-DHPW submitted Applications for a new Licence MV2019L8-0013[1] and new Permit MV2019X0027[2] for its proposed Dempster Fibre Project (Project). The Project includes construction of an approximately 800-km fibre optic line from Dawson City, Yukon, to Inuvik, Northwest Territories. For the purposes of the Land Use Permit and Water Licence application, the project is defined as the section of the Dempster Fibre Project located in the Northwest Territories. The fibre optic cable will enter the Northwest Territories at the Yukon/Northwest Territories border and then travel approximately 271 km north, within the Dempster Highway right-of way to Inuvik. The project is located entirely within the Gwich'in Settlement Area (GSA), passing through the communities of Fort McPherson and Tsiigehtchic. The project will connect to an existing terminal facility in Inuvik and to existing buildings in communities along the route to provide service to those communities.

On October 16, 2019 the Applications were deemed complete and sent for review and comment, on October 23, 2019 the Board received a request to extend the review and comment period. The extension was granted to all reviewing bodies. Comment on the Application were submitted November 14, 2019.

[1] See Water Licence MV2019L8-0013 Application submitted to the MVLWB on October 9, 2019.
[2] See Land Use Permit MV2019X0027 Application submitted to the MVLWB on October 9, 2019.

On November 21, 2019, the Board met and determined that additional studies were needed to consider the application, the specific information that was needed were the responses to the comments from the Proponent. November 21, 2019 was also the end of the 42-day timeline. Also, on November 21, 2019, the responses were received from the Proponent.

On December 2, 2019, an Information Request was issued to the Proponent to address comments and recommendations as well as provide additional information to assist in the drafting of the permit and licence. On March 16, 2020 responses to the Information Request were received.

On March 23, 2020, the responses to the Information Request were distributed for review and comment with recommendations from reviewers due on April 23, 2020. By May 7, 2020 responses to the reviewer comments and recommendations were submitted to the Board by the Proponent.

2.0 Decision

In making its decision and preparing these Reasons for Decision, the Board has reviewed and considered:

1. The evidence and submissions from GY -DHPW received by the Board;
2. The written comments and submissions from parties received by the Board; and
3. The Staff Report prepared for the Board.

Having due regard to the facts, circumstances, and the merits of the submissions made to it, and to the purpose, scope, and intent of the MVRMA and the *Waters Act*, the Board has determined that Permit MV2019X0027 and Licence MV2019L8-0013 should be issued subject to the scope, definitions, conditions, and term contained therein. The Board's determinations and reasons for this decision are set out below.

3.0 General Principles for Land Use Permit MV2019X0027 and Water Licence MV2019L8-0013

In conducting the review process for the Permit and Licence applications, the Board has ensured that all applicable legislative and procedural requirements have been satisfied, as required by section 62 of the MVRMA and as outlined below.

- Notice of the Permit and Licence Applications was given in accordance with sections 63 and 64 of the MVRMA. The Board is satisfied that a reasonable period of notice was given to communities and First Nations so that they could provide comments to the Board.
- The use of land proposed by the Applicant is of a nature contemplated by the MVRMA.
- It is the opinion of the Board that the terms and conditions attached to LUP MV2019X0027 and WL MV2019L8-013, pursuant to the MVRMA, MVLUR, and the Waters Act, will prevent or mitigate any potential significant environmental impacts which might result from the Dempster Fibre Project. Specific conditions and how they relate to issues raised during the review of the Applications are discussed below.
- The scopes, definitions, terms, and conditions set forth in the LUP and WL have been developed in order to address the Board's statutory responsibilities and the concerns that arose during the regulatory process. These Reasons for Decision focus on the major issues and those that (1) were the subject of substantive argument submitted by one or more parties, or (2) resulted in the use of conditions that differ from those found on the MVLWB Standard Land Use Permit Conditions Template (Standard Template).

4.0 Determinations Pertaining to Water Licence MV2019L8-0013

4.1 Requirements of Section 26 of the Waters Act

4.1.1 Existing Licensees

After reviewing the submissions filed on the Public Registry the Board is satisfied that, with respect to paragraph 26(5)(a) of the Waters Act, the granting of this Licence to YG-DHPW will not adversely affect, in a significant way, any existing Licensee, provided that compliance with the conditions of the WL are adhered to.

4.1.2 Existing Water Users

Paragraph 26(5)(b) of the Waters Act prohibits the issuance of a Licence unless the Board is satisfied that appropriate compensation has been or will be paid by the Applicant to people who were, at the time when the Applicant filed its Applications with the Board, members of the classes of water users depositors, owners, occupiers, or holders listed under paragraph 26(5)(b), who would be adversely affected by the use of waters, or deposit of waste proposed by the Applicant.

The Board received no claims for compensation either during the prescribed period or afterwards. Provided that compliance with the Licence conditions is achieved, the Board does not believe that any users or persons listed in paragraph 26(5)(b) of the Waters Act will be adversely affected by the use of Waters or the deposit of Waste proposed by the Applicant.

4.1.3 Water Quality Standards

With regards to subparagraph 26(5)(c)(i) of the Waters Act, the Board is satisfied that compliance with the Licence conditions will ensure that waste produced by the Project will be collected and disposed of in a manner which will maintain water quality consistent with applicable standards.

4.1.4 Effluent Quality Standards

Not applicable: Effluent discharge is not considered by the application.

4.1.5 Financial Responsibility of the Applicant

The Board must satisfy itself of the financial responsibility of the Applicant under paragraph 26(5)(d) of the Waters Act before it can issue the Licence. In this case, the Board is satisfied that the GY-DHPW is capable of meeting the obligations set out in the MVRMA, Waters Act, and the Licence.

4.1.6 Requirements of Subsection 27(2) of the Waters Act

It is the opinion of the Board that compliance with the Licence terms and conditions it has imposed on GY – DHPW will ensure that any potential adverse effects on other water users, which might arise as a result of the issuance of the Licence, will be minimized.

4.2 Water Licence MV2019L8-0013 Terms and Conditions

The conditions in this Licence MV2019L8-0013 have been drafted with the transboundary nature of the project in mind and to assist in the administrative requirements and enforcement of the Project as a whole.

4.2.1 Water Licence Term

GY-DHPW has applied for a permit term of five years and a licence term of seven years. Subsection 26(2) of the Waters Act allows for a Licence term of not more than 25 years or the duration of the undertaking. After reviewing the submissions made during this regulatory process, and taking into consideration the closely linked Permitthe Board decided to continue the practice of setting the Licence term to coincide with that of the Permit, and therefore set the term of the Licence for 7 years from the date of issuance which takes into account the five-year term of the Permit, plus the possibility of a two-year extension of the Permit's term.

4.2.2 Scope and Definitions

Part A contains the scope of allowable activities, and definitions of terms used throughout the Licence.

Scope

The scope of the Licence ensures the Licensee is entitled to conduct activities which have been applied for and screened by the Board. In setting out the scope of the Licence, the Board endeavoured to provide enough detail to identify and describe the authorized activities, without be unduly restrictive or prescriptive, and to allow for project flexibility throughout the life of the Permit.

Part A, conditions 1(b) through 1(e) are consistent with previous Licences issued by the Board. These conditions ensure that the scope of the authorization includes all water uses and deposits of waste associated with the Project, reflect and comply with all applicable legislation for the life of the authorization, and consider and incorporate scientific and Traditional Knowledge where available in the Licensee's effort to protect the environment.

Definitions

The Board defined terms in the Licence to ensure a common understanding of conditions, to avoid future differences in interpretation, and to use wording similar to that found in previously issued Licences and/or the MVLWB Draft Standard Water Licence Conditions Template.

4.2.3 Part B: General Conditions and Schedule 1

Part B and Schedule 1 of the Licence contain general administrative conditions regarding compliance and conformity with the *MVRMA* and *Waters Act* and is consistent with standard conditions found in previous Licences issued by the Board.

Part B, condition 5, clarifies that all references to policies, guidelines, codes of practice, statutes, regulations or other authorities shall be read as a reference to the most recent versions, unless otherwise denoted. This standard practice allows for flexibility in Licence conditions when documents are updated during the life of the Licence.

This section addresses conformity and compliance with submissions to the Board. Annual review and submission of major updates or changes to management plans are required by Part B, condition 9, for Board approval. Such revisions must be approved by the Board prior to the implementation of activities not identified in existing, approved plans. This condition ensures that all applicable plans are regularly

reviewed and updated so they reflect changes in technology and/or changes and phases of the project throughout the life of the authorization.

Part B, item 13 introduces the Schedules which are annexed to and form part of the Licence. Changes to these Licence components are largely administrative matters and are within the Board's authority.

Part B, condition 18 and Schedule 1 condition 1: Annual Water Licence Report

The requirements for the Annual Water Licence Report are outlined in Part B, condition 18, and Schedule 1, condition 1. The purpose of the Annual Water Licence Report is to provide the Board and all stakeholders the opportunity to be annually updated on project components and activities, and to provide a platform for stakeholders to submit comments, observations, feedback, and questions as necessary. The requirements are intended to provide clarity and summarize information already captured through existing submissions; they are not meant to be onerous. The Board organized these requirements to coincide with the layout of the Licence and to be consistent with recently issued licences.

Part B, conditions 19 and 20: Engagement

The Board assesses engagement adequacy of applications through the Board's *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits*, and the Board's *Engagement and Consultation Policy*. The Board notes that GY – DHPW's pre-engagement for the Applications was determined to be in accordance with the Guidelines and Policy. GY – DHPW included an Engagement Plan and Log Version 1 in the Applications.

During the public review, GNWT commented that neither the Engagement Record nor Plan contained information pertaining to engagement with the Hamlet of Fort McPherson (GNWT #35)[3].

The Engagement Plan cannot be approved at this time and should be revised and re-submitted wthin 90 days following the effective date of this Licence to reflect updates as agreed to during the public review, to reflect the scope of the proposed activities, to meet the applicable guidelines, and to include the following:

- Engagement Record and Plan for the Hamlet of Fort McPherson

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part B, condition 21: Inspection and Maintenance Plan

In the Application, GY – DHPW committed to developing an Inspection and Maintenance Plan, for the purpose of delineating inspection and maintenance protocols and schedules for Project activities and equipment. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval (GNWT #11).

[3] See MVLWB public registry for MV2019X0027 MV2019L8-0013 Reviewer Comment Summary Table

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part B, condition 22: Wildlife Management and Mitigation Plan

In the Application, GY – DHPW committed to developing a Wildlife Management and Mitigation Plan for the Project, and during the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval (GNWT #11).

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part B, condition 23: Heritage Resource Protection Plan

In the Application, GY – DHPW committed to developing a Heritage Resource Protection Plan for the Project, which will outline best practices and appropriate protocols in the event that heritage resources are discovered as a result of Project activities. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval (GNWT #11).

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part B, condition 24: Permafrost Protection Plan

In the Application, GY – DHPW committed to developing a Permafrost Protection Plan for the Project which will describe field level construction protocols and appropriate mitigation measures for the protection of permafrost. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval (GNWT #11).

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

4.2.4 Part C: Conditions Applying to Security Requirements and Schedule 2

The Board is authorized to require the Licensee to provide security to the Minister by subsection 35(1) of the *Waters Act*. Subsection 35(2) of the *Waters Act* specifies how the security may be applied.

Part C of the Licence, by reference to Schedule 2, sets the level of security to be maintained by the Licensee and set out requirements related to posting and updating security. As in other licences, the Board may request a security update from the proponent at any time, and may adjust the security amount at any time, based on available information. Specifically, Part C, conditions 3 and 4 stipulate that the Board can revise the security deposit and that the Licensee will post the revised deposit within 90 days following the Board's decision. This condition pertains to both increases and reductions in security. The conditions in this section are similar to those found in other Licences issued by the Board.

The Board has determined that the total security deposit amount for the Dempster Fibre Project shall be $ 190, 161.00 ($91,350.00 is required under the Licence and $98,811.00 is required under the Permit).

4.2.5 Part D: Conditions Applying to Water Use and Schedule 3

Part D and Schedule 3 of the Licence contains conditions related to water use for the Dempster Fibre Project. These are consistent with standard conditions found in previous Licences issued by the Board.

During the public review GNWT commented that GY-DHPW did not provide the requested annual volumes of water to be withdrawn from each proposed water source, nor did it include information on the sources' capacities (GNWT #10). Board staff determined that this additional information was required to complete a preliminary screening, and to set appropriate terms and conditions for the Water Licence.

On December 2, 2019 Staff issued an information request[4] to GY-DHPW requiring the applicant to provide:

a) a finalized list of water sources, including name and location of the water bodies, and the available capacity of each proposed water source;
b) anticipated daily withdrawal volumes and duration of use, including a comparison of the total annual water volume requested for use against the total water volume available;
c) any available bathymetric information, including maximum depths and available water under ice,
d) any available information on other water uses from the source(s), and;
e) shapefiles delineating the proposed project footprint, for the public registry

On December 23, 2019 GY-DHPW submitted a response to IR #1. The finalized list of water sources included both the sources submitted in the original application, as well as a list of the 58 water crossings that would be crossed by HDD during cable installation. The applicant explained that 'Where possible, water required for the s
mall HDD operations will be sourced directly from the feature being crossed." Daily and annual withdrawal volumes were provided for water sources. Bathymetric and flow data was provided for several of the water courses, however GYDHPW acknowledged that limited data was available. In absence of this data, GYDHPW committed to following Fisheries and Oceans' Canada (DFO) Protocol for Winter Withdrawal from Ice-Covered Waterbodies in the Northwest Territories and Nunavut (2010) a for water withdrawal, including restricting water withdrawals from streams to 10% of the instantaneous flow and to restricting summer lake withdrawals to 10% of the available volume.

Because the 58 water crossings had not been identified as withdrawal sources in the accepted application, the IR#1 response was circulated in order to provide reviewers an opportunity to submit comments on the additional water sources.

By April 23, 2020 comments and recommendations on the response to IR #1 were received from

- Government of the northwest Territories – Department of Environment and Natural Resources (ENR)
- Gwich'in Tribal Council – Department of Cultural Heritage
- Gwich'in Renewable Resources Board

During the Public GNWT recommended that a weekly reporting requirement be included in the Water Licence, in order to capture instantaneous flow rates and water withdrawal rates for each source. (GNWT IR #2). Condition D 8 has been added to reflect this recommendation.

[4] See MVLWB.com for IR #1

The maximum volume of water to be withdrawn from all identified sources shall not exceed 280 m^3 per day. The maximum daily withdraw limits for each source has been identified in Schedule 3 of the Water Licence.

4.2.6 Part E: Conditions Applying to Construction

Part E of the Licence contains conditions applying to construction activities for the Dempster Fibre Project and is consistent with standard conditions found in previous Licences issued by the Board. The Board can ensure that monitoring requirements are in place prior to, during, and post-construction.

Part E, condition 3: Construction Environmental Management Plan

In the Application, GY-DHPW committed to developing a Construction Environmental Management Plan for the Project, which identifies field-level mitigation and best management practices. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

4.2.7 Part F: Conditions Applying to Waste and Water Management

Part F of the Licence contains conditions applying to waste and water management activities for the Dempster Fiber Project and is consistent with standard conditions included in previous Licences issued by the Board. Site-specific conditions were developed where necessary.

Part F, condition 1 sets out the objectives for the management of water and waste for the Dempster Fiber Project. This condition is consistent with the principles of objective-based regulation: it essentially defines the objectives of any required management actions, plans or reports. This condition is standard for Licences issued by the Board and reminds the Licensee of the need to manage water and waste with the goal of minimizing impacts on the receiving environment.

Part F, condition 2: Waste Management Plan

The Boards' authority to regulate the management of waste is described in subsection 26(1) of the MVLUR and sections 11 and 27 of the *Waters Act*. As such, the Board developed, and approved, *Guidelines for Developing a Waste Management Plan*.[5] These guidelines can be applied to a wide range of projects and is intended to ensure that all waste management activities specific to each project are carried out in a way that is consistent with best practices and applicable guidelines to minimize waste released from the Project. Waste Management Plan is a defined term in the Licence, ensuring that the required Plan adheres to the Board's Guidelines.

Submittal and compliance with a Waste Management Plan is standard for Licences issued by the Board. GY-DHPW included a Waste Management Plan Version 1 in the Application

[5] See www.mvlwb.com → Resources → Policies and Guidelines: *MVLWB Guidelines for Developing a Waste Management Plan* (March 31, 2011).

Throughout the regulatory review process, comments and recommendations were received from GNWT regarding the Waste Management Plan and that further details should be included in the Plan. In response to concerns, GY – DHPW committed to updating the Waste Management Plan

The Waste Management Plan cannot be approved at this time and should be revised and re-submitted by DATE to reflect updates as agreed to during the public review, to reflect the scope of the proposed activities, to meet the applicable guidelines, and to include the following:

- The volume of waste that could be generated by the Project
- The size of waste storage containers that will be available on site
- Details regarding secondary containment for the temporary storage of hazardous waste.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part F, condition 5

Part F condition 5 requires written authorization from an Inspector prior to the deposit of Waste in the Inuvik Solid Waste Disposal Facilities. This is consistent with the Town's municipal water Licence G17L3-001.

Part F, condition 6

Part F, condition 6 specifically prohibits the deposit of waste into a watercourse, or within 100 meters of a watercourse, and was added in response to GNWT recommendation (GNWT #37)

Part F, condition 9 and 10 Sediment and Erosion Control Plan

Part F, condition 9 and 10 outline the requirements for a Sediment and Erosion Control Plan. This Plan is required by the Licence to ensure the Project is managed in accordance with the *Waters Act*, and the objectives listed in Part G, conditions 1 of the Licence.

In the Application, GY – DHPW committed to developing a Sediment and Erosion Control Plan for the Project, to address the potential for in-stream sedimentation that may occur during vegetation clearing, and during the installation and maintenance of the fibre optic line. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

4.2.8 Part G Conditions Applying to Contingency Planning

Part G of the Licence contains conditions related to spill contingency planning and reporting, reclamation of spills and unauthorized discharges, and emergency response for the Dempster Fibre Project. The purpose of this part is to ensure that GY – DHPW is fully prepared to respond to spills and unauthorized discharges. The planning and reporting requirements in this part ensure that GY – DHPW has identified the lines of authority and responsibility, has an action plan(s) for responses to spills and unauthorized discharges, and has established reliable reporting and communication procedures. This will ensure that

any spills or unauthorized discharges are effectively controlled and cleaned up, with the goal of preventing or limiting damage to the receiving environment. The conditions in Part G are consistent with standard conditions found in previous Licences issued by the Board.

Part G, condition 2 and 3: Spill Contingency Plan

Spill Contingency Plan is a defined term in the Licence, referencing the Indian and Northern Affairs Canada's *Guidelines for Spill Contingency Planning*.[6] GY – DHPW included Spill Contingency Plan version 1 in the Application.

During the Public Review, GNWT commented that additional information was required in the SCP (GNWT #39)

The Spill Contingency Plan cannot be approved at this time and should be revised and re-submitted within 90 days following the effective date of this Licence to reflect the guidelines, updates as agreed to during the public review, to reflect the scope of the proposed activities and to include the following:

- Regional Contact Information
- Safety Data Sheets

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part G, conditions 11 and 12 Emergency Frac-out response Plan

Part G, conditions 11 and 12 outline the requirements for an Emergency Frac-out response Plan. This Plan is required by the Licence to ensure the Project is managed in accordance with the *Waters Act*, and the objectives listed in Part G, conditions 1 of the Licence.

In the Application, GY – DHPW committed to developing a Emergency Frac-out Response Plan for the Project, to be implemented in the event of a release of drilling mud. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval. (GNWT #11)

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

4.2.9 Part H: Conditions Applying to Aquatic Effects Monitoring

The Board did not require conditions in this section to satisfy its mandate and did not receive any comments during the review of the draft Licence.

4.2.10 Part I: Conditions Applying to Closure and Reclamation

Part I of the Licence contains conditions applying to closure and reclamation of the Dempster Fibre Project.

The Licence conditions applying to the security deposit (Part C of the Licence) are closely related to this Part I; the security deposit is directly related to the activities described in the closure plans, and updates

[6] See www.mvlwb.com → Resources → Policies and Guidelines: *INAC Guidelines for Spill Contingency Planning*

to closure plans often result in updates to the security deposit. These conditions are consistent with other Licences issued by the Board.

Part I, condition 2 requires GY – DHPW to submit a Closure and Reclamation Plan a minimum of 90 days prior to the commencement of Project activities.

Part I, condition 2 requires GY – DHPW to submit a Final Closure and Reclamation Plan a minimum two years prior to the end of operations. This is a standard requirement of Licences issued by the Board and will ensure the Project is reclaimed in accordance with established guidelines and expectations of reviewers and the Board.

5.0 Determinations Pertaining to Land Use Permit MV2019X0027

5.1 Term of Permit

GY – DHPW has applied for a term of 5 years for the Permit, with a desire for an extension. Subsections 26(5) of the MVLUR allows for a Permit term of not more than five years. After reviewing the submissions made during this regulatory process, the Board has determined an appropriate term for this land use operation is 5 years.

5.2 Part A: Scope of Permit

The scope of the Permit ensures the Permittee is entitled to conduct activities which have been applied for and screened by the Board. In setting out the scope of the Permit, the Board endeavoured to provide enough detail to identify and describe the authorized activities, without be unduly restrictive or prescriptive, and to allow for project flexibility throughout the life of the Permit.

5.3 Part B: Definitions

The Board defined items in the Permit to ensure a common understanding of conditions, to avoid future differences in interpretation, and to use wording similar to that found in previously issued Permits. For the most part, the definitions used wording from the Board's *Standard Land Use Permit Conditions Template* (Standard Template).

5.4 Part C: Conditions Applying to All Activities

The subheadings below correspond to the headings in the conditions section of the Permit, as outlined in section 26(1) of the MVLUR. Most conditions in the Permit are from the Board's Standard Template, and are not discussed in detail in these Reasons for Decision unless notable due to recommendations or concerns raised during the public review. Where applicable, the Board's reasons for including non-standard conditions are discussed.

<u>26(1)(a) Location and Area</u>

The conditions included in this section are all consistent with the Board's Standard Template.

<u>26(1)(b) Time</u>

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(c) Type and Size of Equipment

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(d) Methods and Techniques

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(e) Type, Location, Operation of All Facilities

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(f) Control or Prevention of Ponding of Water, Flooding, Erosion, Slides, and Subsidence of Land

The Board has included a condition regarding the submission of a Sediment and Erosion Control Plan which is not part of the Standard Template. The Sediment and Erosion Control Plan is intended to explain how erosion and sedimentation will be mitigated and controlled on the land, and to prevent eroded materials from migrating and settling in the water as a result of Project activities. This Plan is also required under Part F, Conditions 9 and 10 of the Licence, and the Board's reasons for including this Plan are described above in section 4.2.7. To ensure consistency between the authorizations regarding the submission of this Plan, the Board has chosen to require Board approval of this Plan prior to commencement of the land-use operation.

26(1)(g) Use, Storage, Handling, and Ultimate Disposal of Any Chemical or Toxic Material

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(h) Wildlife and Fish Habitat

In the Application, GY – DHPW committed to developing a Wildlife Management and Mitigation Plan for the Project which will detail mitigations to reduce or eliminate impacts to wildlife and wildlife habitat. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

26(1)(i) Storage, Handling, and Disposal of Refuse or Sewage;

A Waste Management Plan is a standard requirement for land use permits issued by the Board. This Plan is intended to ensure that all waste management activities are carried out in a way that is consistent with best practices and applicable guidelines to minimize waste released from the Project. This Plan is also required under Part F of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.7. The Board mirrored these conditions

to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

26(1)(j) Protection of Historical, Archaeological, and Burial Sites;

In the Application, GY – DHPW committed to developing a Heritage Resource Protection Plan for the Project, which will outline best practices and appropriate protocols in the event that heritage resources are discovered as a result of Project activities. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

26(1)(k) Objects and Places of Recreational, Scenic, and Ecological Value

The Board did not require conditions in this section to satisfy its mandate and did not receive any comments during the review of the draft Permit.

26(1)(l) Security Deposit

The Board is authorized to require the Permittee to provide security to the Minister by subsection 32(1) of the MVLUR. Subsection 32(2) of the MVRMA specifies how the security may be applied.

The Board has included a requirement for security in the Permit. The Board's reasons associated with this section are described above in Section 4.2.4, in conjunction with reasons for security required by the Licence. The security deposits required by these two instruments are discussed together since the estimates deal with the same project and are intimately linked. The conditions included in this section are consistent with the Board's Standard Template.

26(1)(m) Fuel Storage

A Spill Contingency Plan is a standard requirement for land use permits issued by the Board. This Plan is intended to ensure that an action plan(s) for responses to spills and Unauthorized Discharges, and has established to effectively control and clean up spills and Unauthorized Discharges, with the goal of preventing or limiting damage to the receiving environment. This Plan is also required under Part G of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.8. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

26(1)(n) Methods and Techniques for Debris and Brush Disposal

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(o) Restoration of the Lands

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(p) Display of Permits and Permit Numbers

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(q) Biological and Physical Protection of the Land

An Engagement Plan is a standard requirement for land use permits issued by the Board. This Plan is intended to ensure adequate and effective engagement with potentially affected parties has occurred prior to the submission of the Applications (in the form of the Engagement Log) and is planned for throughout the life of the Project. This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

In the Application, GY-DHPW committed to developing a Construction Environmental Management Plan for the Project, which identifies field-level mitigation and best management practices for construction activities. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

In the Application, GY – DHPW committed to developing a Permafrost Protection Plan for the Project which will describe field level construction protocols and appropriate mitigation measures for the protection of permafrost. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

In the Application, GY – DHPW committed to developing an Inspection and Maintenance Plan, for the purpose of delineating inspection and maintenance protocols and schedules for Project activities and

equipment. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

6.0 Conclusion

Subject to the scopes, definitions, conditions, and terms set out in the Licence and Permit, and for the reasons expressed herein, the MVLWB is of the opinion that the land-use activities, water use, and waste disposal associated with the Dempster Fiber Project can be completed by Government of Yukon Department of Highways and Public works while providing for the conservation, development, and utilization of waters in a manner that will provide the optimum benefit for all Canadians and in particular for the residents of the Mackenzie Valley.

Water Licence MV2019L8-0013 and Land Use Permit MV2019X0027 contain provisions that the Board deems necessary to ensure and monitor compliance with the MVRMA, *Waters Act*, and the Regulations made thereunder, and to provide appropriate safeguards in respect of GY-DHPW use of the land and water affected by the Licence.

SIGNATURE

Mackenzie Valley Land and Water Board

Mavis Cli-Michaud, Chair	August 20, 2020 Date

Appendices and Annexes

Water Licence and Land Use Permit Applications	
Preliminary Screener	MVLWB
File Number	MV2019X0027 and MV2019L8-0013
Company	Government of Yukon – Department of Highways and Public Works
Project	Miscellaneous (Dempster Fiber Project), Inuvik NT

Appendix 1: Reclamation Security for the Dempster Fibre Project

1.0 Introduction

Government of Yukon and the Government of Northwest Territories determined the below security estimate, which was submitted to the Board by the GNWT during the public review period.

Summary of Costs			
CAPITAL COSTS	**COMPONENT NAME**	**LAND LIABILITY**	**WATER LIABILITY**
WELLS AND FACILITIES		$0	$0
BUILDINGS AND EQUIPMENT		$39,248	$31,960
CHEMICALS AND CONTAMINATED SOILD MANAGEMENT		$3,438	$2,503
SURFACE AND GROUNDWATER MANAGEMENT		-	$0
INTERIM CARE AND MAINTENANCE		-	$5,000
	SUBTOTAL: Capital Costs	**$42,686**	**$39,463**
	PERCENT OF SUBTOTAL	**53%**	**49%**
INDIRECT COSTS		**LAND LIABILITY**	**WATER LIABILITY**
MOBILIZATION/DEMOBILIZATIO N		$15,478	$14,310
POST-CLOSURE MONITORING AND MAINTENANCE		$26,988	$24,950
ENGINEERING	5%	$2,134	$1,973
PROJECT MANAGEMENT	5%	$2,134	$1,973

HEALTH AND SAFETY PLANS/MONITORING & QA/QC	1%	$427	$395
BONDING/INSURANCE	1%	$427	$395
CONTINGENCY	20%	$8,537	$7,893
MARKET PRICE FACTOR ADJUSTMENT	0%	$0	$0
	SUBTOTAL: Indirect Costs	**$56,126**	**$51,888**
	++42686		
TOTAL COSTS		**$98,811**	**$91,350**

The Board may consider the following items from subsection 32(2) of the MVLUR in setting the amount of security:

(a) The ability of the applicant or prospective assignee to pay the costs referred to in that subsection;
(b) The past performance of the applicant or prospective assignee in respect of any other permit;
(c) The prior posting of security by the applicant pursuant to other federal legislation in relation to the land-use operation; and
(d) The probability of environmental damage or the significance of any environmental damage.

The Board chose to set security at $190,161.00

Mackenzie Valley Land and Water Board
7th Floor - 4922 48th Street
P.O. Box 2130
YELLOWKNIFE NT X1A 2P6
Phone (867) 669-0506
FAX (867) 873-6610

General Procedures for the Administration of Licences
Issued Under the *Mackenzie Valley Resource Management Act*
in the Northwest Territories

1. At the time of issuance, a copy of the Licence is placed on the Public Registry in the office of the Mackenzie Valley Land and Water Board (MVLWB or the Board) in Yellowknife and is then available to the public.

2. To enforce the terms and conditions of the Licence, the Minister of Indigenous and Northern Affairs Canada has appointed Inspectors in accordance with subsection 84(1) of the *Mackenzie Valley Resource Management Act*. The Inspectors coordinate their activities with staff of the MVLWB. The Inspector responsible for Licence MV2019L8-0013 is located in Beaufort – Delta Regional office.

3. To keep the MVLWB and members of the public informed of the Licensee's conformity to the Licence's conditions, the inspectors prepare reports which detail observations on how each item in the Licence has been met. These reports are forwarded to the Licensee with a covering letter indicating which action, if any, should be taken. The inspection reports and cover letters are placed on the Public Registry, as are any responses received from the Licensee pertaining to the inspection reports. It is therefore of prime importance that you react in all areas of concern regarding all inspection reports so that these concerns may be clarified.

4. Licence MV2019L8-0013 will expire on August 31, 2027, if required; it is the responsibility of the Licensee to apply to the MVLWB for a new licence. The past performance of the Licensee, new documentation and information, and points raised during a public hearing, if required, will be used to determine the terms and conditions of any new licence. Please note that if the Licence expires and another has not been issued, then water and waste disposal must cease, or you, the Licensee, would be in contravention of the *Mackenzie Valley Resource Management Act*. It is suggested that an application for a new licence be made at least eight months in advance of the Licence's expiry date.

5. If, for some reason, Licence MV2019L8-0013 requires amendment, a public hearing may be required. You are reminded that applications for amendments should be submitted as soon as possible to provide the MVLWB ample time to complete the amendment process. The process may take up to six months or more depending on the scope of the amendment requested.

6. Specific clauses of your Licence make reference to the Board, Analyst, or Inspector. The contact person, address, phone, and fax number of each is:

Mackenzie Valley Land and Water Board:

Public Registry Clerk
Mackenzie Valley Land and Water Board
7th Floor - 4922 48 Street,
P.O. Box 2130
YELLOWKNIFE NT XIA 2P6
Phone (867) 669-0506
Fax (867) 873-6610

Analyst:

Street Address:
Taiga Environmental Laboratory
4601 – 52nd Ave
Yellowknife, NT
X1A 1L4

Mailing Address:
Taiga Environmental Laboratory
P.O. Box 1320
Yellowknife, NT
X1A 2L9

Phone: (867) 767-9235, ext 53151
Fax: (867) 920-8740
General Email: taiga@gov.nt.ca

Inspector:

P.O. Box 2749
Inuvik NT X0E 0T0
Phone: (867) 678-0289

7. Specific clauses of your licence may reference security. The contact person, address, and phone and fax numbers of the individual administering security deposits is:

Manager, Financial Services
P.O. Box 1500
Yellowknife NT X1A 2R3
Phone: (867) 669-2517
Fax: (867) 669-2724
Email: Michelle Desjarlais-Morris@aandc-aadnc.gc.ca

Mackenzie Valley Land and Water Board

7th Floor - 4922 48th Street,
P.O. Box 2130, Yellowknife NT X1A 2P6

Tel: 867-669-0506 Fax: 867-873-6610
www.mvlwb.com

August 31, 2020 File: MV2019X0027

Darryl Froese
Government of Yukon
Department of Highways and Public Works
Box 2703 (W-5)
Whitehorse YT Y1A2C6 Sent by email

Dear Darry Froesel,

Issuance of Type A Land Use Permit
Dempster Fibre Project

Attached is Type A Land Use Permit MV2019X0027 granted by the Mackenzie Valley Land and Water Board (MVLWB or the Board) in accordance with the *Mackenzie Valley Resource Management Act* (MVRMA). This Permit has been approved for a period of five (5) years effective August 31, 2020 and expiring August 30, 2025

Permit Conditions
Please read all conditions carefully. For the purpose of submitting plans in accordance with this Permit, the date of this letter, August 30, 2020, is the effective date.

Reclamation Security
In accordance with Permit condition 42 a security deposit in the amount of $98,811.00 shall be posted with the Minister and copied to the Board prior to the start of the operation under section 32 of the Mackenzie Valley Land Use Regulations. As delegated under Schedule A of the Delegation Instrument under the MVRMA, this security deposit, **payable to the Government of the Northwest Territories** in the amount of $98,811, shall be submitted to: the Government of the Northwest Territories, Department of Lands, North Slave Regional Office, 140 Bristol Avenue, Yellowknife NT, X1A 3T2. For more information about posting security with the GNWT, please contact Charlene Coe, Land Use Advisor, at (867) 767-9187 (ext. 24194). Please send a copy of the receipt for the security deposit to the MVLWB office prior to the start of your land use operation.

Management Plans – Resubmission and Additional Plans Required
The Board hereby requires that Government of Yukon Department of Highways and Public Works (GY-DHPW) to submit the below management plans in accordance with comments made during this review.

…/2

Table 1: Plans Requiring Submission

Part C	Item	Date
Condition 14	Sediment and Erosion Plan	Within 90 days of the issuance of this permit, the Permittee shall submit to the Board for approval a Sediment and Erosion Control Plan.
Condition 31	Emergency Frac-Out Response Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, an Emergency Frac-out Response Plan. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 32	Wildlife Management and Mitigation Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a Wildlife Management and Mitigation Plan. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 34	Revised Waste Management Plan	Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board, for approval, a revised Waste Management Plan.
Condition 38	Heritage Resource Protection Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a Heritage Resource Protection Plan. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 54	Revised Spill Contingency Plan	Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board, for approval, a revised **Spill Contingency Plan**.
Condition 61	Interim Closure and Reclamation Plan	Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board for approval a Closure and Reclamation Plan.
Condition 70	Revised Engagement Plan	Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board, for approval, a revised **Engagement Plan**.

Condition 71	Construction Environmental Management Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a **Construction Environmental Management Plan**. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 72	Permafrost Protection Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a **Permafrost Protection Plan**. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 73	Inspection and Maintenance Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, an **Inspection and Maintenance Plan**. The Permittee shall not commence Project activities prior to Board approval of the Plan.

Discontinuance

Should you wish to discontinue your land-use operation at any time prior to the expiry date set out in the Permit, a written notice of discontinuance is required as per section 37 of the MVLUR, in addition to the submission of a final plan.

Public Registry

A copy of this Permit and all related correspondence and documents has been filed on the Public Registry at the MVLWB office. Please be advised that this letter, with its attached procedures, inspection reports, and related correspondence is part of the Public Registry and is intended to keep all interested parties informed of the manner in which the Permit requirements are being met. All Public Registry material will be considered if an amendment to the Permit is requested.

The full cooperation of Government of Yukon Department of Highways and Public Works is anticipated and appreciated. If you have any questions or concerns, please contact AlecSandra Macdonald at (867) 777-4954 or email amacdonald@glwb.com.

Yours sincerely,

Mavis Cli-Michaud
MVLWB, Chair

Copied to: Distribution List
Charlene Coe, GNWT, Land Use Advisor

Attached: Land Use Permit MV2019X0027
Reasons for Decision

Land Use Permit

Permit Class	Permit No	Amendment No
A	MV2019X0027	

Subject to the Mackenzie Valley Land Use Regulations and the terms and conditions in this Permit, authority is hereby granted to:

Government of Yukon – Department of Highways and Public Works

Permittee

to proceed with the land use operation described in the Application of:

Signature Darryl Froese	Date October 9, 2019
Type of Land Use Operation Miscellaneous	
Location Dempster Highway NWT – YU Border	

This Permit may be assigned, extended, discontinued, suspended, or cancelled pursuant to the Mackenzie Valley Land Use Regulations.

Dated at Yellowknife this 31 day of August , 2020

Signature Chair

Mavis Cli-Michaud

Signature Witness

Amanda Gauthier

Effective Date:
August 31, 2020

Expiry Date:
August 30, 2025

ATTENTION

It is a condition of this Permit that the Permittee comply with the provisions of the *Mackenzie Valley Resource Management Act* and Regulations and the terms and conditions set out herein. A failure to comply may result in suspension or cancellation of this Permit.

Conditions Annexed to and Forming Part of Land Use Permit # MV201900X27

Part A: Scope of Permit

1. This Permit entitles the Permittee to conduct the following land-use operation:

    a) Geotechnical drilling;
    b) Horizontal Directional drilling;
    c) Use of pre-existing staging areas for equipment and materials;
    d) The use and storage of fuel;
    e) Construction of temporary camps to accommodate work crews;
    f) Clearing of vegetation as required in the right of way;
    g) Progressive Reclamation and associated Closure and Reclamation activities;
    h) Installation of conduits and fibre optic cable; and
    i) Ongoing operations and maintenance.

2. This Permit is issued subject to the conditions contained herein with respect to the use of land for the activities and area identified in Part A, item 1 of this Permit.

3. Compliance with the terms and conditions of this Permit does not excuse the Permittee from its obligation to comply with the requirements of any applicable Federal, Territorial, or Municipal laws.

Part B: Definitions (defined terms are capitalized throughout the Permit)

Act - the *Mackenzie Valley Resource Management Act.*

Board - the Mackenzie Valley Land and Water Board established under Part 4 of the Act.

Borehole - a hole that is made in the surface of the ground by drilling or boring.

Closure and Reclamation - the process and activities that facilitate the return of areas affected by the Project to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment, human activities, and the surrounding environment.

Drilling Fluid - any liquid mixture of water, sediment, drilling muds, chemical additives or other wastes that are pumped down hole while drilling and are specifically related to drilling activity.

Drilling Waste - all materials or chemicals, solid or liquid, associated with drilling, including drill cuttings and Drilling Fluids.

Durable Land - land that is able to withstand repeated use, such as gravel or sand with minimal vegetative cover.

Engagement Plan - a document, developed in accordance with the Board's *Engagement and Consultation Policy* and the *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits*, that clearly describes how, when, and which engagement activities will occur with an affected party during the life of the project.

Flowing Artesian Well - a well in which water:

a) Naturally rises above the ground surface or the top of any casing; and
b) Flows naturally, either intermittently or continuously.

Fuel Storage Container - a container for the storage of petroleum or allied petroleum products with a capacity of less than 230 litres.

Fuel Storage Tank - a closed container for the storage of petroleum or allied petroleum products with a capacity of more than 230 litres.

Greywater - all liquid wastes from showers, baths, sinks, kitchens, and domestic washing facilities but not including toilet wastes.

Habitat - the area or type of site where a species or an individual of a species of wildlife naturally occurs or on which it depends, directly or indirectly, to carry out its life processes.

Inspector - an Inspector designated by the Minister under the Act.

Minister - the Minister of Indian Affairs and Northern Development Canada or the Minister of the Government of the Northwest Territories – Department of Lands, as the case may be.

Ordinary High Water Mark - the usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the "active channel/bank-full level" which is often the 1:2 year flood flow return level. In inland lakes, wetlands, or marine environments, it refers to those parts of the Watercourse bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs, this refers to normal high operating levels (full supply level).

Permittee - the holder of this permit.

Permafrost - ground (soil or rock) that remains at or below 0^{o}C for at least two consecutive years.

Professional Engineer - a person registered with the Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists to practice as a Professional Engineer in the Northwest Territories as per the territorial *Engineering and Geoscience Professions Act,* and whose professional field of specialization is appropriate to address the components of the Project at hand.

Progressive Reclamation - Closure and Reclamation activities conducted during the operating phase of the project.

Secondary Containment - containment that prevents liquids that leak from Fuel Storage Tanks or containers from reaching outside the containment area and includes double-walled Tanks, piping, liners, and impermeable barriers.

Spill Contingency Plan - a document, developed in accordance with Aboriginal Affairs and Northern Development Canada's *Guidelines for Spill Contingency Planning* that describes the set of procedures to be implemented to minimize the effects of a spill.

Safety Data Sheet - a technical document, typically written by the manufacturer or supplier of a chemical, that provides information about the hazards associated with the product, advice about safe handling and storage, and emergency response procedures.

Sump - a human-made pit or natural depression in the earth's surface used for the purpose of depositing Waste that does not contain Toxic Material, such as non-toxic Drilling Waste or Sewage, therein.

Toxic Material - any substance that enters or may enter the environment in a quantity or concentration or under conditions such that it:

a) Has or may have an immediate or long-term harmful effect on the environment or its biological diversity;
b) Constitutes or may constitute a danger to the environment on which life depends; or
c) Constitutes or may constitute a danger in Canada to human life or health.

Waste - any garbage, debris, chemical, or Toxic Material to be used, stored, disposed of, or handled on land, and also as defined in section 51 of the Act**.**

Waste Management Plan - a document, developed in accordance with the Board's Guidelines for Developing a Waste Management Plan, that describes the methods of Waste management from Waste generation to final disposal.

Watercourse - a natural body of flowing or standing water or an area occupied by water during part of the year, and includes streams, springs, swamps and gulches but does not include groundwater.

Part C: Conditions Applying to All Activities (headings correspond to subsection 26(1) of the Mackenzie Valley Land Use Regulations)

26(1)(*a*) Location and Area

1.	The Permittee shall only conduct this land-use operation on lands designated in the application.	**LOCATION OF ACTIVITIES**
2.	The Permittee shall locate all camps on Durable Land or previously cleared areas, and a minimum of 100 metres from the Ordinary High Water Mark.	**CAMP SETBACK**
3.	The Permittee shall not locate any Sump within 100 metres of the Ordinary High Water Mark of any Watercourse, unless otherwise authorized in writing by an Inspector.	**SUMP SETBACK**

26(1)(*b*) Time

4.	At least 48 hours prior to the initial commencement of the land-use operation, the Permittee's Field Supervisor shall contact an Inspector at (867) 777-8900.	**INITIAL NOTIFICATION – CONTACT INSPECTOR**
5.	At least 48 hours prior to returning to the worksite following a seasonal Shut Down Period, the Permittee's Field Supervisor shall notify the Board and contact an Inspector at (867) 777-8900	**SEASONAL NOTIFICATION – CONTACT INSPECTOR**
6.	At least 48 hours prior to commencement of the land-use operation, the Permittee shall provide the following information, in writing, to the Board and an Inspector: a) the name(s) of the person(s) in charge of the field operation; b) alternates; and c) all methods for contacting the above person(s).	**IDENTIFY AGENT**
7.	At least ten days prior to any seasonal shutdowns the Permittee shall advise an Inspector of: a) the plan for removal or storage of equipment and materials; and b) when cleanup and Progressive Reclamation of the land used will be completed.	**REPORTS BEFORE SEASONAL REMOVAL**
8.	At least ten days prior to the completion of the land-use operation, the Permittee shall advise an Inspector of: a) the plan for removal or storage of equipment and materials; b) when final cleanup and reclamation of the land used will be completed; and c) when the Final Plan will be submitted.	**REPORTS BEFORE FINAL REMOVAL**

26(1)(*c*) Type and Size of Equipment

9. The Permittee shall only use equipment of a similar type, size, and number to that listed in the complete application. **USE APPROVED EQUIPMENT**

26(1)(*d*) Methods and Techniques

10. The Permittee shall not erect camps or store material, other than that required for immediate use, on the ice surface of a Watercourse. **STORAGE ON ICE**

26(1)(*e*) Type, Location, Capacity, and Operation of All Facilities

11. The Permittee shall ensure that the land use area is kept clean at all times. **CLEAN WORK AREA**

26(1)(*f*) Control or Prevention of Ponding of Water, Flooding, Erosion, Slides, and Subsidence of Land

12. The Permittee shall insulate the ground surface beneath all structures associated with this land-use operation to prevent: **PERMAFROST PROTECTION**

    a) the melting of Permafrost; and
    b) the ground settling and/or eroding.

13. The land-use operation shall not cause obstruction to any natural drainage. **NATURAL DRAINAGE**

14. Within 90 days of the issuance of this permit, the Permittee shall submit to the Board for approval a Sediment and Erosion Control Plan. **SEDIMENT AND EROSION PLAN**

15. The Permittee shall install and maintain suitable erosion control structures as the land-use operation progresses. **PROGRESSIVE EROSION CONTROL**

16. The Permittee shall apply appropriate mitigation at the first sign of erosion. **REPAIR EROSION**

17. The Permittee shall, where flowing water from a Borehole is encountered: **FLOWING ARTESIAN WELL**

    a) plug the Borehole in such a manner as to permanently prevent any further outflow of water; and
    b) immediately report the occurrence to the Board and an Inspector.

18. The Permittee shall prepare the site in such a manner as to prevent rutting or gouging of the ground surface. **PREVENTION OF RUTTING**

19. The Permittee shall suspend overland travel of equipment or vehicles at the first sign of rutting or gouging. **SUSPEND OVERLAND TRAVEL**

20. The Permittee shall not move any equipment or vehicles unless the ground surface is in a state capable of fully supporting the equipment or vehicles without rutting or gouging. **VEHICLE MOVEMENT FREEZE-UP**

21. The Permittee shall slope the sides of Waste material piles, excavations, and embankments — except in solid rock — to a minimum ratio of 2:1 vertical, unless otherwise authorized in writing by an Inspector. **EXCAVATION AND EMBANKMENTS**

22. The Permittee shall not remove vegetation or operate heavy equipment within 100 metres of the Ordinary High Water Mark of any Watercourse, except as described in the application. **EQUIPMENT: WATERCOURSE BUFFER**

26(1)(*g*) Use, Storage, Handling, and Ultimate Disposal of Any Chemical or Toxic Material

23. At least seven days prior to the use of any chemicals that were not identified in the complete application, the Safety Data Sheets must be provided to the Board and an Inspector. **CHEMICALS**

24. When drilling within 100 metres of the Ordinary High Water Mark of any Watercourse, and when drilling on ice, the Permittee shall contain all drill water and Drilling Waste in a closed circuit system for reuse, off-site disposal, or deposit into a land-based Sump or natural depression. **DRILLING NEAR WATER OR ON ICE**

25. The Permittee may deposit Drilling Waste that does not contain Toxic Material in a Sump or natural depression. Any Sumps or natural depressions used to deposit Drilling Waste must be located at least 100 metres from the Ordinary High Water Mark of any Watercourse, unless otherwise authorized in writing by an Inspector. **DRILLING WASTE**

26. The Permittee shall remove all Drilling Waste containing Toxic Material to an approved disposal facility. **DRILLING WASTE DISPOSAL**

27. The Permittee shall not allow any Drilling Waste to spread to the surrounding lands or Watercourses. **DRILLING WASTE CONTAINMENT**

28. Prior to the expiry date of this Permit or the end of the land-use operation whichever comes first, the Permittee shall backfill and restore all Sumps, unless otherwise authorized in writing by an Inspector. **RECLAIM NON-OIL AND GAS SUMPS**

29. The Permittee shall dispose of all Toxic Material as described in the approved Waste Management Plan. **WASTE CHEMICAL DISPOSAL**

30. The Permittee shall dispose of all combustible Waste petroleum products by removal to an approved disposal facility. **WASTE PETROLEUM DISPOSAL**

31. A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, an Emergency Frac-out Response Plan. The Permittee shall not commence Project activities prior to Board approval of the Plan. **EMERGENCY FRAC-OUT RESPONSE PLAN**

26(1)(*h*) Wildlife and Fish Habitat

32.	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a Wildlife Management and Mitigation Plan. The Permittee shall not commence Project activities prior to Board approval of the Plan.	**WILDLIFE MANAGEMENT AND MITIGATION PLAN**
33.	The Permittee shall take all reasonable measures to prevent damage to wildlife and fish Habitat during this land-use operation.	**HABITAT DAMAGE**

26(1)(*i*) Storage, Handling, and Disposal of Refuse or Sewage

34.	Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board, for approval, a revised Waste Management Plan.	**REVISED WASTE MANAGEMENT PLAN**
35.	The Permittee shall comply with the **Waste Management Plan**, once approved, and shall annually review the plan and make any necessary revisions to reflect changes in operations, technology, chemicals, or fuels, or as directed by the Board. Revisions to the plan shall be submitted to the Board for approval.	**WASTE MANAGEMENT**
36.	The Permittee shall keep all garbage and debris in a secure container until disposal.	**GARBAGE CONTAINER**
37.	The Permittee shall dispose of all Sewage and Greywater as described in the approved Waste Management Plan.	**SEWAGE DISPOSAL - PLAN**

26(1)(*j*) Protection of Historical, Archaeological, and Burial Sites

38.	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a Heritage Resource Protection Plan. The Permittee shall not commence Project activities prior to Board approval of the Plan.	**HERITAGE RESOURCE PROTECTION PLAN**
39.	The Permittee shall not operate any vehicle or equipment within 30 metres of a known or suspected historical or archaeological site or burial ground.	**ARCHAEOLOGICAL BUFFER**
40.	The Permittee shall not knowingly remove, disturb, or displace any archaeological specimen or site.	**SITE DISTURBANCE**
41.	The Permittee shall, where a suspected archaeological or historical site, or burial ground is discovered: a) immediately suspend operations on the site; and b) notify the Board at (867) 777-4954 or an Inspector at (867) 8900, and the Prince of Wales Northern Heritage Centre at 767-9347 ext. 71255 or ext. 71251.	**SITE DISCOVERY AND NOTIFICATION**

26(1)(*k*) Objects and Places of Recreational, Scenic, and Ecological Value

This Section left intentionally blank

26(1)(*l*) Security Deposit

42. Prior to the commencement of the land-use operation, the Permittee shall deposit with the Minister a security deposit in the amount of $98,811 — **SECURITY DEPOSIT**

43. All costs to remediate the area under this Permit are the responsibility of the Permittee. — **RESPONSIBILITY FOR REMEDIATION COSTS**

26(1)(*m*) Fuel Storage

44. The Permittee shall: — **REPAIR LEAKS**

a) examine all Fuel Storage Containers and Tank for leaks; and
b) repair all leaks immediately.

45. The Permittee shall place Fuel Storage Containers and or Tanks a minimum of 100 metres from the Ordinary High Water Mark of any Watercourse, unless otherwise authorized in writing by an Inspector. — **FUEL STORAGE SETBACK**

46. The Permittee shall ensure that all fuel caches have adequate Secondary Containment. — **FUEL CACHE SECONDARY CONTAINMENT**

47. The Permittee shall set up all refueling points with Secondary Containment. — **SECONDARY CONTAINMENT - REFUELING**

48. The Permittee shall not allow petroleum products to spread to surrounding lands or Watercourses. — **FUEL CONTAINMENT**

49. The Permittee shall locate mobile fuel facilities on land when the facilities are stationary for more than 12 hours. — **FUEL ON LAND**

50. The Permittee shall mark all Fuel Storage Containers and Tanks with the Permittee's name. — **MARK CONTAINERS AND TANKS**

51. Within ten days of the establishment of any fuel cache, the Permittee shall report the location and quantity of the cache in writing to the Board and an Inspector. — **REPORT FUEL LOCATION**

52. The Permittee shall seal all outlets of Fuel Storage Containers and store the containers on their sides with the outlets located at 3 and 9 o'clock, except for containers currently in use. — **SEAL OUTLET**

53. The Permittee shall adhere to the **Spill Contingency Plan**, once approved, and shall annually review the plan and make any necessary revisions to reflect changes in operations, technology, chemicals, or fuels, or as directed by the Board. Revisions to the plan shall be submitted to the Board for approval. — **SPILL CONTINGENCY PLAN**

54. Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board, for approval, a revised **Spill Contingency Plan**. **REVISED SPILLCONTINGENCY PLAN**

55. Prior to commencement of the land-use operation the Permittee shall ensure that spill-response equipment is in place to respond to any potential spills. **SPILL RESPONSE**

56. All equipment that may be parked for two hours or more, shall have a haz-mat/drip tray under it or be sufficiently diapered. Leaky equipment shall be repaired immediately. **DRIP TRAYS**

57. The Permittee shall clean up all leaks, spills, and contaminated material immediately **CLEAN UP SPILLS**

58. During the period of this Permit, if a spill occurs or is foreseeable, the Permittee shall: **REPORT SPILLS**

a) implement the approved Spill Contingency Plan;
b) report it immediately using the NU-NT Spill Report Form by one of the following methods:
   - Telephone: (867) 920-8130
   - Fax: (867) 873-6924
   - E-mail: spills@gov.nt.ca
   - Online: Spill Reporting and Tracking Database
c) within 24 hours, notify the Board and an Inspector; and
d) within 30 days of initially reporting the incident, submit a detailed report to the Board and an Inspector, including descriptions of causes, response actions, and any changes to procedures to prevent similar occurrences in the future. Any updates to this report shall be provided to the Board and an Inspector in writing as changes occur.

26(1)(*n*) Methods and Techniques for Debris and Brush Disposal

59. The Permittee shall progressively dispose of all brush and trees; all disposal shall be completed prior to the end of this landuse operation **BRUSH DISPOSAL/ TIME**

60. The Permittee shall not clear areas larger than identified in the complete application. **MINIMIZE AREA CLEARED**

26(1)(*o*) Restoration of the Lands

61. Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board for approval a Closure and Reclamation Plan. **INTERIM CLOSURE AND RECLAMATION PLAN**

62. Prior to the end of the land-use operation, the Permittee shall complete all cleanup and restoration of the lands used. **FINAL CLEANUP AND RESTORATION**

63. Prior to the end of the land-use operation, the Permittee shall prepare the site in such a manner as to facilitate natural revegetation. **NATURAL VEGETATIO**N

64. The Permittee shall carry out Progressive Reclamation of disturbed areas as soon as it is practical to do so. **PROGRESSIVE RECLAMATION**

26(1)(*p*) Display of Permits and Permit Numbers

65. The Permittee shall display a copy of this Permit in each campsite established to carry out this land-use operation. **DISPLAY PERMIT**

66. The Permittee shall keep a copy of this Permit on hand at all times during this land-use operation. **COPY OF PERMIT**

26(1)(*q*) Biological and Physical Protection of the Land

67. If nesting areas are encountered during the course of operations, the Permittee shall minimize all activity so as to not disturb them. **MIGRATORY BIRD NEST DISTURBANCE**

68. If any plan is not approved by the Board, the Permittee shall revise the plan according to the Board's direction and re-submit it to the Board for approval. **RESUBMIT PLAN**

69. The Permittee shall comply with the **Engagement Plan**, once approved, and shall annually review the plan and make any necessary revisions to reflect changes in operations or as directed by the Board. Revisions to the plan shall be submitted to the Board for approval. **ENGAGEMENT PLAN**

70. Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board, for approval, a revised **Engagement Plan**. **REVISED ENGAGEMENT PLAN**

71. A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a **Construction Environmental Management Plan**. The Permittee shall not commence Project activities prior to Board approval of the Plan. **CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN**

72. A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a **Permafrost Protection Plan**. The Permittee shall not commence Project activities prior to Board approval of the Plan. **PERMAFROST PROTECTION PLAN**

73. A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, an **Inspection and Maintenance Plan**. The Permittee shall not commence Project activities prior to Board approval of the Plan. **INSPECTION AND MAINTENACE PLAN**

74. All revised plans submitted to the Board shall include a brief summary of the changes made to the plan. **SUMMARY OF CHANGES**

Annex A: Table of Items Requiring Submission

Attached to **Land Use Permit MV2019X0027**

Supplemental information to be submitted by Permittee as required through Land Use Permit conditions.

Part C	Item	Date
Condition 14	Sediment and Erosion Plan	Within 90 days of the issuance of this permit, the Permittee shall submit to the Board for approval a Sediment and Erosion Control Plan.
Condition 31	Emergency Frac-Out Response Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, an Emergency Frac-out Response Plan. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 32	Wildlife Management Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a Wildlife Management and Mitigation Plan. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 34	Revised Waste Management Plan	Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board, for approval, a revised Waste Management Plan.
Condition 38	Heritage Resource Protection Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a Heritage Resource Protection Plan. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 54	Revised Spill Contingency Plan	Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board, for approval, a revised **Spill Contingency Plan**.

Condition 61	Interim Closure and Reclamation Plan	Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board for approval a Closure and Reclamation Plan.
Condition 70	Revised Engagement Plan	Within 90 days of the issuance of this Permit, the Permittee shall submit to the Board, for approval, a revised **Engagement Plan**.
Condition 71	Construction Environmental Management Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a **Construction Environmental Management Plan**. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 72	Permafrost Protection Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, a **Permafrost Protection Plan**. The Permittee shall not commence Project activities prior to Board approval of the Plan.
Condition 73	Inspection and Maintenance Plan	A minimum of 90 days prior to the commencement of this land-use operation, the Permittee shall submit to the Board, for approval, an **Inspection and Maintenance Plan**. The Permittee shall not commence Project activities prior to Board approval of the Plan.

Annex B: Revisions to Land Use Permit MV2019X0027

Attached to Land Use Permit MV2019X0027

List of changes that have been made to the Land Use Permit since issuance.

Date	Location of Change	What has changed
-	-	-

Mackenzie Valley Land and Water Board
7th Floor - 4922 48th Street
P.O. Box 2130
YELLOWKNIFE NT X1A 2P6
Phone (867) 669-0506
FAX (867) 873-6610

Reasons for Decision

Issued pursuant to paragraph 40(2)(c) of the Mackenzie Valley Land Use Regulations (MVLUR) and Sections 72.25 and 121 of the *Mackenzie Valley Resource Management Act* (MVRMA) and sections 36 of the *Waters Act*

Water Licence and Land Use Permit Applications	
Preliminary Screener	MVLWB
File Number	MV2019X0027 and MV2019L8-0013
Company	Government of Yukon – Department of Highways and Public Works
Project	Miscellaneous (Dempster Fiber Project)
Date of Decision	August 20, 2020

These Reasons for Decision set out the Mackenzie Valley Land and Water Board's (the MVLWB/Board) regulatory process and decisions on Applications made by Government of Yukon – Department of Highways and Public Works (GY-DHPW) to the Board on October 9, 2019 for Water Licence (Licence) MV2019L8-0013 and Land Use Permit (Permit) MV2019X0018 for the Dempster Fiber Project.

1.0 Summary of Applications

On October 9, 2019 GY-DHPW submitted Applications for a new Licence MV2019L8-0013[1] and new Permit MV2019X0027[2] for its proposed Dempster Fibre Project (Project). The Project includes construction of an approximately 800-km fibre optic line from Dawson City, Yukon, to Inuvik, Northwest Territories. For the purposes of the Land Use Permit and Water Licence application, the project is defined as the section of the Dempster Fibre Project located in the Northwest Territories. The fibre optic cable will enter the Northwest Territories at the Yukon/Northwest Territories border and then travel approximately 271 km north, within the Dempster Highway right-of way to Inuvik. The project is located entirely within the Gwich'in Settlement Area (GSA), passing through the communities of Fort McPherson and Tsiigehtchic. The project will connect to an existing terminal facility in Inuvik and to existing buildings in communities along the route to provide service to those communities.

On October 16, 2019 the Applications were deemed complete and sent for review and comment, on October 23, 2019 the Board received a request to extend the review and comment period. The extension was granted to all reviewing bodies. Comment on the Application were submitted November 14, 2019.

[1] See Water Licence MV2019L8-0013 Application submitted to the MVLWB on October 9, 2019.
[2] See Land Use Permit MV2019X0027 Application submitted to the MVLWB on October 9, 2019.

On November 21, 2019, the Board met and determined that additional studies were needed to consider the application, the specific information that was needed were the responses to the comments from the Proponent. November 21, 2019 was also the end of the 42-day timeline. Also, on November 21, 2019, the responses were received from the Proponent.

On December 2, 2019, an Information Request was issued to the Proponent to address comments and recommendations as well as provide additional information to assist in the drafting of the permit and licence. On March 16, 2020 responses to the Information Request were received.

On March 23, 2020, the responses to the Information Request were distributed for review and comment with recommendations from reviewers due on April 23, 2020. By May 7, 2020 responses to the reviewer comments and recommendations were submitted to the Board by the Proponent.

2.0 Decision

In making its decision and preparing these Reasons for Decision, the Board has reviewed and considered:

1. The evidence and submissions from GY -DHPW received by the Board;
2. The written comments and submissions from parties received by the Board; and
3. The Staff Report prepared for the Board.

Having due regard to the facts, circumstances, and the merits of the submissions made to it, and to the purpose, scope, and intent of the MVRMA and the *Waters Act*, the Board has determined that Permit MV2019X0027 and Licence MV2019L8-0013 should be issued subject to the scope, definitions, conditions, and term contained therein. The Board's determinations and reasons for this decision are set out below.

3.0 General Principles for Land Use Permit MV2019X0027 and Water Licence MV2019L8-0013

In conducting the review process for the Permit and Licence applications, the Board has ensured that all applicable legislative and procedural requirements have been satisfied, as required by section 62 of the MVRMA and as outlined below.

- Notice of the Permit and Licence Applications was given in accordance with sections 63 and 64 of the MVRMA. The Board is satisfied that a reasonable period of notice was given to communities and First Nations so that they could provide comments to the Board.
- The use of land proposed by the Applicant is of a nature contemplated by the MVRMA.
- It is the opinion of the Board that the terms and conditions attached to LUP MV2019X0027 and WL MV2019L8-013, pursuant to the MVRMA, MVLUR, and the Waters Act, will prevent or mitigate any potential significant environmental impacts which might result from the Dempster Fibre Project. Specific conditions and how they relate to issues raised during the review of the Applications are discussed below.
- The scopes, definitions, terms, and conditions set forth in the LUP and WL have been developed in order to address the Board's statutory responsibilities and the concerns that arose during the regulatory process. These Reasons for Decision focus on the major issues and those that (1) were the subject of substantive argument submitted by one or more parties, or (2) resulted in the use of conditions that differ from those found on the MVLWB Standard Land Use Permit Conditions Template (Standard Template).

4.0 Determinations Pertaining to Water Licence MV2019L8-0013

4.1 Requirements of Section 26 of the Waters Act

4.1.1 Existing Licensees

After reviewing the submissions filed on the Public Registry the Board is satisfied that, with respect to paragraph 26(5)(a) of the Waters Act, the granting of this Licence to YG-DHPW will not adversely affect, in a significant way, any existing Licensee, provided that compliance with the conditions of the WL are adhered to.

4.1.2 Existing Water Users

Paragraph 26(5)(b) of the Waters Act prohibits the issuance of a Licence unless the Board is satisfied that appropriate compensation has been or will be paid by the Applicant to people who were, at the time when the Applicant filed its Applications with the Board, members of the classes of water users depositors, owners, occupiers, or holders listed under paragraph 26(5)(b), who would be adversely affected by the use of waters, or deposit of waste proposed by the Applicant.

The Board received no claims for compensation either during the prescribed period or afterwards. Provided that compliance with the Licence conditions is achieved, the Board does not believe that any users or persons listed in paragraph 26(5)(b) of the Waters Act will be adversely affected by the use of Waters or the deposit of Waste proposed by the Applicant.

4.1.3 Water Quality Standards

With regards to subparagraph 26(5)(c)(i) of the Waters Act, the Board is satisfied that compliance with the Licence conditions will ensure that waste produced by the Project will be collected and disposed of in a manner which will maintain water quality consistent with applicable standards.

4.1.4 Effluent Quality Standards

Not applicable: Effluent discharge is not considered by the application.

4.1.5 Financial Responsibility of the Applicant

The Board must satisfy itself of the financial responsibility of the Applicant under paragraph 26(5)(d) of the Waters Act before it can issue the Licence. In this case, the Board is satisfied that the GY-DHPW is capable of meeting the obligations set out in the MVRMA, Waters Act, and the Licence.

4.1.6 Requirements of Subsection 27(2) of the Waters Act

It is the opinion of the Board that compliance with the Licence terms and conditions it has imposed on GY – DHPW will ensure that any potential adverse effects on other water users, which might arise as a result of the issuance of the Licence, will be minimized.

4.2 Water Licence MV2019L8-0013 Terms and Conditions

The conditions in this Licence MV2019L8-0013 have been drafted with the transboundary nature of the project in mind and to assist in the administrative requirements and enforcement of the Project as a whole.

4.2.1 Water Licence Term

GY-DHPW has applied for a permit term of five years and a licence term of seven years. Subsection 26(2) of the Waters Act allows for a Licence term of not more than 25 years or the duration of the undertaking. After reviewing the submissions made during this regulatory process, and taking into consideration the closely linked Permitthe Board decided to continue the practice of setting the Licence term to coincide with that of the Permit, and therefore set the term of the Licence for 7 years from the date of issuance which takes into account the five-year term of the Permit, plus the possibility of a two-year extension of the Permit's term.

4.2.2 Scope and Definitions

Part A contains the scope of allowable activities, and definitions of terms used throughout the Licence.

Scope

The scope of the Licence ensures the Licensee is entitled to conduct activities which have been applied for and screened by the Board. In setting out the scope of the Licence, the Board endeavoured to provide enough detail to identify and describe the authorized activities, without be unduly restrictive or prescriptive, and to allow for project flexibility throughout the life of the Permit.

Part A, conditions 1(b) through 1(e) are consistent with previous Licences issued by the Board. These conditions ensure that the scope of the authorization includes all water uses and deposits of waste associated with the Project, reflect and comply with all applicable legislation for the life of the authorization, and consider and incorporate scientific and Traditional Knowledge where available in the Licensee's effort to protect the environment.

Definitions

The Board defined terms in the Licence to ensure a common understanding of conditions, to avoid future differences in interpretation, and to use wording similar to that found in previously issued Licences and/or the MVLWB Draft Standard Water Licence Conditions Template.

4.2.3 Part B: General Conditions and Schedule 1

Part B and Schedule 1 of the Licence contain general administrative conditions regarding compliance and conformity with the *MVRMA* and *Waters Act* and is consistent with standard conditions found in previous Licences issued by the Board.

Part B, condition 5, clarifies that all references to policies, guidelines, codes of practice, statutes, regulations or other authorities shall be read as a reference to the most recent versions, unless otherwise denoted. This standard practice allows for flexibility in Licence conditions when documents are updated during the life of the Licence.

This section addresses conformity and compliance with submissions to the Board. Annual review and submission of major updates or changes to management plans are required by Part B, condition 9, for Board approval. Such revisions must be approved by the Board prior to the implementation of activities not identified in existing, approved plans. This condition ensures that all applicable plans are regularly

reviewed and updated so they reflect changes in technology and/or changes and phases of the project throughout the life of the authorization.

Part B, item 13 introduces the Schedules which are annexed to and form part of the Licence. Changes to these Licence components are largely administrative matters and are within the Board's authority.

Part B, condition 18 and Schedule 1 condition 1: Annual Water Licence Report

The requirements for the Annual Water Licence Report are outlined in Part B, condition 18, and Schedule 1, condition 1. The purpose of the Annual Water Licence Report is to provide the Board and all stakeholders the opportunity to be annually updated on project components and activities, and to provide a platform for stakeholders to submit comments, observations, feedback, and questions as necessary. The requirements are intended to provide clarity and summarize information already captured through existing submissions; they are not meant to be onerous. The Board organized these requirements to coincide with the layout of the Licence and to be consistent with recently issued licences.

Part B, conditions 19 and 20: Engagement

The Board assesses engagement adequacy of applications through the Board's *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits*, and the Board's *Engagement and Consultation Policy*. The Board notes that GY – DHPW's pre-engagement for the Applications was determined to be in accordance with the Guidelines and Policy. GY – DHPW included an Engagement Plan and Log Version 1 in the Applications.

During the public review, GNWT commented that neither the Engagement Record nor Plan contained information pertaining to engagement with the Hamlet of Fort McPherson (GNWT #35)[3].

The Engagement Plan cannot be approved at this time and should be revised and re-submitted wthin 90 days following the effective date of this Licence to reflect updates as agreed to during the public review, to reflect the scope of the proposed activities, to meet the applicable guidelines, and to include the following:

- Engagement Record and Plan for the Hamlet of Fort McPherson

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part B, condition 21: Inspection and Maintenance Plan

In the Application, GY – DHPW committed to developing an Inspection and Maintenance Plan, for the purpose of delineating inspection and maintenance protocols and schedules for Project activities and equipment. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval (GNWT #11).

[3] See MVLWB public registry for MV2019X0027 MV2019L8-0013 Reviewer Comment Summary Table

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part B, condition 22: Wildlife Management and Mitigation Plan

In the Application, GY – DHPW committed to developing a Wildlife Management and Mitigation Plan for the Project, and during the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval (GNWT #11).

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part B, condition 23: Heritage Resource Protection Plan

In the Application, GY – DHPW committed to developing a Heritage Resource Protection Plan for the Project, which will outline best practices and appropriate protocols in the event that heritage resources are discovered as a result of Project activities. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval (GNWT #11).

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part B, condition 24: Permafrost Protection Plan

In the Application, GY – DHPW committed to developing a Permafrost Protection Plan for the Project which will describe field level construction protocols and appropriate mitigation measures for the protection of permafrost. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval (GNWT #11).

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

4.2.4 Part C: Conditions Applying to Security Requirements and Schedule 2

The Board is authorized to require the Licensee to provide security to the Minister by subsection 35(1) of the *Waters Act*. Subsection 35(2) of the *Waters Act* specifies how the security may be applied.

Part C of the Licence, by reference to Schedule 2, sets the level of security to be maintained by the Licensee and set out requirements related to posting and updating security. As in other licences, the Board may request a security update from the proponent at any time, and may adjust the security amount at any time, based on available information. Specifically, Part C, conditions 3 and 4 stipulate that the Board can revise the security deposit and that the Licensee will post the revised deposit within 90 days following the Board's decision. This condition pertains to both increases and reductions in security. The conditions in this section are similar to those found in other Licences issued by the Board.

The Board has determined that the total security deposit amount for the Dempster Fibre Project shall be $ 190, 161.00 ($91,350.00 is required under the Licence and $98,811.00 is required under the Permit).

4.2.5 Part D: Conditions Applying to Water Use and Schedule 3

Part D and Schedule 3 of the Licence contains conditions related to water use for the Dempster Fibre Project. These are consistent with standard conditions found in previous Licences issued by the Board.

During the public review GNWT commented that GY-DHPW did not provide the requested annual volumes of water to be withdrawn from each proposed water source, nor did it include information on the sources' capacities (GNWT #10). Board staff determined that this additional information was required to complete a preliminary screening, and to set appropriate terms and conditions for the Water Licence.

On December 2, 2019 Staff issued an information request[4] to GY-DHPW requiring the applicant to provide:

a) a finalized list of water sources, including name and location of the water bodies, and the available capacity of each proposed water source;
b) anticipated daily withdrawal volumes and duration of use, including a comparison of the total annual water volume requested for use against the total water volume available;
c) any available bathymetric information, including maximum depths and available water under ice,
d) any available information on other water uses from the source(s), and;
e) shapefiles delineating the proposed project footprint, for the public registry

On December 23, 2019 GY-DHPW submitted a response to IR #1. The finalized list of water sources included both the sources submitted in the original application, as well as a list of the 58 water crossings that would be crossed by HDD during cable installation. The applicant explained that 'Where possible, water required for the s
mall HDD operations will be sourced directly from the feature being crossed." Daily and annual withdrawal volumes were provided for water sources. Bathymetric and flow data was provided for several of the water courses, however GYDHPW acknowledged that limited data was available. In absence of this data, GYDHPW committed to following Fisheries and Oceans' Canada (DFO) Protocol for Winter Withdrawal from Ice-Covered Waterbodies in the Northwest Territories and Nunavut (2010) a for water withdrawal, including restricting water withdrawals from streams to 10% of the instantaneous flow and to restricting summer lake withdrawals to 10% of the available volume.

Because the 58 water crossings had not been identified as withdrawal sources in the accepted application, the IR#1 response was circulated in order to provide reviewers an opportunity to submit comments on the additional water sources.

By April 23, 2020 comments and recommendations on the response to IR #1 were received from

- Government of the northwest Territories – Department of Environment and Natural Resources (ENR)
- Gwich'in Tribal Council – Department of Cultural Heritage
- Gwich'in Renewable Resources Board

During the Public GNWT recommended that a weekly reporting requirement be included in the Water Licence, in order to capture instantaneous flow rates and water withdrawal rates for each source. (GNWT IR #2). Condition D 8 has been added to reflect this recommendation.

[4] See MVLWB.com for IR #1

The maximum volume of water to be withdrawn from all identified sources shall not exceed 280 m^3 per day. The maximum daily withdraw limits for each source has been identified in Schedule 3 of the Water Licence.

4.2.6 Part E: Conditions Applying to Construction

Part E of the Licence contains conditions applying to construction activities for the Dempster Fibre Project and is consistent with standard conditions found in previous Licences issued by the Board. The Board can ensure that monitoring requirements are in place prior to, during, and post-construction.

Part E, condition 3: Construction Environmental Management Plan

In the Application, GY-DHPW committed to developing a Construction Environmental Management Plan for the Project, which identifies field-level mitigation and best management practices. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

4.2.7 Part F: Conditions Applying to Waste and Water Management

Part F of the Licence contains conditions applying to waste and water management activities for the Dempster Fiber Project and is consistent with standard conditions included in previous Licences issued by the Board. Site-specific conditions were developed where necessary.

Part F, condition 1 sets out the objectives for the management of water and waste for the Dempster Fiber Project. This condition is consistent with the principles of objective-based regulation: it essentially defines the objectives of any required management actions, plans or reports. This condition is standard for Licences issued by the Board and reminds the Licensee of the need to manage water and waste with the goal of minimizing impacts on the receiving environment.

Part F, condition 2: Waste Management Plan

The Boards' authority to regulate the management of waste is described in subsection 26(1) of the MVLUR and sections 11 and 27 of the *Waters Act*. As such, the Board developed, and approved, *Guidelines for Developing a Waste Management Plan*.[5] These guidelines can be applied to a wide range of projects and is intended to ensure that all waste management activities specific to each project are carried out in a way that is consistent with best practices and applicable guidelines to minimize waste released from the Project. Waste Management Plan is a defined term in the Licence, ensuring that the required Plan adheres to the Board's Guidelines.

Submittal and compliance with a Waste Management Plan is standard for Licences issued by the Board. GY-DHPW included a Waste Management Plan Version 1 in the Application

[5] See www.mvlwb.com → Resources → Policies and Guidelines: *MVLWB Guidelines for Developing a Waste Management Plan* (March 31, 2011).

Throughout the regulatory review process, comments and recommendations were received from GNWT regarding the Waste Management Plan and that further details should be included in the Plan. In response to concerns, GY – DHPW committed to updating the Waste Management Plan

The Waste Management Plan cannot be approved at this time and should be revised and re-submitted by DATE to reflect updates as agreed to during the public review, to reflect the scope of the proposed activities, to meet the applicable guidelines, and to include the following:

- The volume of waste that could be generated by the Project
- The size of waste storage containers that will be available on site
- Details regarding secondary containment for the temporary storage of hazardous waste.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part F, condition 5

Part F condition 5 requires written authorization from an Inspector prior to the deposit of Waste in the Inuvik Solid Waste Disposal Facilities. This is consistent with the Town's municipal water Licence G17L3-001.

Part F, condition 6

Part F, condition 6 specifically prohibits the deposit of waste into a watercourse, or within 100 meters of a watercourse, and was added in response to GNWT recommendation (GNWT #37)

Part F, condition 9 and 10 Sediment and Erosion Control Plan

Part F, condition 9 and 10 outline the requirements for a Sediment and Erosion Control Plan. This Plan is required by the Licence to ensure the Project is managed in accordance with the *Waters Act*, and the objectives listed in Part G, conditions 1 of the Licence.

In the Application, GY – DHPW committed to developing a Sediment and Erosion Control Plan for the Project, to address the potential for in-stream sedimentation that may occur during vegetation clearing, and during the installation and maintenance of the fibre optic line. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

4.2.8 Part G Conditions Applying to Contingency Planning

Part G of the Licence contains conditions related to spill contingency planning and reporting, reclamation of spills and unauthorized discharges, and emergency response for the Dempster Fibre Project. The purpose of this part is to ensure that GY – DHPW is fully prepared to respond to spills and unauthorized discharges. The planning and reporting requirements in this part ensure that GY – DHPW has identified the lines of authority and responsibility, has an action plan(s) for responses to spills and unauthorized discharges, and has established reliable reporting and communication procedures. This will ensure that

any spills or unauthorized discharges are effectively controlled and cleaned up, with the goal of preventing or limiting damage to the receiving environment. The conditions in Part G are consistent with standard conditions found in previous Licences issued by the Board.

Part G, condition 2 and 3: Spill Contingency Plan

Spill Contingency Plan is a defined term in the Licence, referencing the Indian and Northern Affairs Canada's *Guidelines for Spill Contingency Planning*.[6] GY – DHPW included Spill Contingency Plan version 1 in the Application.

During the Public Review, GNWT commented that additional information was required in the SCP (GNWT #39)

The Spill Contingency Plan cannot be approved at this time and should be revised and re-submitted within 90 days following the effective date of this Licence to reflect the guidelines, updates as agreed to during the public review, to reflect the scope of the proposed activities and to include the following:

- Regional Contact Information
- Safety Data Sheets

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

Part G, conditions 11 and 12 Emergency Frac-out response Plan

Part G, conditions 11 and 12 outline the requirements for an Emergency Frac-out response Plan. This Plan is required by the Licence to ensure the Project is managed in accordance with the *Waters Act*, and the objectives listed in Part G, conditions 1 of the Licence.

In the Application, GY – DHPW committed to developing a Emergency Frac-out Response Plan for the Project, to be implemented in the event of a release of drilling mud. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval. (GNWT #11)

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

4.2.9 Part H: Conditions Applying to Aquatic Effects Monitoring

The Board did not require conditions in this section to satisfy its mandate and did not receive any comments during the review of the draft Licence.

4.2.10 Part I: Conditions Applying to Closure and Reclamation

Part I of the Licence contains conditions applying to closure and reclamation of the Dempster Fibre Project.

The Licence conditions applying to the security deposit (Part C of the Licence) are closely related to this Part I; the security deposit is directly related to the activities described in the closure plans, and updates

[6] See www.mvlwb.com → Resources → Policies and Guidelines: *INAC Guidelines for Spill Contingency Planning*

to closure plans often result in updates to the security deposit. These conditions are consistent with other Licences issued by the Board.

Part I, condition 2 requires GY – DHPW to submit a Closure and Reclamation Plan a minimum of 90 days prior to the commencement of Project activities.

Part I, condition 2 requires GY – DHPW to submit a Final Closure and Reclamation Plan a minimum two years prior to the end of operations. This is a standard requirement of Licences issued by the Board and will ensure the Project is reclaimed in accordance with established guidelines and expectations of reviewers and the Board.

5.0 Determinations Pertaining to Land Use Permit MV2019X0027

5.1 Term of Permit

GY – DHPW has applied for a term of 5 years for the Permit, with a desire for an extension. Subsections 26(5) of the MVLUR allows for a Permit term of not more than five years. After reviewing the submissions made during this regulatory process, the Board has determined an appropriate term for this land use operation is 5 years.

5.2 Part A: Scope of Permit

The scope of the Permit ensures the Permittee is entitled to conduct activities which have been applied for and screened by the Board. In setting out the scope of the Permit, the Board endeavoured to provide enough detail to identify and describe the authorized activities, without be unduly restrictive or prescriptive, and to allow for project flexibility throughout the life of the Permit.

5.3 Part B: Definitions

The Board defined items in the Permit to ensure a common understanding of conditions, to avoid future differences in interpretation, and to use wording similar to that found in previously issued Permits. For the most part, the definitions used wording from the Board's *Standard Land Use Permit Conditions Template* (Standard Template).

5.4 Part C: Conditions Applying to All Activities

The subheadings below correspond to the headings in the conditions section of the Permit, as outlined in section 26(1) of the MVLUR. Most conditions in the Permit are from the Board's Standard Template, and are not discussed in detail in these Reasons for Decision unless notable due to recommendations or concerns raised during the public review. Where applicable, the Board's reasons for including non-standard conditions are discussed.

<u>26(1)(a) Location and Area</u>

The conditions included in this section are all consistent with the Board's Standard Template.

<u>26(1)(b) Time</u>

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(c) Type and Size of Equipment

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(d) Methods and Techniques

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(e) Type, Location, Operation of All Facilities

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(f) Control or Prevention of Ponding of Water, Flooding, Erosion, Slides, and Subsidence of Land

The Board has included a condition regarding the submission of a Sediment and Erosion Control Plan which is not part of the Standard Template. The Sediment and Erosion Control Plan is intended to explain how erosion and sedimentation will be mitigated and controlled on the land, and to prevent eroded materials from migrating and settling in the water as a result of Project activities. This Plan is also required under Part F, Conditions 9 and 10 of the Licence, and the Board's reasons for including this Plan are described above in section 4.2.7. To ensure consistency between the authorizations regarding the submission of this Plan, the Board has chosen to require Board approval of this Plan prior to commencement of the land-use operation.

26(1)(g) Use, Storage, Handling, and Ultimate Disposal of Any Chemical or Toxic Material

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(h) Wildlife and Fish Habitat

In the Application, GY – DHPW committed to developing a Wildlife Management and Mitigation Plan for the Project which will detail mitigations to reduce or eliminate impacts to wildlife and wildlife habitat. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

26(1)(i) Storage, Handling, and Disposal of Refuse or Sewage;

A Waste Management Plan is a standard requirement for land use permits issued by the Board. This Plan is intended to ensure that all waste management activities are carried out in a way that is consistent with best practices and applicable guidelines to minimize waste released from the Project. This Plan is also required under Part F of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.7. The Board mirrored these conditions

to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

26(1)(j) Protection of Historical, Archaeological, and Burial Sites;

In the Application, GY – DHPW committed to developing a Heritage Resource Protection Plan for the Project, which will outline best practices and appropriate protocols in the event that heritage resources are discovered as a result of Project activities. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

26(1)(k) Objects and Places of Recreational, Scenic, and Ecological Value

The Board did not require conditions in this section to satisfy its mandate and did not receive any comments during the review of the draft Permit.

26(1)(l) Security Deposit

The Board is authorized to require the Permittee to provide security to the Minister by subsection 32(1) of the MVLUR. Subsection 32(2) of the MVRMA specifies how the security may be applied.

The Board has included a requirement for security in the Permit. The Board's reasons associated with this section are described above in Section 4.2.4, in conjunction with reasons for security required by the Licence. The security deposits required by these two instruments are discussed together since the estimates deal with the same project and are intimately linked. The conditions included in this section are consistent with the Board's Standard Template.

26(1)(m) Fuel Storage

A Spill Contingency Plan is a standard requirement for land use permits issued by the Board. This Plan is intended to ensure that an action plan(s) for responses to spills and Unauthorized Discharges, and has established to effectively control and clean up spills and Unauthorized Discharges, with the goal of preventing or limiting damage to the receiving environment. This Plan is also required under Part G of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.8. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

26(1)(n) Methods and Techniques for Debris and Brush Disposal

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(o) Restoration of the Lands

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(p) Display of Permits and Permit Numbers

The conditions included in this section are all consistent with the Board's Standard Template.

26(1)(q) Biological and Physical Protection of the Land

An Engagement Plan is a standard requirement for land use permits issued by the Board. This Plan is intended to ensure adequate and effective engagement with potentially affected parties has occurred prior to the submission of the Applications (in the form of the Engagement Log) and is planned for throughout the life of the Project. This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

In the Application, GY-DHPW committed to developing a Construction Environmental Management Plan for the Project, which identifies field-level mitigation and best management practices for construction activities. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

In the Application, GY – DHPW committed to developing a Permafrost Protection Plan for the Project which will describe field level construction protocols and appropriate mitigation measures for the protection of permafrost. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

In the Application, GY – DHPW committed to developing an Inspection and Maintenance Plan, for the purpose of delineating inspection and maintenance protocols and schedules for Project activities and

equipment. During the public review GNWT recommended that it – and all management plans that pertain to the use of land or Water and/or the deposit of waste – be submitted to the Board for approval.

Because it is for Board approval, the Plan will be publicly reviewed, allowing for incorporation of comments or concerns raised.

This Plan is also required under Part B of the Licence and the Board's reasons for including this Plan, and requiring revisions and re-submittals, are described above in Section 4.2.3. The Board mirrored these conditions to the extent possible with the Licence requirements to ensure one submission will satisfy conditions of both the Licence and Permit.

The remaining conditions included in this section are consistent with the Board's Standard Template.

6.0 Conclusion

Subject to the scopes, definitions, conditions, and terms set out in the Licence and Permit, and for the reasons expressed herein, the MVLWB is of the opinion that the land-use activities, water use, and waste disposal associated with the Dempster Fiber Project can be completed by Government of Yukon Department of Highways and Public works while providing for the conservation, development, and utilization of waters in a manner that will provide the optimum benefit for all Canadians and in particular for the residents of the Mackenzie Valley.

Water Licence MV2019L8-0013 and Land Use Permit MV2019X0027 contain provisions that the Board deems necessary to ensure and monitor compliance with the MVRMA, *Waters Act*, and the Regulations made thereunder, and to provide appropriate safeguards in respect of GY-DHPW use of the land and water affected by the Licence.

SIGNATURE

Mackenzie Valley Land and Water Board

Mavis Cli-Michaud, Chair	August 20, 2020 Date

Appendices and Annexes

Water Licence and Land Use Permit Applications	
Preliminary Screener	MVLWB
File Number	MV2019X0027 and MV2019L8-0013
Company	Government of Yukon – Department of Highways and Public Works
Project	Miscellaneous (Dempster Fiber Project), Inuvik NT

Appendix 1: Reclamation Security for the Dempster Fibre Project

1.0 Introduction

Government of Yukon and the Government of Northwest Territories determined the below security estimate, which was submitted to the Board by the GNWT during the public review period.

Summary of Costs			
CAPITAL COSTS	**COMPONENT NAME**	**LAND LIABILITY**	**WATER LIABILITY**
WELLS AND FACILITIES		$0	$0
BUILDINGS AND EQUIPMENT		$39,248	$31,960
CHEMICALS AND CONTAMINATED SOILD MANAGEMENT		$3,438	$2,503
SURFACE AND GROUNDWATER MANAGEMENT		-	$0
INTERIM CARE AND MAINTENANCE		-	$5,000
	SUBTOTAL: Capital Costs	**$42,686**	**$39,463**
	PERCENT OF SUBTOTAL	**53%**	**49%**
INDIRECT COSTS		**LAND LIABILITY**	**WATER LIABILITY**
MOBILIZATION/DEMOBILIZATIO N		$15,478	$14,310
POST-CLOSURE MONITORING AND MAINTENANCE		$26,988	$24,950
ENGINEERING	5%	$2,134	$1,973
PROJECT MANAGEMENT	5%	$2,134	$1,973

HEALTH AND SAFETY PLANS/MONITORING & QA/QC	1%	$427	$395
BONDING/INSURANCE	1%	$427	$395
CONTINGENCY	20%	$8,537	$7,893
MARKET PRICE FACTOR ADJUSTMENT	0%	$0	$0
	SUBTOTAL: Indirect Costs	**$56,126**	**$51,888**
	++42686		
TOTAL COSTS		**$98,811**	**$91,350**

The Board may consider the following items from subsection 32(2) of the MVLUR in setting the amount of security:

(a) The ability of the applicant or prospective assignee to pay the costs referred to in that subsection;
(b) The past performance of the applicant or prospective assignee in respect of any other permit;
(c) The prior posting of security by the applicant pursuant to other federal legislation in relation to the land-use operation; and
(d) The probability of environmental damage or the significance of any environmental damage.

The Board chose to set security at $190,161.00

Mackenzie Valley Land and Water Board
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APPENDIX B

YESAB Project Proposal

YESAB PROJECT PROPOSAL

Dempster Fibre Project

Government of Yukon, Department of Highways and Public Works, Property Management Division

Prepared for:

Government of Yukon
Department of Highways and Public Works
Property Management Division
9010 Quartz Rd.
Whitehorse, Yukon Y1A 2C6

Prepared by:

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T: 867.456.4865
F: 604.669.0430
hemmera.com

Project No. 103469-01

August 16, 2019

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LIST OF FIGURES (WITHIN TEXT)

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LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

List of Acronyms	
Acronym	**Definition**
CAPP	Canadian Association of Petroleum Producers
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRA	Commercial, recreational, aboriginal
DFO	Department of Fisheries and Oceans
DFP	Dempster Fibre Project
DO	Designated Office
FNNND	First Nation of the Na-Cho Nyäk Dun
GCLCA	Gwich'in Comprehensive Land Claim Agreement
GTC	Gwitch'in Tribal Council
HDD	Horizontal Direction Drilling
HDPE	High-density polyethylene
HROA	Heritage Resource Overview Assessment
LMU	Landscape Management Units
NYRLUP	North Yukon Regional Land Use Plan
NWTEL	NorthwesTel
OSP	Outside Plant
PCMB	Porcupine Caribou Management Board
PHFR	Preliminary Heritage Field Reconnaissance
POP	Point of Presence
ROW	Right-of-way
SARA	*Species at Risk Act*
TGC	Tetlit Gwich'in Council
TH	Tr'ondëk Hwëch'in
VC	Valued Components
VGFN	Vuntut Gwitchin First Nation
WKA	Wildlife Key Areas
YEC	Yukon Energy Corporation
YESAA	*Yukon Environmental and Socio-economic Assessment Act*
YESAB	Yukon Environmental and Socio-economic Assessment Board
YG-HPW	Yukon Government – Department of Highways and Public Works
YHSI	Yukon Historic Sites Inventory
YTA	Yukon Transboundary Agreement

1.0 INTRODUCTION

The Government of Yukon, Department of Highways and Public Works (the "Proponent") is proposing the Dempster Fibre Project (DFP) that will see the construction of an approximately 800-km fibre optic line from Dawson City, Yukon, to Inuvik, Northwest Territories. The line will connect Yukon to the existing Mackenzie Valley Fibre Link in Northwest Territories, creating a continuous network running through Yukon, Northwest Territories and Northern British Columbia. This new line will ensure Yukon, Northwest Territories, and other northern communities will have access to a secondary fibre network in the event of a service disruption. It will also benefit the northern communities that tie into the line through satellite by providing redundancy. The extent of the DFP is shown in **Figure 1-1**.

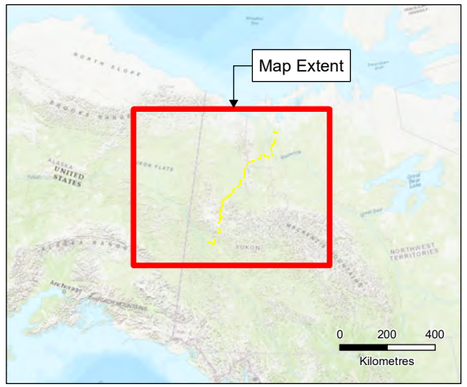
The Dempster Highway extends for 735 km from the Dempster Highway junction (40 km east of Dawson City) to Inuvik. Other than Inuvik, there are two communities adjacent to the Dempster Highway: Fort McPherson and Tsiigehtchic, both located in Northwest Territories. The highway is located within a legally defined 60 m-wide right-of-way (ROW). Both the Government of Yukon Department of Highways and Public Works and the Government of Northwest Territories Department of Infrastructure exercise authority over the operation and maintenance of the Dempster Highway in Yukon and the Northwest Territories, respectively.

For the purposes of this Project Proposal submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB), the "Project" is defined as the section of the DFP located in Yukon. The portion located in Northwest Territories is not considered as it is subject to the Land Use Permitting Process under the *Mackenzie Valley Resource Management Act*, for which a separate application is being submitted. The Application will be available on the Mackenzie Valley Land and Water Board Public Registry (https://mvlwb.com/registry).

INUVIK
AKLAVIK
NORTHWEST TERRITORIES
YUKON
FORT MCPHERSON
TSIIGEHTCHIC
EAGLE PLAINS
DAWSON CITY
MAYO

Dempster Fibre Project

Route of the Dempster Fibre Project along the Klondike and Dempster Highways from Dawson City, YT to Inuvik, NWT



Legend

- Community
- Dempster Fibre Project
- Territorial Boundary

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

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Highways and
Public Works

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1.1 Proponent Contact Information

The Project proponent for the assessment under the *Yukon Environmental and Socio-economic Assessment Act* (S.C. 2003, c. 7) (YESAA) is the Government of Yukon, Department of Highways and Public Works. The Proponent has retained Hemmera to prepare and submit the Project Proposal to the Designated Office of Dawson City.

The Proponent contact information is:

Darryl Froese, Project Manager
Highways and Public Works
9010 Quartz Rd.
Whitehorse, Yukon, Y1A 2C6
Email: Darryl.Froese@gov.yk.ca

The Agent contact information is:

Hemmera Envirochem Inc.
Kurt Neunherz, Project Manager
230 - 2237 2nd Avenue
Whitehorse, Y1A 0K7 Yukon
Email: kneunherz@hemmera.com

The preferred method of communication for the Proponent and Agent is via email. The Agent authorization has been submitted to the Designated Office as part of the Project Proposal documents.

1.2 Location

The Project is located primarily within the ROW of the Klondike and Dempster highways, commencing at Dawson City and traveling approximately 500 km northeast to the Northwest Territories border (**Figure 1-2**). The latitude and longitude coordinates for the commencement and termination of the proposed Project are:

Dawson City: Latitude: 64° 3′ 36″ N Longitude: 139° 25′ 55″ W

Yukon-Northwest Territories border: Latitude: 67° 2′ 50″ N Longitude: 136° 12′ 31″ W

The fibre line leaves the Klondike or Dempster ROW at the locations identified in **Table 1-1** and shown in **Figure 1-2**. Segments outside of Klondike or Dempster ROWs are included in the Project design to either make use of existing infrastructure, provide service to points such as communities or highway camps, or connect to microwave sites to amplify the signal.

Table 1-1 Locations where Fibre Line Leaves the Klondike or Dempster ROW

Location	Description
Dawson City	The Project will be located outside of the ROW from the Dawson City Central Office to the Klondike Highway. This segment will be within Dawson City municipal boundaries.
Hunker Creek	The Project will be strung on existing Yukon Energy poles from Hunker Creek to Henderson Corner
Klondike Highway	The Project may be strung on existing Yukon Energy poles that are adjacent to the Klondike Highway, but outside the ROW[1].
Eagle Plains Central Office	An existing access road connects the Central Office to the Dempster. The fibre line will be located entirely within the ROW of the Central Office's access road.
Ogilvie Highway Camp	An existing access road connects the camp to the Dempster. The Project will be located entirely within the ROW of the camp's access road.
Klondike Highway Camp	An existing access road connects the camp to the Dempster. The Project will be located entirely within the ROW of the camp's access road.
Tombstone Interpretive Center	An existing access road connects the interpretive center to the Dempster. The Project will be located entirely within the ROW of the center's access road.
North Klondike River Microwave Site	An existing access road connects the microwave site to the Dempster. The Project will be located entirely within the ROW of the site's access road.
North Fork Pass Microwave	An existing access road connects the microwave site to the Dempster. The Project will be located entirely within the ROW of the site's access road.
Scriver Creek Microwave	An existing access road connects the microwave site to the Dempster. The Project will be located entirely within the ROW of the site's access road.
Enjuu Choo Microwave	An existing access road connects the microwave site to the Dempster. The Project will be located entirely within the ROW of the site's access road.
North Vittrekwa Microwave	An existing access road connects the microwave site to the Dempster. The Project will be located entirely within the ROW of the site's access road.

[1] The Project may be installed in the Klondike Highway ROW, or on the existing poles adjacent to the ROW. This will be determined during final Project design, and through discussions with Tr'ondëk Hwëch'in

NORTH VITTREKWA MICROWAVE

NORTHWEST TERRITORIES
YUKON

EAGLE PLAINS

ENJUU CHOO MICROWAVE

SCRIVER CREEK MICROWAVE

OGILVIE HIGHWAY MAINTENANCE CAMP

NORTH FORK PASS MICROWAVE

TOMBSTONE INTERPRETIVE CENTRE

KLONDIKE HIGHWAY MAINTENANCE CAMP

NORTH KLONDIKE RIVER MICROWAVE

DAWSON CITY MICROWAVE

HUNKER CREEK

HENDERON CORNER

Dempster Fibre Project

Project Location

Legend

- Maintenance Camp
- Microwave Tower
- Other Feature
- Dempster Fibre Project - Yukon Portion
- Territorial Boundary

Notes

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2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

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Public Works

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1.2.1 Regional Land Use Plans and Park Management Plans

Portions of the Project are located within the North Yukon Land Use Planning Region and are subject to the North Yukon Regional Land Use Plan (NYRLUP). Landscape Management Units (LMU) that the Project will pass through are identified in **Table 1-2** and shown in **Figure 1-3**.

Table 1-2 Landscape Management Units Overlapping the Project

Landscape Management Unit Number	Landscape Management Unit Name	Integrated Management Area Zone
9	Eagle Plains	IMA – IV, Highest Development
10B	Rock River – Mount Joyal	IMA – II, Low Development
10A	South Richardson Mountains	IMA – II, Low Development

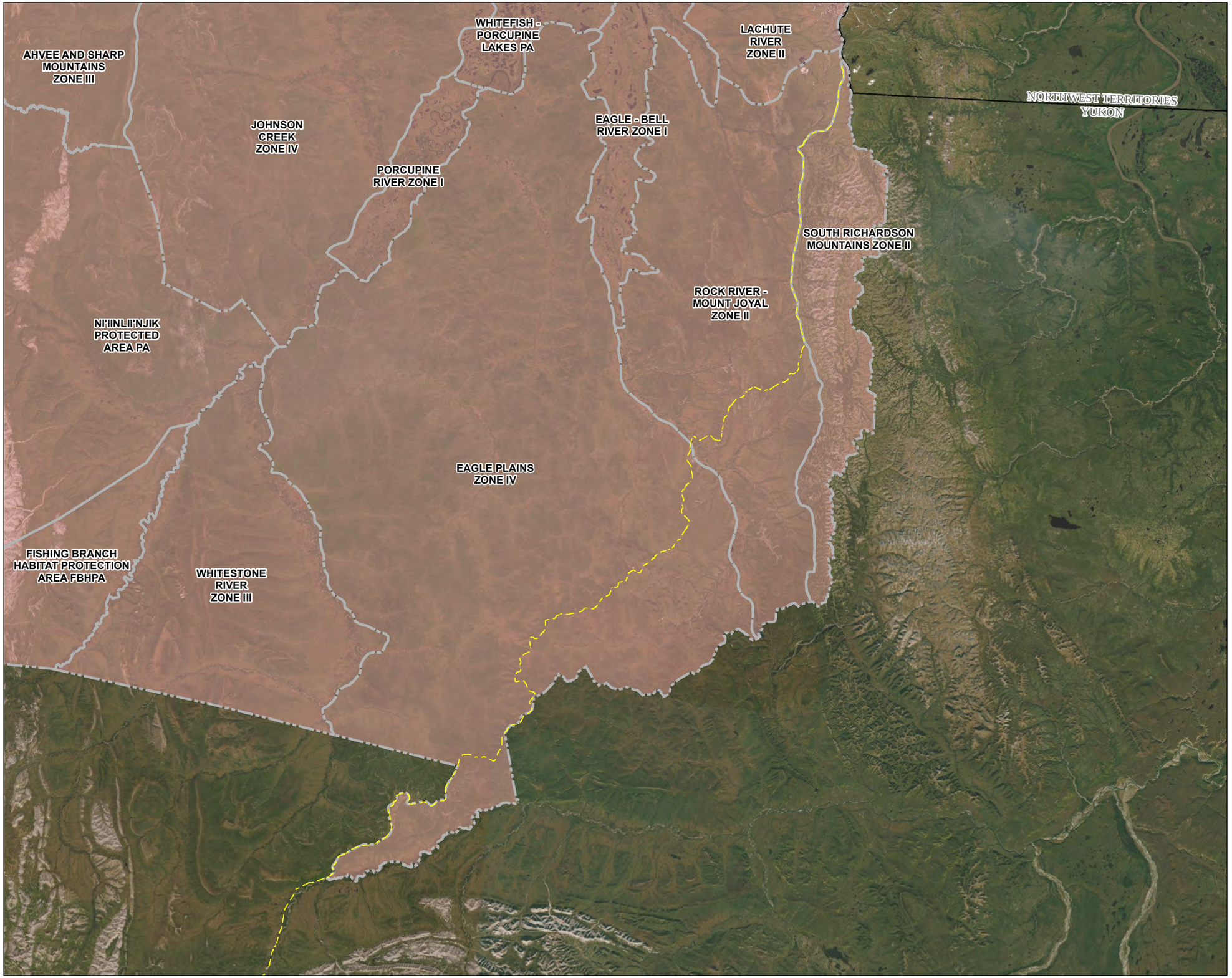
In the area of the NYRLUP, the fibre line will be located primarily within the Dempster Highway ROW. The plan acknowledges that the Dempster Highway provides an important corridor for communications, and other activities and states:

> *In recognition of the strategic importance of the Dempster Highway and its designation as a Northern and Remote Route under the National Highway System, surface disturbance and linear density indicator reporting and evaluation are exempt within a distance of 1 km on each side of the highway centre line (2-km total corridor width). (North Yukon Planning Commission 2009, p. 5-25)*

The Proponent has considered the NYRLUP when developing the proposed Project. In addition, mitigation measures described in **Section 7.0** were developed in consideration of the NYRLUP's General Management Directions and Best Management Practices. A summary of alignment between the General Management Directions and Best Management Practices and proposed Project mitigation measures is shown in **Table 1-3.**

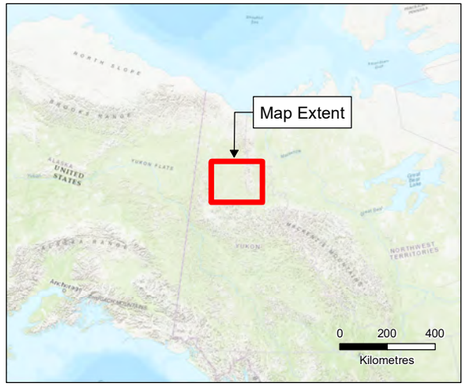
Additionally, portions of the Project are located within the Dawson and the Peel Watershed Land Use Planning Regions. Planning is ongoing in these regions at this time and there are no regional land use plans in effect. However, the Project will be located primarily within the highway ROW of the Klondike and Dempster Highways. As such it is likely that the proposed Project would be consistent with the recommendations of the Dawson and Peel Watershed Regional Land Use Planning Commissions and any resultant Land Use Plans.

The Project runs through the Tombstone Territorial Park which is managed under the Tombstone Territorial Park Management Plan. The Project falls within the Tombstone Corridor; an area of highway corridor approximately 500 m from the highway centerline excluded from Tombstone Territorial Park. The Tombstone Corridor is managed under the *Area Development Act* (RSY 2002, c.10) and is consistent with the Tombstone Territorial Park Management Plan and within the Dempster Highway Development Area.



Dempster Fibre Project

North Yukon Regional Land Use Plan
Landscape Management Units



Legend

- Dempster Fibre Project - Yukon Portion
- Territorial Boundary
- Landscape Management Units North Yukon Land Use Plan

Notes

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Table 1-3 Commitments and Mitigation Measures to Meet NYRLUP Recommendations and Best Management Practices

Topic	Recommendation	Best Management Practice	Commitment/Mitigation
Sustainable Development			
Cumulative Effects	As a general guideline for decision makers and land users, in the Integrated Management Area the amount of surface disturbance in a landscape management unit should be maintained below the cumulative effects indicator levels recommended in the Plan.		The Project is located primarily within existing highway and road ROW, which is previously disturbed and subject to ongoing disturbance through active vegetation control programs.
Surface Disturbances	Site Closure/remediation plans should be developed, implemented and monitored for large/scale industrial and/or infrastructure projects that create significant surface disturbance.		The Project will continue to operate for as long as the fibre optic line remains functional, with the typical lifespan of a fibre optic line being 20 to 25 years. At the end of the Project's operational life, it will be decommissioned, and available best practices will be followed at that time. The Project will primarily be below-ground with those components remaining in place to minimize disturbance.
	To provide a benchmark for the monitoring of cumulative effects indicator levels, the status of existing surface disturbances should be documented		The Project is located primarily within existing highway and road ROW, which can be considered entirely previously disturbed.
		The size, intensity and duration of all surface disturbances should be reduced	Reduction of surface disturbance has been incorporated into several mitigation measures, including the following: ▫ Any brushing (clearing) of vegetation in advance of installation will be limited to trees and tall shrubs, with deliberate avoidance or minimization of disturbance to surface organic cover. ▫ Every effort will be made to minimize the extent, severity and duration of ground disturbance, including compaction, during cable installation. ▫ The width and footprint of disturbance for fibre line installation will be kept to an absolute minimum. ▫ Cable installation will be accomplished using small equipment with only minimal and temporary compaction of organics and little to no potential for rutting. No stripping of surface organics is planned. ▫ Geotechnical drilling will use a lightweight track-mounted rig where possible to minimize compaction of organics, and potential for ruts to form. ▫ Existing rights-of-way and previously cleared or brushed areas will be used for cable alignment as much as possible. ▫ Construction equipment will be chosen with the aim of minimizing ground pressure and ground disturbance. ▫ During winter construction, snow will be maintained on trails to avoid damaging underlying soil and roots.
		Native endemic plants should be used for active reclamation of disturbed sites	The use of native endemic plants for the active reclamation of disturbed sites has been incorporated into several mitigation measures, including the following: ▫ During operational inspections, the Proponent will re-seed areas where natural revegetation has not been established using a seed mix of native endemic plants (**Section 3.3**). ▫ In areas where natural revegetation may be inhibited revegetate riparian areas with native grasses, shrubs, and/or trees, (e.g., with willow cuttings) to prevent erosion and help seeds germinate (**Section 7.2.3**)
Climate Change	In the North Yukon Planning Region, potential climate change impacts should be considered in all land management decisions		Climate change impacts were considered in the assessment of permafrost (**Section 7.1**).
	Due to the potential cumulative effects of climate change and land use impacts, sensitive wetland habitats and Porcupine Caribou Herd habitats at risk of significant change should be managed more cautiously, and with a high level of conservation focus		The installation methodology for wetlands was developed to minimize effects to wetlands. When wetlands are encountered, the installation will be moved to the other side of the highway, where possible. If not possible, the cable will be surface-laid in the wetland. with the intention that the cable will sink to the bottom and settle into the soils. Effects to the Porcupine Caribou Herd and their habitat were considered as part of the assessment (**Section 7.3.2.1**) and mitigation measures have been developed accordingly (**Section 7.3.3**).

Topic	Recommendation	Best Management Practice	Commitment/Mitigation
Ecological Resources			
Fish and Fish Habitat	To minimize potential impacts to regional fish populations, in-stream and lake over-wintering habitat should be identified in advance of the assessment process for large-scale industrial and/or infrastructure projects		Identification of over-wintering habitat for fish was not considered to be required as no in-stream work is proposed.
	Water withdrawals in sensitive fish over-wintering areas should be prohibited (Map in Appendix 1 of land use plan for known locations)		Only established water withdrawal sites will be used, as defined in the Environmental Field Assessment (**Appendix A**). Only established water withdrawal sites in current use or with indications of recent use during highway maintenance activities were recorded. The Project crosses the Eagle River, which is identified as a sensitive fish over-wintering area. Water withdrawal will not occur from this site in the winter.
		To minimize potential impacts to regional fish populations, aggregate (gravel) mining should be prohibited in significant fish habitats.	Not applicable – no aggregate mining is proposed as part of the Project.
Wetland, Lakes and Rivers	To minimize potential impacts to regional wetlands, an assessment of wetland hydrology and connectivity should be conducted in advance of the assessment process for large-scale industrial and/or infrastructure projects		The installation methodology for wetlands was developed to minimize effects to wetlands. When wetlands are encountered, the installation will be moved to the other side of the highway, where possible. If not possible, the cable will be surface-laid in the wetland with the intention that the cable will sink to the bottom and settle into the soils. Potential impacts with respect to wetlands are mitigated through project design and mitigation measures described in **Section 7.4.3**. Given these minimal effects to wetlands, an assessment of wetland hydrology and connectivity was not considered to be required.
	Water withdrawals in ecologically sensitive wetland areas should be prohibited		Only established water withdrawal sites will be used, as defined in the Environmental Field Assessment (**Appendix A**). Only established water withdrawal sites in current use or with indications of recent use during highway maintenance activities were recorded All water withdrawals will conform to DFO's Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut (2010), Fish Screen Design Criteria for Flood and Water Truck Pumps (2011), and Freshwater Intake End-of-Pipe Fish Screen Guideline (1995), if applicable (**Section 7.2.3**)
		All-season infrastructure should be discouraged in key wetland complexes (Appendix 1 map 2)	Not applicable – the Project is not located within key wetland complexes identified in Appendix 1 map 2 of the NYRLUP.
		Locations of all-season infrastructure should maintain a minimum distance of 100m from wetlands and lakes	The Project is located primarily within existing highway and road ROW. While the fibre line is proposed to be in use year-round, it is not considered "all-season infrastructure" such as an access road or construction site. In addition, the installation methodology for wetlands was developed to minimize effects to wetlands. When wetlands are encountered, the installation will be moved to the other side of the highway, where possible. If not possible, the cable will be surface-laid in the wetland. with the intention that the cable will sink to the bottom and settle into the soils. Potential impacts with respect to wetlands are mitigated through project design and mitigation measures described in **Section 7.4.3**.
		Activities in the vicinity of wetlands and wetland complexes should be carried out during the winter period	The surface lay of cable in wetlands is scheduled to occur in frozen conditions (see **Table 2-1**).
		If land use activities are required in wetlands, hydrology, water flow, and natural drainage patterns should be maintained.	The contractor will be responsible for developing a Construction Environmental Management Plan that outlines the permit conditions and best management practices for works in and around water, including the Preferred Practice of Works Affecting Yukon Waters (Yukon Government 2019) (**Section 7.2.3**).
		If required, surface disturbance within and adjacent to wetlands and lakes should not result in diminished water quality or quantity.	This Best Management Practice is addressed by mitigation measures included in **Section 7.2.3**, including the following: ▫ A qualified Environmental Monitor will conduct monitoring (including water quality assessments), with an emphasis on those works with the greatest potential to impact fish habitat (e.g., stream crossings). ▫ Install erosion and sediment control measures as appropriate (e.g., by constructing small settling basins/berms at drill entry and exit points for HDD crossings). ▫ Cover any soils exposed as a result of Project activities, and/or implement other erosion protection or sediment control measures until such time that permanent stabilization occurs. Avoid placing stockpiles within the riparian area.

Topic	Recommendation	Best Management Practice	Commitment/Mitigation
			▫ Direct any sediment-laden flow to stable vegetated areas at least 30 m away from any watercourses to allow for infiltration back into the ground. ▫ Where possible, schedule works around watercourses to avoid wet, windy and rainy periods that may increase erosion and sedimentation. ▫ Develop an Erosion and Sediment Control Plan for Project Operations prior to construction.
Major Rivers and River Valleys		To maintain visual quality and aesthetics, all-season infrastructure should be discouraged within Major River corridors (Appendix 1 Map 2)	The Project is located primarily within existing highway and road ROW. In addition, while the fibre line is proposed to be in use year-round, it is not considered “all-season infrastructure” such as an access road or construction site.
		Minimize construction of new permanent river crossing structures and routing new all-season access roads through Major River and other riparian corridors	For river crossings, horizontal directional drilling of fish-bearing streams, rivers, other waterbodies and challenging sections (**Section 3.2.5.3**) or bridge attachment of the cable to existing bridges (**Section 3.2.5.4**) or potentially aerial installation (**Section 3.2.5.5)** will be used, utilizing existing infrastructure when possible.
		Where new all-season or winter access roads and/or trails are required to cross Major River and other riparian corridors, these should be designed, constructed, and used in a manner that minimized direct and indirect impacts to fish, wildlife and their habitats.	Not applicable – no new all-season or winter access roads and/or trails are being proposed to cross major river and other riparian corridors.
		Surface disturbance and land use activities within and adjacent to Major River and other riparian corridors should not result in diminished water quality, quantity or flow.	Where surface disturbance is required within and adjacent to Major Rivers and other riparian corridors, it is anticipated that activities will not result in diminished water quality or quantity. Potential impacts with respect to water quality and quantity are mitigated through project design and mitigation measures described in **Sections 7.1.3, 7.2.3, and 7.4.3**.
		Whenever possible, avoid aggregate (gravel) mining activities in Major River Corridors	Not applicable – no aggregate mining is proposed as part of the Project.
Wildlife Habitat (General)		Avoid or minimize the creation of new access roads and trails; utilize existing routes unless their use will cause additional long term environmental impacts (e.g. permafrost degradation)	The Project is located primarily within existing highway and road ROW and will not create permanent access roads and trails outside of the ROW.
		Avoid or minimize the size, extent, duration and level of activities in concentrated seasonal use areas.	The Project is located primarily within existing highway and road ROW and has been designed to avoid or minimize the size, extent, duration and level of activities in concentrated seasonal use areas.
		Use appropriate operational timing-windows in significant wildlife habitats to minimize activities, whenever possible, during periods of wildlife use	The Proponent has proposed various operational timing-windows in relation to wildlife and wildlife habitat which can be found in **Section 7.3.3**.
		When new access creation is necessary: Non-permanent winter access routes should be developed and utilized versus all-weather access routes; Gate or otherwise restrict hunting along new access routes; Where possible, direct new access routes through less significant wildlife habitats	The Project is located primarily within existing highway and road ROW and will not create permanent access roads and trails outside of the ROW.
Porcupine Caribou Herd		Avoid or minimize the size, extent, duration and level of activities in concentrated seasonal use areas.	The Project is located primarily within existing highway and road ROW and has been designed to avoid or minimize the size, extent, duration and level of activities in concentrated seasonal use areas. In relation to Porcupine Caribou, project activities will not disturb, block or cause substantial diversion to migrating caribou and will not alter caribou migration habitat in a way that will prevent caribou from using it in the future (**Section 7.3.3)**
		Avoid using or crossing seasonal migration corridors with new access routes	The Project is located primarily within existing highway and road ROW and will not create new permanent access roads and trails outside of the ROW.
		Define and implement safe operating distances from the herd	If any caribou are observed within a 1 km radius of a work site, all work activities will cease until the caribou have moved safely beyond the 1 km buffer. The Dawson City regional biologist will be contacted if caribou remain in the area for more than 2 weeks.
		Consider the following seasons when determining appropriate operational timing-windows: Winter (Dec 1 – Mar 31); Spring migration (Apr 1 – May 31); Early summer (July 1 -15); Mid to late summer (July 16 – Aug 7); Fall migration (Aug 8 – Oct 7); Rut (Oct 8 – Nov 30)	In relation to Porcupine Caribou, project activities will not disturb, block or cause substantial diversion to migrating caribou and will not alter caribou migration habitat in a way that will prevent caribou from using it in the future. If any caribou are observed within a 1 km radius of a work site, all work activities will cease until the caribou have moved safely beyond the 1 km buffer. The Dawson City regional biologist will be contacted if caribou remain in the area for more than 2 weeks. (**Section 7.3.3)**

Topic	Recommendation	Best Management Practice	Commitment/Mitigation
Moose		Avoid seasonal use/concentration areas and migration corridors	Temporary camps will not be placed within 1 km of the Ogilvie or Blackstone Rivers in May, as these river corridors are known for moose calving (**Section 7.3.3**).
		Avoid using or crossing seasonal migration corridors with new access routes	The Project is located primarily within existing highway and road ROW and will not create permanent access roads and trails outside of the ROW.
Sheep		Avoid sensitive sheep habitats and key areas, with emphasis on winter range avoidance	The Project is located primarily within existing highway and road ROW. The Proponent will avoid performing construction activities, including the establishment of camps, within a 5 km radius of Angelcomb Mountain and Km 180 of the Dempster Highway during May and June, as these areas are known sheep lambing sites (**Section 7.3.3**).
Heritage, Social and Cultural Resources			
Heritage, Social and Cultural Resources		Avoid and/or mitigate exploration and development activities and impacts in areas with known heritage or historic resource values, where such areas or sites are not otherwise protected through existing land withdrawals	The Project has been designed to avoid and/or mitigate potential impacts to heritage and historic resource values. Potential impacts with respect to known and unknown heritage resources are mitigated through project design and mitigation measures described in **Section 7.5.3.**
		In identified current community use areas, exploration and construction activities should be minimized or mitigated during subsistence harvesting or other periods of seasonal cultural activities (Appendix 1 map 3)	Project activities will be limited to the highway ROW through the VGFN Community Use Area.
		Work camps associated with resource exploration and development activity should be sited near areas of resource production, away from identified heritage routes, historic sites, current community use areas, and the Old Crow Community Area	Temporary camps will be constructed at existing quarries along the Project route.
VGFN Heritage Routes and Sites	Management guidelines for identified routes and sites within the Integrated Management Area should be developed jointly by VGG and YG		The fibre line will be located on the opposite side of the ROW away from Settlement Land as much as possible. Communication on this matter with VGFN will be ongoing during final Project design (**Section 4.2.2**)
Other Heritage and Historic Resources	Known historic camps/cabins, historical fish trap locations, archaeological sites and other heritage resources should be identified prior to exploration and development activities, and protected from disturbance		A Heritage Resource Protection Plan (or Chance Find Procedure) will be developed for the Project, which will include methods for avoiding, mitigating, reporting, and recovering artifacts or heritage resources uncovered during Project activities. Further research with Yukon Heritage and engagement with First Nations is recommended to confirm the location of specific sites (e.g., location of the old Dawson to Fort McPherson Trail) and ensure First Nations have the opportunity to raise heritage resource concerns associated with the Project (**Section 7.5.3**)
Economic Development			
Transportation and Access		Avoid or minimize the creation of new access roads and trails; utilize existing routes unless their use will cause additional long term environmental impacts (e.g., permafrost degradation)	The Project is located primarily within existing highway and road ROW and will not create permanent access roads and trails outside of the ROW.
		Where new all-season or winter access roads and/or trails are required, these should be designed, constructed and used in a manner that minimizes direct and indirect impacts to fish and wildlife, their habitats and human viewscapes (i.e., minimize size and extent of features).	The Project is located primarily within existing highway and road ROW and will not create permanent access roads and trails outside of the ROW.
		Avoid significant caribou, moose, marten, and sheep habitat where possible when constructing new access routes.	The Project is located primarily within existing highway and road ROW and will not create permanent access routes outside of the ROW.
		Avoid important trapping, harvesting, and current use areas (Appendix 1 map 3)	The Project is located primarily within existing highway and road ROW. Trapping and harvesting concessions adjacent to the ROW are identified in **Section 6.2.3**.
		Avoid using or crossing wildlife seasonal migration corridors with new access routes	Not applicable – no all-season or winter access roads and/or trails are being proposed.
		Whenever possible, land use activities should be coordinated to utilize the same access route(s).	Not applicable – no all-season or winter access roads and/or trails are being proposed.

Topic	Recommendation	Best Management Practice	Commitment/Mitigation
		Reclamation requirements and decommissioning strategies should be considered during planning and assessment of new road and access features.	All material excavated for development of the entry pits will be side-casted for replacement once the conduit connection is complete. In upland areas, the disturbed terrain will be allowed to vegetate naturally. In riparian and wetland areas, if willows naturally occur in the area, willow cuttings will be applied to the backfilled pits to facilitate natural regrowth. Boughs and branches may also be placed over top of the drill site to decrease the likelihood of erosion. Upon the successful completion of each HDD, all equipment and materials will be removed from the site and the area will be cleaned up (**Section 3.2.5**)
		Limit and/or control use of new industrial access routes to authorized users only.	Not applicable – no new industrial access routes will be created.
Dempster Highway	In recognition of the strategic importance of the Dempster Highway and its designation as a Northern and Remote Route under the National Highway System, surface disturbance and linear density indicator reporting and evaluation are exempt within a distance of 1 km on each side of the highway centre line (2-km total corridor width).		The Project is located primarily within the ROW of the Klondike and Dempster highways and as such is exempt from surface disturbance and linear density indicator reporting and evaluation.
Eagle Plains Access Management	In advance of significant levels of energy sector activity, an access management plan should be developed for the Eagle Plains oil and gas basin		Not applicable – Project not related to energy sector activities.
Community of Old Crow	To support maintenance and growth of Old Crow, the Community Area (CA) should be exempt from surface disturbance and linear density indicator monitoring		Not applicable – Project does not overlap with community of Old Crow.
Aggregate (Gravel) Resources	To mitigate potential impacts to significant and/or sensitive ecological or cultural resources and values, the identification and mapping of potential sources of aggregate should be undertaken in advance of the assessment process for large-scale industrial and/or infrastructure projects		Not applicable – no aggregate mining is proposed as part of the Project.
		To minimize potential impacts to regional fish populations, aggregate (gravel) mining should be prohibited where it may affect significant fish habitats	Not applicable – no aggregate mining is proposed as part of the Project.
		Minimize gravel requirements for necessary infrastructure through coordinated access, feature reduction, and geo-technical engineering	Fill material required for this project will be purchased through local contractors. Aggregate requirements will be minimized.
		Ensure efficient use of identified aggregate resources.	Fill material required for this project will be purchased through local contractors. Aggregate requirements will be minimized.

1.2.2 First Nations and Indigenous Groups

The proposed Project is located in the following First Nations' Traditional Territories (**Figure 1-4**):

- Tr'ondëk Hwëch'in;
- Vuntut Gwitchin First Nation;
- First Nation of the Na-Cho Nyäk Dun;

The Project also overlaps with the Secondary Use Areas of the following Indigenous groups:

- Tetlit Gwich'in Council; and,
- Gwich'in Tribal Council.

The Tr'ondëk Hwëch'in (TH) are a Yukon First Nation based in Dawson City, Yukon. They are descendants of the Hän-speaking people and are a diverse mix of families descended from Gwich'in, Northern Tutchone, and other language groups (TH n.d.). The First Nation of Na-Cho Nyäk Dun (FNNND) are a Yukon First Nation based in Mayo, Yukon. They are also of the Northern Tutchone language and cultural group (FNNND 2019).

Vuntut Gwitchin First Nation (VGFN) and Tetlit Gwich'in Council (TGC) are Gwich'in First Nations that have traditionally used and occupied lands in the Northwest Territories and the Yukon, and are linked by close cultural and linguistic (Athapaskan) traditions (Bennett 2019). VGFN are based in Old Crow, Yukon, while the TGC are based in Fort McPherson, Northwest Territories. The Gwich'in Tribal Council (GTC) is an Indigenous organization based in Inuvik, Northwest Territories. The GTC holds rights under Section 35 of the *Constitution Act*, 1982, Treaty 11 and the Gwich'in Comprehensive Land Claim Agreement (GCLCA), included in Appendix C – Yukon Transboundary Agreement (YTA). Under the GCLCA, GTC is the body responsible for representing the collective rights of GCLCA participants, including all Tetlit Gwich'in as defined in the YTA. Yukon lands of the TGC are identified in the YTA as the Primary Use Area and the Secondary Use Area lands (see **Figure 1-4**).

Summaries of consultation for each affected First Nation are provided in **Section 4.0**.

TETLIT GWICH'IN COUNCIL, SECONDARY USE AREA

NORTHWEST TERRITORIES
YUKON

VUNTUT GWITCHIN FIRST NATION

EAGLE PLAINS

TETLIT GWICH'IN COUNCIL, PRIMARY USE AREA

FIRST NATION OF NA-CHO NYÄK DUN

TR'ONDËK HWËCH'IN

DEMPSTER HIGHWAY

DAWSON CITY

Legend

- Community
- Dempster Fibre Project
- Territorial Boundary

Traditional Territories

- First Nation of Na-cho Nyäk Dun
- Tr'ondëk Hwëch'in
- Vuntut Gwitchin First Nation

Primary and Secondary Use Areas

- Tetlit Gwich'in Council, Primary Use Area
- Tetlit Gwich'in Council, Secondary Use Area

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licenced under the Open Goverment License - Government of Yukon
- Aerial Image: ESRI World Imagery

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Dempster Fibre Project

Traditional Territories

103469-01	Production Date: Jun 28, 2019	Figure 1-4

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An Ausenco Company

Yukon Government
Highways and
Public Works

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1.2.3 Communities

The Project will pass through Dawson City and Eagle Plains. Dawson City lies within the Traditional Territory of the Tr'ondëk Hwëch'in, and is situated on a small flood plain at the confluence of the Klondike and Yukon Rivers (Government of Yukon 2014). Located at the north end of the Klondike Highway, Dawson City has an estimated population of 2,326 people working largely in the town's tourism and mining industries as well as the Public Service (Government of Yukon 2014). Dawson City served as the capital of the Yukon government from 1898 until 1952, when the seat was moved to Whitehorse (Bennett 2019).

Eagle Plains is a small settlement located halfway between Dawson City and Inuvik, near kilometer 370 of the Dempster Highway. The Eagle Plains Hotel is open year-round and provides a motel, restaurant, showers, laundromat, service station and garage, staff housing, and a government office (Eagle Plains Hotel n.d.; PR Services Ltd. n.d.).

1.3 *Yukon Environmental and Socio-economic Assessment Act* Triggers

The proposed Project requires an evaluation by a Yukon Environmental and Socio-economic Assessment Board (YESAB) Designated Office (DO) because:

1. The project location is in the Yukon;
2. The *Assessable Activities, Exceptions and Executive Committee Projects Regulations* identifies several triggers for the Project, namely the construction, installation, operation, modification, decommissioning, or abandonment of, or other activity in relation to, a power line or a telecommunications line (Schedule 1, Part 4, Item 1); and,
3. A territorial agency is the proponent.

The Project is located within the North Yukon assessment district, and it is understood that the Dawson City Designated Office will carry out the evaluation.

1.4 Permits and Licences

Permits and licences required for Project construction are shown in **Table 1-4**.

Table 1-4 Approvals Required for the Project

Act/Regulation	Approval	Trigger	Status
Municipal			
City of Dawson Zoning Bylaw No. 12-27	Development Permit	Installation of Project components in municipal boundaries	An application will be submitted at least three months prior to Project construction. Preliminary discussions have been held with the municipality.
Territorial (Yukon)			
Area Development Act (RSY 2002, c.10)	Dempster Highway Development Permit	Land Use on Dempster Hwy	An application will be submitted at least two months prior to Project construction. Preliminary discussions have been held with the Environmental Affairs Branch of the Government of Yukon's Department of Environment

Act/Regulation	Approval	Trigger	Status
Highways Act (RSY 2002, c.108)	Work in Right-of-way permit	Perform work within highway right-of-way	An application will be submitted at least two months prior to Project construction. Communication with the Transportation and Maintenance Branch of the Government of Yukon's Department of Highways and Public Works has been ongoing and regular.
Highways Act (RSY 2002, c.108)	Licence of Occupation	Working outside of the right-of-way	An application will be submitted at least two months prior to Project construction. Preliminary discussions have been held with the Lands Management Branch of the Government of Yukon's Department of Energy, Mines, and Resources.
Waters Act (SY 2003, c.19)	Water Use License	Use of 100 or more cubic metres per day and deposit of a waste (HDD Drilling).	An application will be submitted to the Water Board as soon as possible.
First Nations Governments			
The Tr'ondëk Hwëch'in Final Agreement, (Chapter 5.5)	Land Use Permit	Activities on Settlement Lands	An application will be submitted at least three months prior to Project construction. Preliminary discussions have been held with TH.

A Request for Review will be submitted to the Department of Fisheries and Oceans (DFO) for the Project. It is not anticipated that a Project Near Water Authorization under the *Fisheries Act (R.S.C 1985, C.F-14)* will be required.

1.5 Alternatives

Over the past decade, an alternate route, known as the South Klondike line, was considered for the fibre route. This route would have connected Whitehorse to Skagway, Alaska, via Carcross, Yukon, and Fraser, British Columbia, along the South Klondike Highway.

The Government of Yukon received Expressions of Interest for both options in 2017. For the Dempster Highway route, two Expressions of Interest were received. Northwestel's (NWTel) response indicated that it could operate the line at no cost to the Government of Yukon, and was also in a position to contribute up to $15 million towards the capital build. For the South Klondike route, six Expressions of Interest were received. None provided evidence to suggest that the line could be financially sustainable to operate.

Other benefits of the Dempster Highway versus the South Klondike route include:

- Stable internet for a larger percentage of Yukon's population and for neighbouring communities in the Northwest Territories, Nunavut, and Northern British Columbia which removes a barrier to northerners fully participating in the digital economy.
- Construction activity will have a significantly higher capital investment in the Yukon economy than the South Klondike.
- More employment opportunities for Yukon contractors and residents.
- Most affordable route for Government of Yukon based on capital and operating expenditures.
- Avoids routing sensitive data through a foreign country.

1.6 Project History

Prior to the expression of interest and federal funding being obtained, Government of Yukon worked in partnership with NWTel to obtain preliminary studies of the Project. In 2018, the decision to build the line to Inuvik was made and a commitment for federal funding was secured. At this point, it was also determined that Government of Yukon, Department of Highways and Public Works would be the owner and proponent of the Project. The regulatory process led by this proponent has since been initiated. Reports completed from the partnership prior to 2018 are being used as baseline material for this application, including the following:

- **Environmental baseline** (Ecofor 2016) (**Appendix A**): Identifies wetlands, species-at-risk potentially present, and suitable locations for water withdrawal. The environmental baseline was conducted for the entire DFP, including the Northwest Territories portion.
- **Heritage Resource Overview Assessment – Yukon** (Ecofor 2019) (**Appendix B**): Identifies and assesses heritage resource potential or sensitivity within the study area, details the findings of the Heritage Resource Overview Assessment and presents recommendations, summarizes the results obtained through previous phases of heritage resource assessment and provides updates. The Heritage Resource Overview Assessment is specific to the Yukon portion of the DFP and was updated in 2019.
- **Preliminary Heritage Field Reconnaissance** (Ecofor 2017) (**Appendix C**): Provides an interim results summary of the PHFR study aimed at ground truthing the heritage resource potential predictions made in the preceding 2016 Heritage Resource Overview Assessment study conducted by Ecofor. Presents general results and recommendations for the avoidance of heritage resource concerns within the study area, discusses specific areas of concern along the proposed ROW corridor, and presents recommendations for avoiding and/or mitigating heritage resource impacts to those areas. The Preliminary Heritage Field Reconnaissance was conducted for the entire DFP, including the Northwest Territories portion.
- **Hydrotechnical Hazard Assessment** (M. Miles and Associates 2011): Provides detailed information on water crossings of the Blackstone River, Ogilvie River, Sheep Creek, and Rock Creek).
- **Fluvial Geomorphological Assessments Report** (Associated Engineering, 2017): Includes the following analyses:
  - Fluvial geomorphological assessments were conducted at existing and proposed aggregate extraction sites on the active floodplain areas of Ogilvie River and Engineer Creek along the Dempster Highway. The potential for aggregate removal on the active floodplains close to the pits was reviewed.
  - Fluvial geomorphological assessments were conducted in active floodplain areas of the Ogilvie River and Engineer Creek along the highway with no nearby pits to determine the potential for aggregate removal.
  - Review of icing known to develop in winter near km 169, just north of where the highway crosses Red Creek. These build-ups of river ice and slush occur late in the winter and can extend onto the highway surface.
  - Fluvial geomorphological assessments of the condition and function of old in-channel berms near the confluence of Engineer Creek and Red Creek.
- **Broadband and its Impact on Economic Development in the Yukon** (Lemay-Yates Associates, 2015): Summarizes the economic benefits of improving internet service through Yukon.

Studies that have been completed by the Proponent since 2018 include the following:

- **Conceptual Design Brief** (Stantec 2019) **(Appendix D):** Provides a high-level design scope and basis for the DFP routing along the Dempster Highway and into the key NWTel microwave integration, breakout sites, and termination sites along the route. The report summarizes design codes and standards, construction methodologies, geotechnical considerations, and outside plant components. It includes a decision matrix for construction methodologies, and a high-level risk assessment of cable placement options for various features. A Geotechnical Design Brief is appended to the Conceptual Design Brief.

2.0 PROJECT DESCRIPTION

As mentioned in **Section 1.0**, the Project for the purposes of this assessment is the portion located in Yukon only. As such, the Project description is limited to those components.

2.1 Project Components

The proposed Project comprises the following components:

- Fibre optic cable and conduit to be installed adjacent to the Klondike Highway and Dempster Highway along the ROWs, extending from Dawson City to the Northwest Territories border (**Section 2.1.1**); and,
- Handholes along the route (**Section 2.1.2**).

The Project will connect to an existing terminal facility in Dawson City and to existing buildings in communities along the route to provide service to those communities.

Construction and operation of this Project will require the following supporting activities:

- Use of pre-existing staging areas for equipment and materials. Up to five staging areas may be used at one time;
- Construction of temporary camps to accommodate work crews;
- Clearing of vegetation as required in the ROW along the all-season highway;
- Installation of conduits and fibre optic cable; and,
- Ongoing operations and maintenance.

2.1.1 Fibre Optic Cable and Conduit

The cable will be located primarily within the Klondike and Dempster highway ROWs, with the exception of the locations listed in **Table 1-1**.

2.1.1.1 Direct-buried and Surface-laid Cable

Cable buried directly into the ground is specifically designed to withstand harsh environments. Due to terrain, vegetation, and permafrost constraints in this Project, a double armoured fibre cable configuration would be the minimum required in order to protect the fibre cable sufficiently from rocky backfill expected along many sections of the Dempster highway route. Surface laid cable is laid on the ground surface.

The cables will be roughly 15 mm in outside diameter. A sample of the type of cable which will be considered for direct-buried or surface-laid application is shown in **Plate 2-1**.

Plate 2-1 Typical Cable Considered for Direct-buried or Surface-laid installation

2.1.1.2 Aerial Cable

The aerial components are anticipated between the NWTel Dawson terminal facility and the South West Edge of Dawson City. In town, the fibre cable will be attached to Yukon Power poles via a route that provides a minimum of 10 m of separation between the fibre cable and the NWTel network fibre cable. The specific alignment and route are to be determined after discussions and consultation with NWTel. A sample of the type of cable which will be considered for aerial installation is shown in **Plate 2-2**.

Further, depending on the alignment of the existing NWTel cable along the Klondike Highway the fibre cable may be installed aerially from the South edge of town to the Dempster Highway turn-off. Additional details on proposed aerial installations are in **Section 3.2.5.5**.

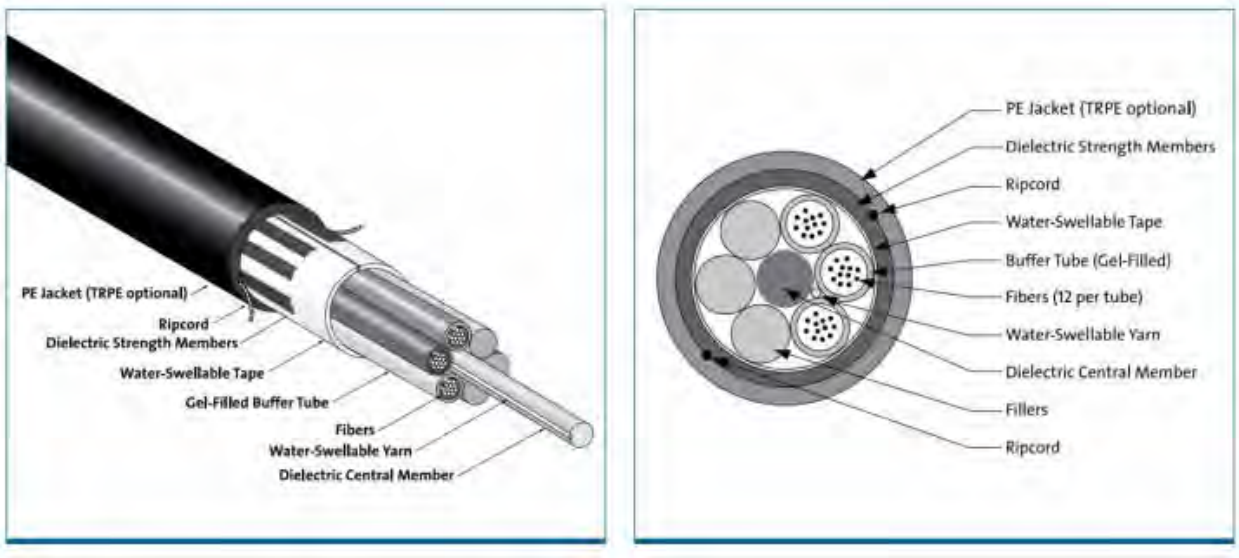


Plate 2-2 Typical Aerial Fibre Cable

2.1.1.3 Cable Installed in Conduit

Conduit is an enclosed circular channel designed for holding and protecting electrical wires or telecommunication cabling. It is common in the telecommunications industry for cables to be buried in conduit to provide further protection and allow for ease of repair and future expansion. Conduits (high-density polyethylene (HDPE)) will be used for HDD crossings and possibly for bridge attachments. Conduits may also be used in the entrance to terminal facility in Dawson. Using conduits in surface-laid cable areas where there has been landslide history will also be considered.

Small diameter heavy walled HDPE conduits will primarily be used for the HDD crossings along the route. Given some of the difficult terrain conditions and route challenges, the fibre cables may require additional protection through the use of a heavy walled conduit.

2.1.1.4 Warning Signs and Marker Posts

For buried cable, metallic warning tape will be placed midway between the cable and the ground surface to provide an early warning mechanism for any excavation that may occur near the cable.

Marker posts will be installed to indicate the presence of buried cable. The marker will include a warning decal sign on each side warning of the presence of a cable and will provide information for who to contact before digging or driving stakes. Marker post configuration and materials will be compliant with NWTel and CSA standards. Markers typically consist of an orange high-impact post, 1.8m (6 ft.) long with an anchor fin at the bottom. However, final marker design will be determined through engagement with TH, as they expressed concern that while the markers should ensure safety for motorists, they should also be minimally intrusive to wildlife migration and wilderness tourism (**Section 6.2.2**).

The final location of the line will be surveyed at the time of installation with the records being stored with Highways and Public Works.

2.1.2 Handholes

Handholes are shallow box-type structures made of rigid material such as fibreglass or HDPE whose purpose is to allow for storage of cable slack and to provide access for cable splices. Handholes are necessary for maintenance of the cable line because they provide access for repairs or replacements at manageable intervals along the route. Handholes will be installed along the length of the line, spaced between three and four km apart on average.

The handholes will be approximately 1.6m long x 1.04m wide x 0.6m high depending on the fibre cable selected. The diameter of the cable will govern the bending radius of the cable and the handhole sizing will need to accommodate the static bending radius of the cable without any stress. The fibre optic cable will enter the handhole from the underside of the fibreglass box. A typical handhole is shown in **Plate 2-3** and **Plate 2-4** shows typical handhole installation.

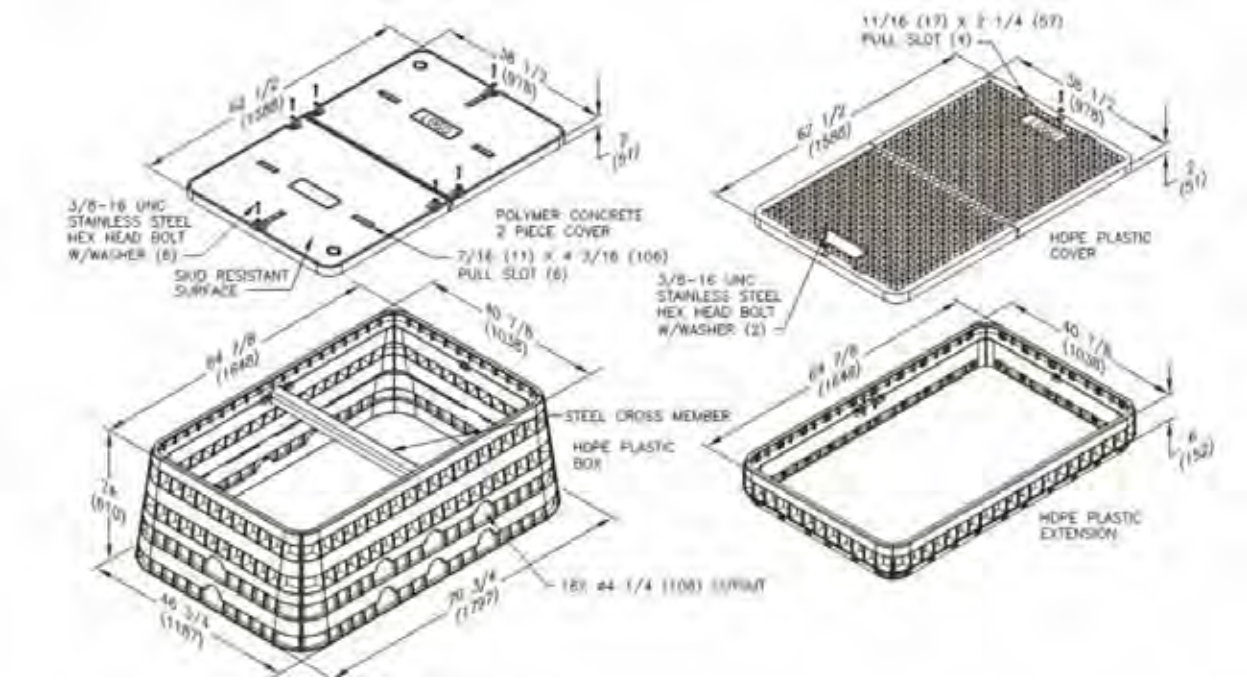


Plate 2-3 Typical Handhole to be Used for the Project

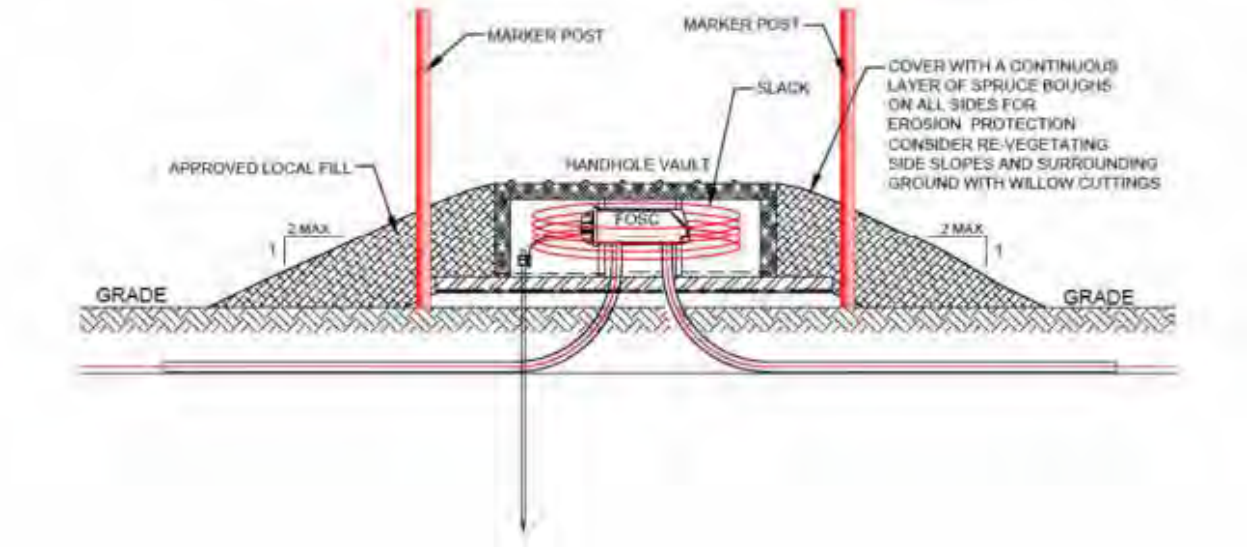


Plate 2-4 Typical Handhole Installation for the Project

Handholes are being used rather than pedestals, to reduce the risk of interacting with land users (e.g., snow machines or all-terrain vehicle collisions). To further decrease the likelihood of interactions with land users, the Proponent will provide each handhole site with adequate signage.

Handholes will be placed away from the road prism above the road embankment. They will be located on high ground elevation with flat terrain to the extent possible so that they can be accessed easily from the road and drainage concerns are alleviated.

In continuous permafrost regions, the handholes will be placed at grade, to minimize disturbance of the organics and the active permafrost. The handholes will have fill placed around them with a slope of 2:1 to offer protection against movement and to minimize water pooling inside.

To allow for future tie-ins, handholes with slack cable storage will be placed at the entrances of all highway's maintenance yards and other relevant sites, as well as future customer tie-in locations specified by NWTel and the Proponent.

2.2 Project Schedule

Project construction will begin in spring 2020 and will be completed by winter 2022 at the earliest. Much of the work may need to occur in winter if permafrost and climatic conditions lead to the ground not being able to support the weight of the vehicles in the warmer months. Such a scenario would lead to an extension of the construction schedule.

Project construction is planned to advance during both frozen and non-frozen conditions. Detailed construction planning will take place based on a completed final design. However, at a high level, the proposed construction methodology and construction timing in **Table 2-1**. A detailed construction schedule will be developed with the contractor and the Proponent and provided to the decision bodies prior to construction.

Table 2-1 Construction Timing and Activity

Construction Timing	Activity
Non-frozen Conditions	Perform HDD activities on all road prism crossings along the route.
	Perform HDD activities on all flowing water crossings
	Complete all large river crossings
	Plow/Trench shallow-buried cable/conduit into organic layer using lightweight equipment.
	Install all bridge raceways and/or detachable conduits.
	Install all handholes.
	Install all pile technology pole foundations, all anchors, poles and pole line hardware.
	Install all aerial ADSS cable.
	Pre-Test all fibre reels prior to installation
	Perform fibre splicing and testing after installation
Frozen Conditions	Perform some HDD where ground conditions preclude summer work and where surface-laid, shallow-buried cable/conduit or conventional cable plowing methods are impractical.
	To minimize potential impacts leading to erosion and sedimentation, complete most of the necessary ROW clearing and HDD stream crossing activities in the frozen ground conditions.
	Using small equipment, clear a narrow strip of vegetation (34 m maximum) along the ROW for the cable alignment, just wide enough to allow lightweight equipment for shallow plowing of the cable/conduit where required.
	Complete clearing of narrow strip (1-2 m) along the surface-laid alignment to allow for cable placement
	For equalization culverts in wetland areas, the cable/conduit can be surface-laid in frozen conditions, so that it submerges into the wetland during the freshet. This also allows for buoyancy control using strategically fastened saddle sandbags or cable weights along the crossing.

3.0 PROJECT DEVELOPMENT STAGES

3.1 Pre-construction

Permitting for the Project is underway and will conform with the regulatory requirements summarized in **Section 1.4** of this application.

Geotechnical work has been completed to support the development of the Project to date. Extensive drilling was conducted over several years to support various activities. The information obtained from these drilling programs has been reviewed in depth by the Proponent's engineering team, and additional geotechnical work will be performed on an as-needed basis if further information is required.

To support detailed design, the Proponent will drive the route with the Project engineer to refine construction techniques to a finer scale. Detailed survey data will also be included in the final design.

3.1.1 Summary of Completed Geotechnical Studies

All geotechnical information that has been collected by the Government of Yukon Transportation Engineering Branch for the construction and maintenance of the Dempster Highway has been reviewed by the Project's geotechnical engineers. Available reports include 41 borehole studies and additional permafrost reports.

3.1.2 Proposed Geotechnical Studies

Additional boreholes will be drilled on an as-needed basis to supplement any potential gaps or unknown conditions that are encountered. As described in the Geotechnical Design Brief (**Appendix D**), it is imperative that construction techniques be adaptable to the range of terrain and permafrost conditions to be traversed by the Project. The Geotechnical Design Brief recommends that the contractor implement an adaptive construction approach involving the use of alternative construction methods (as required) to mitigate for uncertainties encountered in the field. When additional information is required to inform decisions about construction techniques, additional geotechnical work will be performed on an as-needed basis. This is considered a mitigation measure to protect subsurface structures, namely permafrost (**Section 7.1.3**).

3.2 Construction

Infrastructure projects in northern Canada commonly face construction and installation challenges related to varying terrain and permafrost conditions. With this in mind, and based on experience working in northern Canada, an adaptive construction approach is proposed for the Project. This approach will yield construction methods that are best suited for the actual field conditions encountered.

In order to ensure the most suitable construction method is being used, Government of Yukon has retained the design engineer to oversee construction. In addition, the design engineer for the project is independent from the construction contractor and is contracted directly to Government of Yukon. During construction, if the construction crew encounters an area that is different than the broader area they are working in (e.g., micro-geographic or environmental subsystem), construction will cease. The matter will be brought to the design engineer to determine the most suitable construction method to use within that area. Construction crews will not make a decision without first discussing it with the design engineer. The construction decision matrix shown in Section 11 of the Conceptual Design Brief (**Appendix D**) will help to inform decisions about alternate techniques should the preferred construction technique be unfeasible.

3.2.1 Mobilizing and Staging

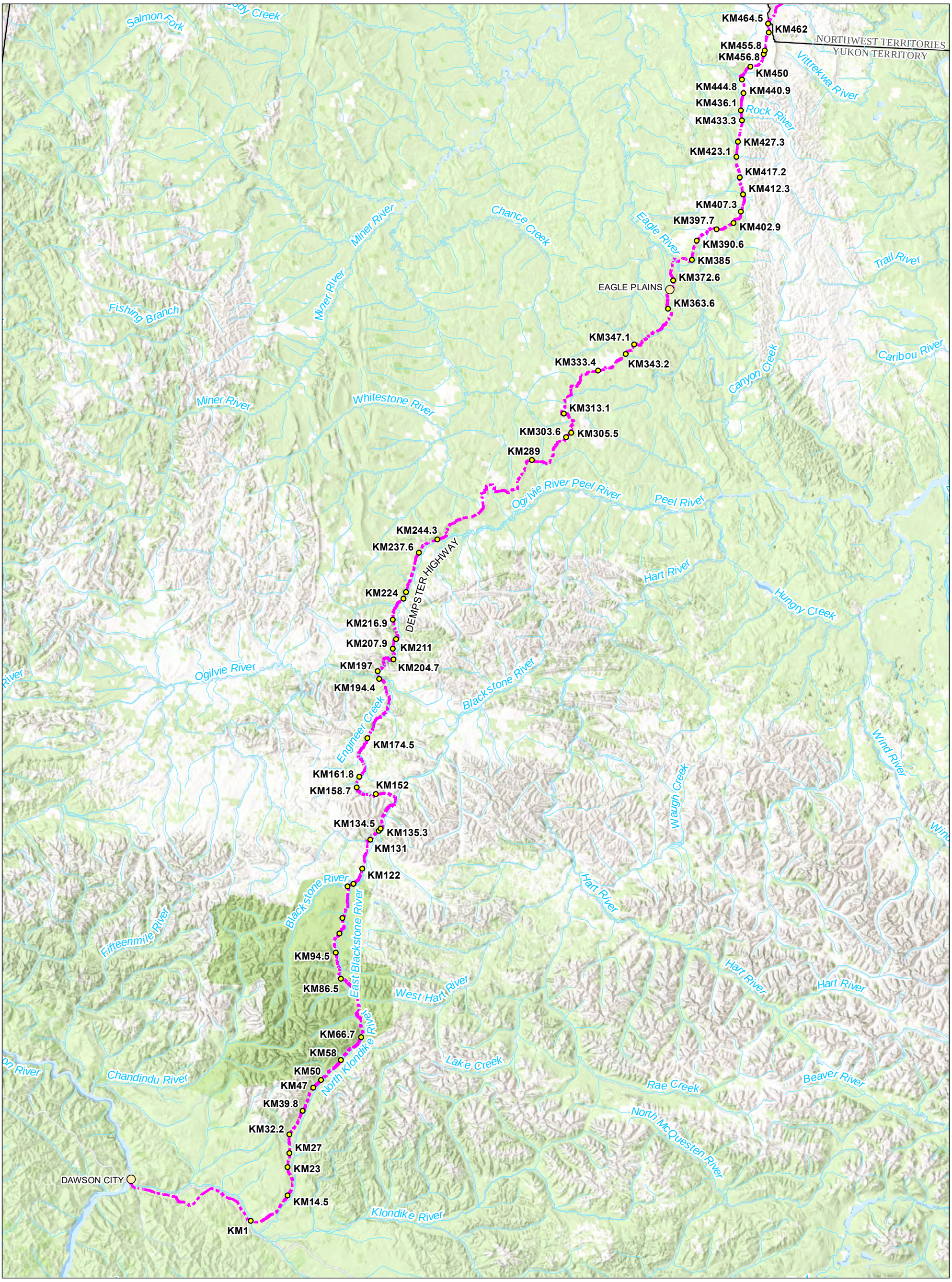
All equipment and materials needed for construction of the Project will be mobilized to site by trucks on the existing all-weather highways, namely the Klondike and Dempster highways. Equipment and materials will include cable reels, conduit, bridge troughing, handholes, building components and equipment, mobile camps or motorhomes, and equipment for cable installation.

Temporary staging areas will be required to allow access for personnel and equipment within the ROW. Design and construction will need flexibility during construction for these ancillary features, so the exact locations will be determined as needed in the field.

Direction has been provided by the Government of Yukon, Highways and Public Works, that temporary staging during construction can be located at existing quarry and road maintenance depot sites along the route. These will be used to the extent possible. Identified staging areas include the following:

- Klondike Highway Maintenance Camp (km 64 of the Dempster Highway);
- Ogilvie Highway Maintenance Camp (km 198 of the Dempster Highway) ;
- Eagle Plains Maintenance Camp (km 369 of the Dempster Highway);
- NWTel storage yard (Dawson City);
- Private industrial properties in communities along the route (Eagle Plains). Agreements with the property owners would be established ahead of time; and,
- Existing quarries owned by Government of Yukon on the Dempster Highway, as shown in **Figure 3-1**.

Final locations for staging areas are dependent on logistical needs during construction. The Proponent will use of up to five pre-existing staging areas for equipment and materials at a time. Detailed staging and camp information will be provided by the contractor to the decision bodies and applicable regulators prior to the start of construction. No vegetation clearing is proposed for preparation and use of the staging areas.



Legend

- Quarry Location
- Community
- Dempster Fibre Project Center Line
- Territorial Boundary
- Highlighted Watercourse
- Watercourse
- Waterbody

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licenced under the Open Goverment License - Government of Yukon
- Basemap: ESRI World Topographic Map

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Dempster Fibre Project Permitting
Yukon

Quarry Locations along the Dempster Highway

103469-01	Production Date: Aug 14, 2019	Figure 3-1

Hemmera
An Ausenco Company

Yukon Government
Highways and
Public Works

Path: S:\Geomatics\Projects\103469\01\mxd\Fig3-1_103469_01_QuarryLocYK_190814.mxd

3.2.2 Project Equipment and Fuel Storage

A list of equipment anticipated for Project construction is included in **Table 3-1**.

Table 3-1 Project Equipment List

Equipment (Similar to)	Weight (ESTIMATED)	# of Items	Purpose
Crew Trucks	3,000 kg	8	Transportation of personnel, small equipment and fuel
Splice Technician Trucks (and equipment)	4,500 kg	2	Splicing of fibre at handhole locations
Mechanic Truck	5,000 kg	2	Repair of equipment and tools
Track Hoe	10,000 kg	2	Construction of drill pads and HDD assist
Rubber Tire Backhoe (JD 710)	10,000 kg	1	Construction of drill pads and HDD assist
Telehandlers or bucket trucks	3,000 kg	2	Cable installation support
Screening Buckets	300 kg	4	Screen of backfill
Small D2/D4 Dozer	8,000 kg	2	Moving and carrying of reels, conduit and plowing
Large D3 Crawler/Tractor	12,000 kg	2	Moving and carrying of reels, conduit and plowing
20 Ton Boom Truck	7,500 kg	1	Carrying and installation of cable/conduit from roadway
Reel Trailers (loaded)	3,500 kg	4	Transporting of cable and conduit
ATV (side by side or equivalent)	600 kg	4	Transportation, shallow burial, surface lay
HDPE Fusion Machine	100 kg	2	Splicing of conduit
Jetting Trailer and Jetting Equipment	1,500 kg	2	For installation cable within conduit
JT5/10 Horizontal Directional Bore Rig (<150mm). 100m Capacity	3,300 kg	3	Horizontal Direction Drilling
Drill Mud Vacuum	5,000 kg	4	Containment and collection of drill mud
Transport Flat Bed – Trailer hauler	12,000 kg	2	Transportation of equipment
Compressor (Min 375CFM)	200 kg	3	HDD support
HDD 440 Drill	45,000 kg	1	HDD at ferry crossings
Geotechnical Drill	5,000-25,000 kg	3	Drilling boreholes
Loader	24,000 kg	2	Cable installation support
Camp – Per Spread			
Trailer mounted sleeper unit	15,000kg	4	Camp Sleeping Quarters
Trailer mounted kitchen unit	15,000kg	1	Camp Kitchen
Trailer mounted office	15,000kg	1	Camp Office
Trailer mounted recreation/meeting unit	15,000kg	1	Camp Recreation Room

The construction phase will require the use of diesel and gasoline fuel for mobile equipment and camp facilities. All fuel needed for the Project will be supplied by standard fuel trucks and distributed as needed

with pick-up trucks equipped with tidy tanks. Estimated construction fuel and containment requirements are presented in **Table 3-2**. A final list of fuel and storage requirements can be provided once the contractor is hired and prior to construction.

Diesel will be used for the majority of fueling. Gasoline will be used to fuel pick-up trucks and potentially for generators at the camps. Propane will be used for heating at the camps.

Table 3-2 Estimated Fuel and Fuel Storage Requirements

Fuel Type and Location	Containment Requirements (L)	Containment Type	Amount	Secondary Containment
Diesel p-50 (ULSDF): at staging areas	3,400	Double-walled fuel tank	2	Secondary tank and/or external secondary containment area
Diesel p-50 (ULSDF) at staging areas:	2,250	Double-walled fuel tank	2	Double-walled and/or external secondary containment
Diesel drums on trucks	235	Double-walled fuel tank	4	Secondary tank and/or external secondary containment area
Diesel drums at staging areas	235	New steel drums	20	Steel or polyurethane tub designed to hold 110% of the total volume and/or secondary containment area.
Gasoline (mid-grade) at staging areas	235	New steel drums	4	Steel or polyurethane tub designed to hold 110% of the total volume and/or secondary containment area.
Oils and Grease at staging areas	22	Polyurethane pail	20	Steel or polyurethane tub designed to hold 110% of the total volume stored.
Propane at camps	375	Propane Cylinder	10	n/a

3.2.3 Camps

Temporary camps will be constructed at existing quarries to accommodate work crews. Direction has been provided by the Government of Yukon that camps during construction can be located at existing quarries along the route. As such, no additional clearing will be required for camps.

The Proponent will operate one camp at a time. Once the Proponent deems it necessary to move a camp to a more suitable location (e.g., closer proximity to area of construction), all infrastructure will be mobilized from one camp location and moved to the next location.

Camps will be constructed to accommodate approximately 24 people, and up to 40 people if necessary, using modular camp trailers. Camps will include trailers for kitchen and dining, washhouse, sleeping, office, first aid, and recreation. Potable water will be hauled by the contractor or delivered by water truck and stored in appropriate tanks on-site. Non-potable water may be taken from water withdrawal sites. Waste (waste water, sewage, and domestic waste) will be disposed of in accordance with the Waste Management Plan (**Appendix E**).

3.2.4 Clearing

Route clearing along the ROW is proposed during the 2020 season and will utilize two primary techniques: mulching and hand slashing. Mulching involves cutting tall grass and shrubs or small trees using rotating blades mounted on a mechanized vehicle and hand slashing refers to cutting trees, branches or brush with hand-held tools. Project-specific requirements that dictate the use of a certain technique will depend on the location, ground suitability, environmental sensitivity, installation methodology and project scheduling.

Areas to be cleared for the Project are the cable alignment and temporary access trails. Clearing requirements will depend on the current status of vegetation control in the ROW conducted under regular highways maintenance. Temporary access trails will be required to allow access for personnel and equipment within the ROW. Project design and construction will need flexibility during construction of these ancillary features, so their exact locations will be determined as needed in the field. The area needed for cable installation varies greatly depending on the terrain, season, and other factors, but trails with a width of 1 m to 2 m are generally sufficient.

When selecting suitable locations within the existing ROW, existing disturbances will be used and cutting mature trees will be avoided to the greatest extent practical. Hand slashing will be utilized in sensitive environments and in riparian zones. These zones will be identified by a qualified environmental professional during the detailed design field pick up and indicated on the construction drawings. Where route clearing is required during the summer season, a bird nest sweep will be completed by a qualified professional (as required) in advance of the work. A complete list of mitigation measures for clearing is in **Section 7.4.3**.

Brush and timber will be disposed of in accordance with the Waste Management Plan (**Appendix E**).

3.2.5 Conduit Placement and Cable Installation

Construction methods include the following techniques:

- **Conventional and shallow-buried cable** using equipment to install the cable below the ground surface (**Section 3.2.5.1**);
- **Surface-laid cable** in sensitive terrain and wetland areas in frozen and non-frozen conditions (**Section 3.2.5.2**);
- **Horizontal Directional Drilling** (HDD) of fish-bearing streams, rivers, other waterbodies and challenging sections (**Section 3.2.5.3**);
- **Bridge** attachment of the cable to existing bridges (**Section 3.2.5.4**); and,
- **Aerial installation** of cable in selected sensitive or challenging construction areas and along Yukon Energy Corporation (YEC) Transmission Line poles for approximately 41 km adjacent to the Klondike highway (**Section 3.2.5.5**). Existing poles will be used whenever possible.

The preferred construction technique by segment is shown in the mapbook in **Appendix F**. This mapbook was developed using the Route Design Guide included in **Appendix D**. The Route Design Guide splits the Project into three segments, each with multiple sub-segments. For each sub-segment, preferred construction technique, culverts, and requirements for conduits are identified. The construction methods identified are subject to change based on observations in the field at the time of construction to best suit the conditions encountered. The process the contractor and design engineer will use to ensure the most suitable construction method is being used has been summarized in **Section 3.2**.

3.2.5.1 Conventional and Shallow Buried

Conventional and shallow-buried cable will be installed either by plowing or trenching. Shallow burial may be used in areas where permafrost is continuous, comparatively shallow and locally ice-rich. Conventional burial will be used in areas where thaw is not a concern and where the ground is stable (i.e., the southernmost section of the route).

Plowing is a standard method of installing conduit or cable using equipment affixed with a cable plow directly behind or just off to one side of it and large conduit reels on trailers in tow. A second tractor may be connected in front of the plow tractor to provide additional pulling force. Trenching involves digging a trench with a backhoe or trencher, laying the cable and then filling the trench. All sizes of trenchers are available, and don't need to be fibre specific equipment unlike plows.

Cables are buried up to a depth of 1,000 mm for conventional burial and 150 mm to 400 mm for shallow burial, depending on the depth of the organic layer.

Typical shallow-buried installation is shown in **Plate 3-1** and **Plate 3-2**.

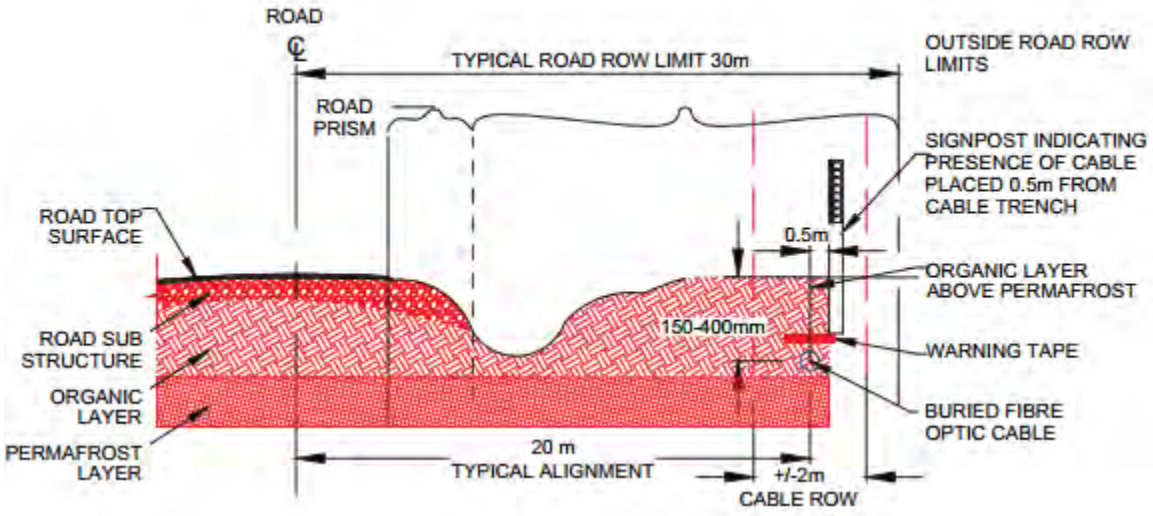


Plate 3-1 Typical Shallow Burial Installation - Negligible Permafrost

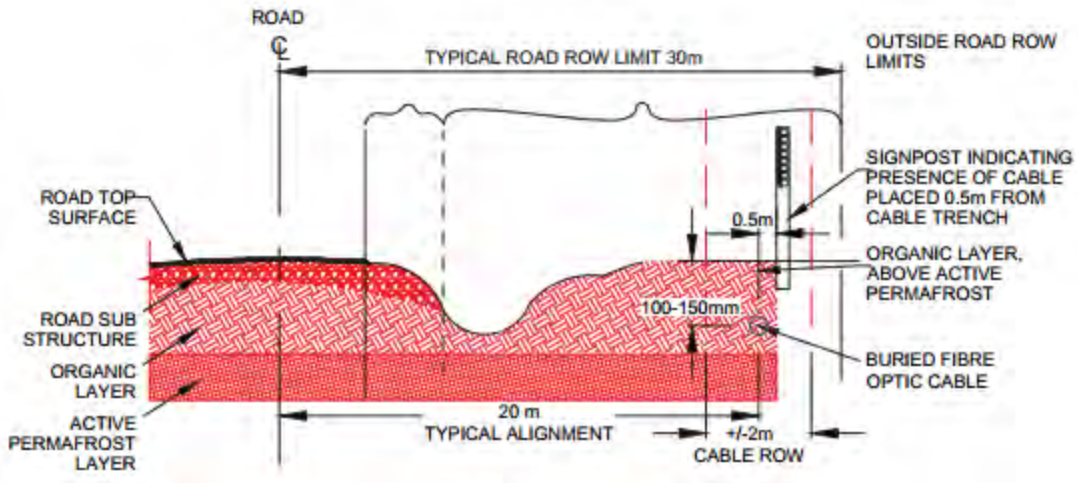


Plate 3-2 Typical Shallow Burial Installation – Continuous Permafrost

3.2.5.2 Surface Lay

The fibre optic cable will be laid on the ground surface where other methods cannot be used because slopes are too steep, or the ground is too rocky. Surface lay is also proposed for wetlands and sections where terrain is not accessible by equipment and the highway road prism must not be disturbed. Examples include areas where high road embankments or steep slopes prevent access by heavy equipment and steep slopes. Surface lay can be with or without conduit, depending on the circumstances. Especially where conduit is used, reasonable efforts will be made to clear obstacles from the path of the cable and lay it flat on the ground, but the conduit may be elevated in places due to uneven terrain. Where required, and to counteract the tendency of the conduit to coil, the crew may pin the conduit down with weights (e.g. a geotextile sand bag). However, because the conduit is stiff, there may be some depressions in the ground where the conduit is not in contact with the ground.

Some clearing will be required to allow surface placement of the cable as the crew will need regular access to the alignment during installation so they can move cable and reels to the alignment as needed. These access points will be established between 500 m and 1,000 m apart, and natural clearings will be utilized wherever possible. Offset plows with boom extensions will be used to either lift the cable into place or spool off cable as the surface-laid process travels along the highway. **Plate 3-3** shows a typical boom truck and associated equipment. **Plate 3-4** shows the typical placement of the boom truck on the highway.

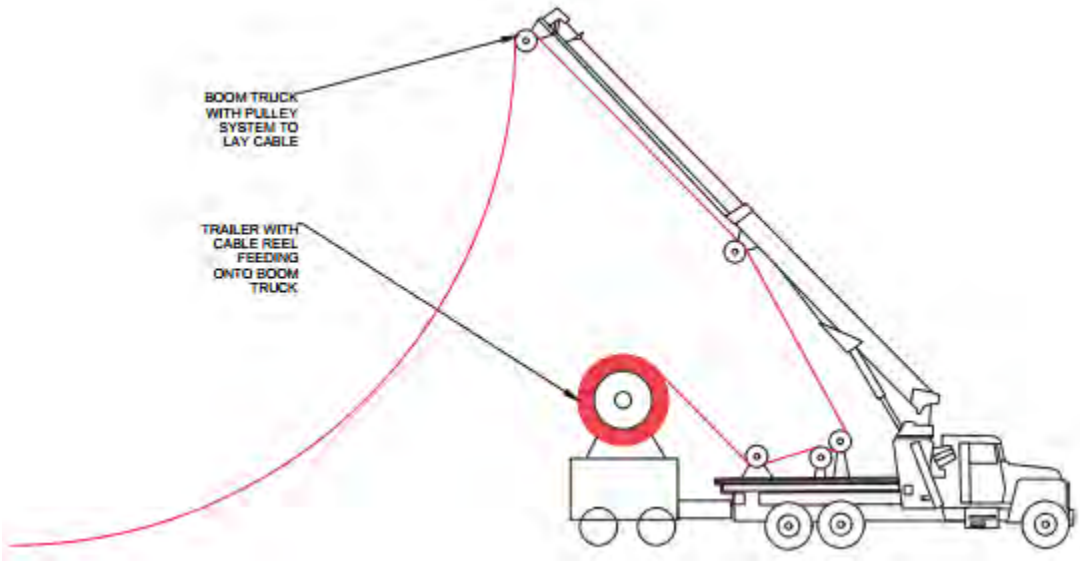


Plate 3-3 Typical Boom Truck and Equipment Used for Surface Lay

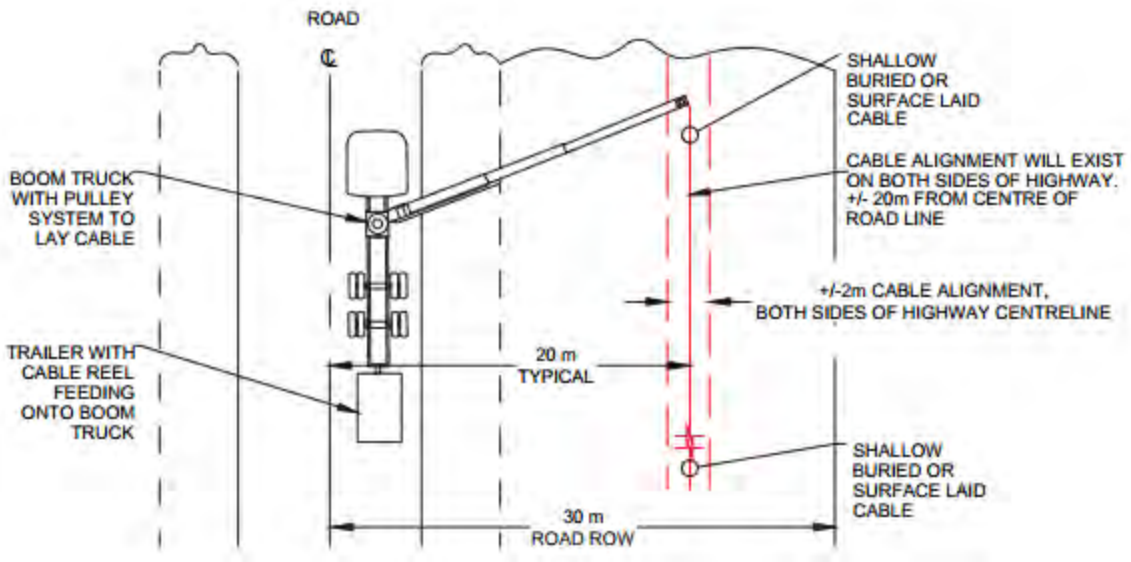


Plate 3-4 Typical Positioning of Boom Truck and Equipment Used for Surface Lay

3.2.5.3 Horizontal Directional Drilling

Horizontal Directional Drilling (HDD) is a standard industry technique to cross roads, hazards, watercourses, creeks and rivers in the installation of fibre optic cables and pipelines. HDD will be used as a construction technique in the following situations:

- Crossing of flowing watercourses where aerial crossings are unsuitable;
- Road crossings (e.g. when changing from one side of highway to the other, or to cross vehicle pull-outs or intersecting roads);
- Where rock outcrops cannot be avoided by alternative construction means;
- Areas where soil stability and ground conditions indicate significant risk of permafrost damage; and,
- Where direct-buried or surface-laid options are not practical.

There will be a large number of HDD crossings depending on final geotechnical requirements and field conditions. The use of HDD is anticipated to cross all major rivers without bridges, larger creeks, and any watercourses with flowing water and fish habitat. HDD will also be used on all Dempster Highway road prism crossings and any significant road turnouts or highway access roads along the route.

The design will utilize a small diameter drill size, up to 125 mm, in order to minimize disturbance of the soil substructure. In all HDD cases, a conduit will be pulled back and used to create the pathway for the cable. Typically, conduit is installed to a depth of at least 5 m to 6 m below the expected future creek bottom. **Plate 3-3** below shows a diagram of a typical HDD operation.

Only small HDD rigs will be used. Small drill rigs are self-contained units, which are used to create an underground path for conduit. Operationally, a small drill rig requires a work space of approximately 12 m x 12 m. Within the workspace drilling is further supported by an excavator, a fresh water supply, and a hydro-vac truck. Drilling also requires an entry point. A typical entry point is approximately 1 m x 2 m x 1.5 m deep and contains the drilling fluid. Depending on soil types, drill mud consisting of fresh water and

bentonite is typically used to maintain the integrity of the borehole during drilling. In most cases, the quantity of mud used for these smaller crossings is small enough that it can be left contained in the subsequent borehole once established.

For typical operations, a daily freshwater supply of between 20 m^3 and 40 m^3 is required for small rigs. The small HDD rigs operate using water and bentonite clay and typically do not produce more mud than the size of the entry pit excavation. There are two primary methods for drill mud disposal; overland or at an approved location. Overland disposal would only be considered for drill muds that are a water and/or bentonite mix and where suitable natural depressions exist.

All material excavated for development of the entry pits will be side-casted for replacement once the conduit connection is complete. In upland areas, the disturbed terrain will be allowed to vegetate naturally. In riparian and wetland areas, if willows naturally occur in the area, willow cuttings will be applied to the backfilled pits to facilitate natural regrowth. Boughs and branches may also be placed over top of the drill site to decrease the likelihood of erosion. Upon the successful completion of each HDD, all equipment and materials will be removed from the site and the area will be cleaned up.

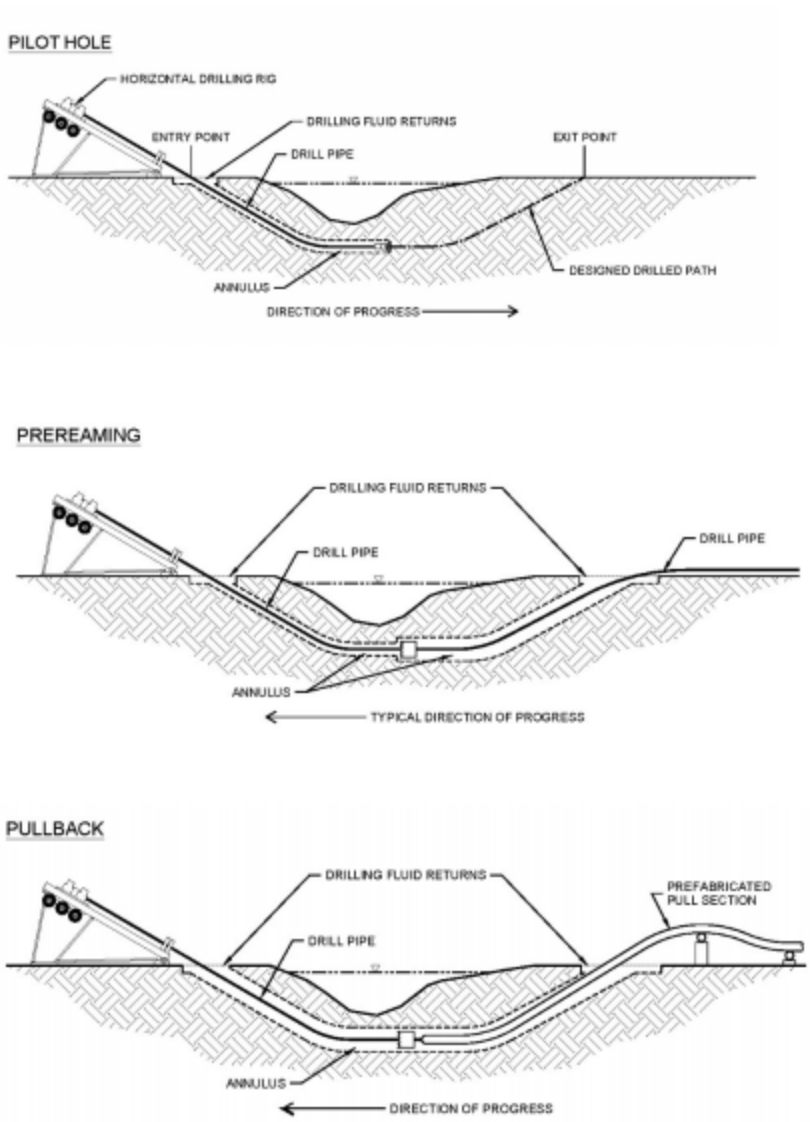


Plate 3-5 Typical HDD Components

3.2.5.4 Bridge Attachment

Table 3-3 summarizes the six locations where the highway (Klondike or Dempster) crosses rivers by means of major bridges in Yukon. The proposed method for crossing the river with the cable at these bridge locations is indicated. The preferred crossing methods indicate the most cost-effective and least risky approach, while the alternative crossing method indicates other methods that are feasible but will result in higher cost and risk. Typical methodology for bridge attachment is shown in **Plate 3-4**.

Table 3-3 Methods for Bridge Crossings

Bridge	Location	Primary Crossing Method	Alternate Crossing Method
Klondike River (Klondike Highway)	Klondike	Bridge attachment	Aerial
Klondike River (Dempster Highway)	km 0.2	Bridge attachment	Aerial or HDD
Blackstone River	km 114.5	Bridge attachment	HDD
Engineer Creek	km 194.3	Aerial	HDD
Ogilvie River	km 194.6	Bridge attachment	Aerial or HDD
Eagle River	km 377.9	Bridge attachment	Aerial

The final method and location for cable placement will be determined in consultation with the Yukon Department of Highways and Public Works, possibly resulting in alternate crossing methods.

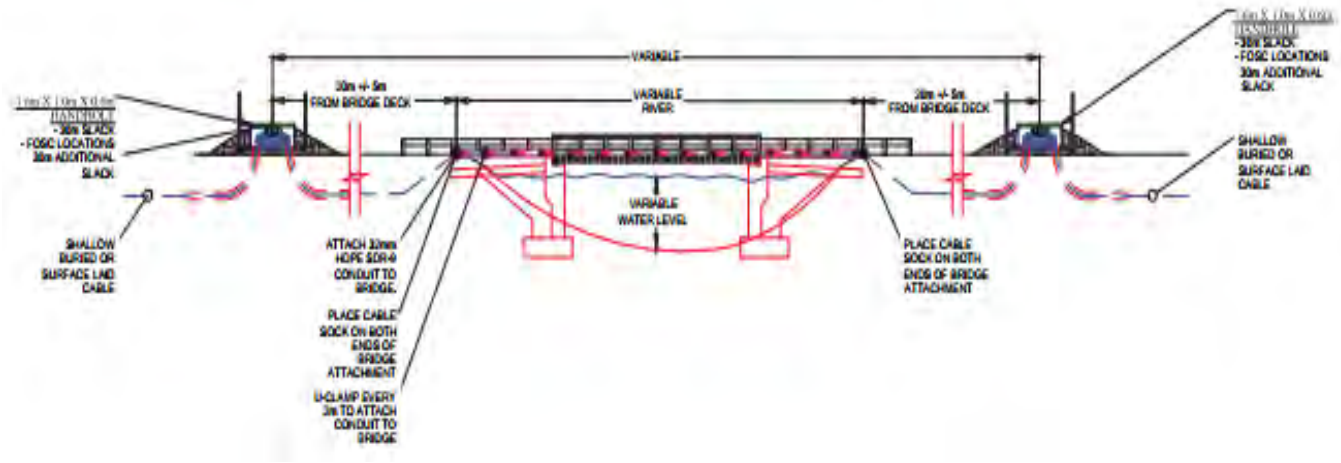


Plate 3-6 Typical Bridge Attachment Methodology

3.2.5.5 Aerial

Aerial installations are proposed for certain sections of the Project. Cables will be installed on existing poles along the highway where challenging physical conditions exist in the vicinity of Dawson City. When determining which areas are suited for aerial installation, the Proponent will consider constraints such as access for equipment and personnel, sensitive terrain, and difficult drilling conditions.

The longest aerial stretch on the Project is roughly 41 km from the Klondike Highway to Dawson City limits. Existing poles on the YE power transmission line will be used wherever possible. To be compatible with the long spans and high voltage of the YE transmission line, all-dielectric self-supporting cable will be used for this section. For the other aerial installations, the cable will be lashed to the messenger strand along the existing pole lines.

New installation of poles is proposed along the Dempster highway where surface-laid method is high-risk or not feasible, or where the use of HDD is either too risky, impractical or too costly due to the length of the crossing required or the ground geology. Such constraints could include, for example, a large ravine or gorge, washout areas, high erosion areas, or large standing water crossings. The Proponent will work to limit new aerial sections and will use them only where needed. Final decisions regarding methods for cable placement will be based on field information gathered to guide the detailed design.

To reduce construction risk associated with HDD at the larger, more challenging river crossings, aerial cable is proposed at Blackstone River and Engineer Creek. For these crossings, between two and four new poles will be placed at each crossing, with one or two poles on each side. The total number of poles will depend on the aerial length required to cross the river and other constructability constraints.

New aerial construction will require new wooden or steel poles, which can be augered in place in most mineral soils. In sensitive permafrost areas, grillage foundations may be required for the pole bases and guy anchors. These structures are built up from a grid of timber, metal or fibreglass members, placed on a layer of aggregate covering the natural ground and loaded with stone. Additional design considerations include ice and wind loading and collision risk placement.

Table 3-4 summarizes the total aerial attachments expected for the Project.

Table 3-4 Estimate of Aerial Cable Expected

Location	Estimated Length (km)
Klondike Highway to Dawson City limits	41
Dawson City (from the edge of town to the Terminal Facility)	0.5
Along the Dempster Highway	25
TOTAL	**66.5**

3.2.5.6 Road Prism installation

Installation in the road prism is considered a last resort and would only be performed with approval from Government of Yukon's Transportation and Engineering Branch.

When cable installation is required within the road prism, it will be installed in a conduit which will be placed in a trench, backfilled and compacted (or as otherwise dictated by the Transportation and Engineering Branch). The cable will then be jetted or pulled through the conduit. In instances that pose a high risk of erosion of the road base such as the presence of an adjacent river, the cable will be installed on the upslope side of the road.

3.3 Operations

The Government of Yukon will own the DFP, but NWTel will operate and maintain the line for 20 years.

The Government of Yukon, Department of Highways and Public Works will perform informal inspections during quarterly site visits. Formal inspections will occur on an annual basis unless maintenance items are identified during informal inspections. A sample inspection form is included in **Appendix G**.

A formal Inspection and Maintenance Plan will be developed prior to the beginning of Project operations.

4.0 SUMMARY OF CONSULTATION

The Proponent recognizes the importance of consulting affected First Nations governments prior to making decisions about the Project. Consultation was initiated by the Proponent as early as possible in January 2019 to ensure First Nations had a reasonable period of time to review and prepare their views on the Project. Early consultation also provided the Proponent necessary time to give full and fair consideration of the views presented. Summaries of consultation for each affected First Nation are provided below. Plans for future consultation are described in the Consultation Plan in **Appendix H**.

4.1 Tr'ondëk Hwëch'in

On January 31, 2019, the Proponent initiated consultation with TH in a letter requesting a meeting to discuss TH treaty rights, interests, and values in the Project Area, if there may be adverse effects from the proposed Project, and if those impacts could or could not be mitigated.

An initial meeting with TH on the Project occurred on February 21, 2019. The Proponent presented the following about the Project to facilitate discussions and to identify any potential impacts to treaty rights, interests and values:

- Overview of the Project and Project details;
- Consultation overview;
- Construction methods and bridge crossings;
- Project interaction with environmental and socio-economic values;
- Employment and business opportunities; and,
- Discussion and next steps.

Maps of the Project were also provided showing the Project route in relation to TH's Traditional Territory to ensure that detailed information on the Project was provided for consideration.

Follow-up meetings on March 27 and May 17, 2019 were arranged to provide opportunities to learn about the Project as well as to provide Project updates to Chief and Council.

An Open House was held on June 12, 2019 to provide TH citizens an opportunity to learn about the Project and to raise concerns for Proponent's consideration.

4.1.1 Overview of Issues Raised

Environmental and socio-economic concerns raised by TH throughout Proponent's consultation were the following:

- Settlement Land C-3B – TH is conducting work on the parcel and indicated that it would be better to lay the fibre line in the ROW on the north side of the highway.
- Chapman Lake and R-19B – Project construction to accommodate ongoing erosion and washout along the Dempster Highway near Chapman Lake and to avoid construction on Settlement Land parcel R-19B.
- Settlement Land S-166B – Fibre line attached to existing poles that crosses through corner of the Settlement Land will would require Land Use Permit from TH.

- Caribou herd – Caribou is a major concern for TH, in particular, caribou herd movements along the Dempster Highway. Proponent's goal is to avoid work wherever the herd is active to minimize any potential effects, including reviewing appropriate installation methods to understand possible effects. The Proponent has also been in contact with the Porcupine Caribou Management Board (PCMB) to understand potential effects of the Project on caribou. See **Section 7.3** for the effects assessment on caribou and relevant mitigation measures.
- Fibre line markers – TH indicated orange buckets for the existing fibre line on Klondike Highway have negative impact on visual aesthetic landscape for TH. The Project should use other markings that do not impact the aesthetic landscape along the Dempster Highway.

4.1.2 Proponent Commitments / Mitigation

The Proponent has made the following commitments to address issues raised by TH:

- Settlement Land C-3B – The Proponent will not install the fibre line to the south of the highway.
- Chapman Lake and R-19B – The Project will be built to accommodate ongoing erosion and washout along the Dempster Highway near Chapman Lake and to avoid construction on Settlement Land parcel R-19B.
- Settlement Lands S-113B1, S-165B, and S-166B – A TH Land Use Permit application will be prepared for each of the three Settlement Lands.
- Caribou herd – See mitigation measures included in **Section 7.3.3**.
- Fibre line markers – The Proponent has committed to ongoing engagement with TH in finalization of marker design.

4.2 Vuntut Gwitchin First Nation

On January 31, 2019, the Proponent initiated consultation with VGFN in a letter requesting a meeting to discuss VGFN treaty rights, interests, and values in the Project Area, if there may be adverse effects from the proposed Project, and if those impacts could or could not be mitigated.

An initial meeting with VGFN on the Project occurred on March 5, 2019. The Proponent presented the following about the Project to facilitate discussions and to identify any potential impacts to treaty rights, interests and values:

- Overview of the Project and Project details;
- Consultation overview;
- Construction methods and bridge crossings;
- Project interaction with environmental and socio-economic values;
- Employment and business opportunities; and,
- Discussion and next steps.

Maps of the Project were also provided showing the Project route in relation to VGFN's Traditional Territory to ensure that detailed information on the Project was provided for consideration.

An Open House was held on April 29, 2019 to provide VGFN citizens an opportunity to learn about the Project and to raise concerns for Proponent's consideration.

4.2.1 Overview of Issues Raised

Environmental and socio-economic concerns raised by VGFN throughout the Proponent's consultation were the following:

- VGFN Settlement Lands – In areas where VGFN Settlement Lands are located near the highway ROW, concern was raised about how the fibre line will restrict access and future development of access roads from the ROW to Settlement Lands.

4.2.2 Proponent Commitments / Mitigation

The Proponent has made the following commitments to address issues raised by VGFN:

- The fibre line will be located on the opposite side of the ROW away from Settlement Land as much as possible. Communication on this matter with VGFN will be ongoing during final Project design.

4.3 First Nation of Na-Cho Nyäk Dun

On January 31, 2019, the Proponent initiated consultation with FNNND in a letter requesting a meeting to discuss FNNND treaty rights, interests, and values in the Project Area, if there may be adverse effects from the proposed Project, and if those impacts could or could not be mitigated. On February 28, 2019, FNNND requested that the Proponent consider Project effects on heritage resources and caribou herd.

4.3.1 Overview of Issues Raised

Two environmental and socio-economic concerns were raised by FNNND:

- Caribou – FNNND mentioned caribou may be affected by construction activities and that the schedule and timing during construction should avoid times when caribou is in the Project Area.
- Heritage resources – FNNND raised the importance of Dempster Highway to the First Nation as an area that is commonly travelled for traditional activities, and requested the Proponent to examine potential effects of construction activities on heritage resources.

4.3.2 Proponent Commitments / Mitigation

The Proponent has made the following commitments to address issues raised by FNNND:

- Caribou: Effects to caribou have been considered and mitigation measures have been developed to address FNNND concerns. The Proponent has also been in contact with the PCMB to understand potential effects of the Project on caribou.
- Heritage resources: Heritage resources area assessed as a VC, and heritage studies were completed for the Project.

4.4 Gwich'in Tribal Council

On January 31, 2019, the Proponent initiated consultation with GTC in a letter requesting a meeting to discuss Tetlit Gwich'in treaty rights, as well as Gwich'in interests and values in the Project Area. On February 20, 2019, The Proponent met with GTC to discuss consultation process on the Project. On April 10, 2019, the Proponent presented the following about the Project to facilitate discussions and to identify any potential impacts to treaty rights, interests and values:

- Overview of the Project and Project details;
- Consultation overview;
- Construction methods and bridge crossings;
- Project interaction with environmental and socio-economic values;
- Employment and business opportunities; and,
- Discussion and next steps.

Maps of the Project were also provided showing the Project route in relation to the Secondary Use Area to ensure that detailed information on the Project was provided for consideration.

An Open House on the Project was held on April 24, 2019 to provide the community and GTC members an opportunity to learn about the Project and to raise concerns for the Proponent to consider.

4.4.1 Overview of Issues Raised

Environmental and socio-economic concerns in the Yukon raised by GTC throughout Proponent's consultation were the following:

- Caribou and caribou habitat – Construction activities may impact caribou populations along the Dempster Highway.
- Forest fires – GTC asked whether the fibre line is susceptible to forest fires. The Proponent responded that there is little risk to the line when it is buried 10 cm or deeper underground. The Proponent will assess the risk if any sections of the fibre line are laid on the surface.
- Monitoring and traditional knowledge – GTC requested that results of wildlife and environmental monitoring during construction be shared.

4.4.2 Proponent Commitments / Mitigation

The Proponent has made the following commitments to address issues raised by GTC:

- Caribou and caribou habitat - Effects to caribou and caribou habitat have been considered and mitigation measures have been developed to address GTC concerns. The Proponent has also been in contact with the PCMB to understand potential effects of the Project on caribou.
- Forest fires –The Proponent has assessed the risk to forest fires. As a mitigation, cable is being buried whenever possible (though not if the fire risk is outweighed by environmental risk).
- Monitoring and traditional knowledge – The results of wildlife and environmental monitoring during construction will be shared with GTC.

4.5 Tetlit Gwich'in Council

On January 31, 2019, the Proponent initiated consultation with TGC in a letter requesting a meeting to discuss Tetlit Gwich'in treaty rights, as well as Tetlit Gwich'in interests and values in the Project Area. Working with GTC and TGC, the Proponent held two Open Houses (April 26 and May 8) in Fort McPherson to meet with TGC and presented the following about the Project to facilitate discussions about impacts to treaty rights, interests and values:

- Overview of the Project and Project details;
- Consultation overview;
- Construction methods and bridge crossings;
- Project interaction with environmental and socio-economic values;
- Employment and business opportunities; and,
- Discussion and next steps.

Maps of the Project were also provided showing Project route in relation to the Secondary Use Area to ensure that detailed information on the Project was provided for consideration.

4.5.1 Overview of Issues Raised

Issues raised by TGC were related to business and contract opportunities during construction of the Project. No environmental and socio-economic concerns were identified TGC.

4.5.2 Proponent Commitment/Mitigation

As no issues were raised no specific commitments or mitigation measures were required.

5.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT METHODOLOGY

The assessment methodology outlined in this section provides a structured framework that is consistently applied to all valued components. The following guidance documents were considered when developing the Project's effects assessment methodology:

- *Proponent's Guide to Project Proposal Submission to a Designated Office* (YESAB 2010)

This methodology makes use of assessment terms Valued Components (VCs), defined as elements of the environmental and socio-economic systems valued for environmental, scientific, social, aesthetic, or cultural reasons.

The assessment methodology for VCs follows the main steps described below:

- Assessment scoping;
- Establishing assessment boundaries;
- Establishing baseline conditions;
- Identifying Project-related interactions and potential effects;
- Assessing potential effects; and,
- Significance determination.

5.1 Assessment Scope

The scope of the effects assessment focuses the application on the Project activities with the greatest potential to cause significant adverse effects on selected VCs. The VCs selected for this assessment were based on Project relevance and importance to First Nations, government agencies, and stakeholders, as well as previous assessment documents for related fibre optic projects in Yukon. VCs selected are discussed further in **Section 6.0**.

5.2 Establishing Assessment Boundaries

Assessment boundaries have been identified to define the spatial and temporal extent of the assessment. The spatial assessment boundaries are based on the spatial characteristics of the Project and the VC, and the areas where the Project-VC interactions and effects are expected to occur. Temporal boundaries encompass periods when the Project is expected to affect VCs. The temporal boundaries were determined based on the timing and duration of the Project. The spatial and temporal boundaries for the assessment of the Project are defined in **Table 5-1**.

Table 5-1 Spatial and Temporal Boundary Definition

Boundary	Definition
Spatial Boundaries	The spatial boundaries of the Project Area are 30 m on either side of the highway center line. The route of the fibre line is described in **Section 1.2**.
Temporal Boundaries	The temporal boundaries for the assessment of the Project covers the construction, operation and maintenance of the fibre optic line. The Government of Yukon has leased the fibre line to NWTel for a 20-yr term. To include permitting and construction timelines with some contingency, the temporal scope of this assessment is 25 years.

5.3 Establishing Baseline Conditions

The first step in performing an environmental and socio-economic effects assessment is to understand the existing environmental and socio-economic conditions currently present within the assessment area. The existing environmental and socio-economic conditions within the Project Area are based on a number of sources including historic literature, recent technical reports, databases, monitoring programs, government information, and first-hand knowledge. A summary of existing conditions is provided as part of each VC assessment to establish the setting for the assessment of Project-related effects on each VC. The level of detail provided for the existing conditions is sufficient to enable potential Project–VC interactions to be identified and understood.

5.4 Identifying Project-Related Interactions and Potential Effects

A key step in performing the environmental and socio-economic effects assessment is to understand the Project-related activities that are proposed and how those activities are likely to interact with the selected VCs. The intensity of the interaction will result in the potential effect on the VC and will ultimately dictate the mitigation measures implemented to minimize the effect of that interaction. The intensity of the interaction may be “none”, “negligible”, or “potential”. All Project components/activities that will not interact with a VC and will not result in potential effects are not considered further in the assessment. Where a potential interaction is predicted, a potential effect is identified and carried forward in the assessment. Where there is potential for the effect to be significant, mitigation measures are developed.

Consistent with direction provided in *YESAA*, each VC assessment section includes descriptions of mitigation measures of relevance to the particular VC to eliminate, reduce, or control adverse Project-related effects, as well as measures contained in industry codes and standards. The effectiveness of mitigation measures in reducing the potential effect is considered in the effects characterization.

5.5 Effects Characterization and Determination of Significance

For each VC, an effects characterization is performed, which evaluates the potential Project-specific effects with the implementation of the mitigation. Each effect is characterized based on its direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and probability of occurrence. Each VC assessment section provides a description of the relative context for the assessment in terms of the resiliency and sensitivity of the VC. General definitions for these characteristics are presented in **Table 5-2**.

Table 5-2 Residual Effect Characteristics

Residual Effect Characteristic	General Definition	General Rating
Direction	Identifies whether the residual effect will be adverse or positive	· Adverse · Positive
Magnitude	Size or severity of the residual effect relative to the existing condition of the VC, generally measured in terms of the proportion of the VC affected within the Project Area, relative to the range of natural variation (or historic variation in the case of human environment VCs)	· Low · Moderate · High
Geographic Extent	Geographic area where the residual effect is likely to occur	· An area within the Project Area
Timing	Occurrence of the residual effect with respect to a temporal attribute important to the VC (e.g., time of day, season, stage in life cycle, etc.)	· VC-specific
Frequency	How often the residual effect is likely to occur, taking into account VC-specific temporal characteristics	· Infrequent · Frequent · Continuous
Duration	Length of time the residual effect to the VC is likely to persist, taking into account VC-specific temporal characteristics	· Short-term · Long-term · Permanent
Reversibility	Degree to which the residual effect can be reversed once the causal factors cease; irreversible effects are considered to be permanent	· Fully reversible · Partially reversible · Irreversible
Context	The extent to which the VC has been affected by past and present environmental and socio-economic processes and conditions, and its potential sensitivity to the Project-related residual effect, and its ability to recover from that effect	· Undisturbed · Disturbed · Resilient · Sensitive
Probability of occurrence	Likelihood that the residual effect will occur, taking into account how probable it is that a disturbance will actually be caused by the Project or that a specific mitigation will be successful	· Likely · Unlikely

The significance of effect on the VC will be assessed based on the effects characteristics, and the likelihood of the effect. The likelihood of the effect is in part determined by the scientific certainty relative to the quantification of the effect, scientific certainty relative to the effectiveness of the proposed mitigation, and professional judgement based on prior experience in assessing effects and the known effectiveness of proven mitigation measures. The rationale for the determination of significance is provided for each VC.

6.0 VALUED COMPONENT SCOPING

Valued ecological, social, cultural, and economic components (VC) identified for the Project form the basis of the assessment conducted in **Section 7.0**. These components were selected based on the results of environmental and archaeological field studies, literature reviews, consultation with First Nations, and professional expertise. The valued components are described in **Section 6.1**, along with a rationale for their selection. The assessment in **Section 7.0** focuses on these valued components.

Issues that were identified but were NOT carried through for assessment are described in **Section 6.2**. These issues were investigated for potential interactions with the Project and were determined to not require further assessment. **Section 6.2** provides a description of the issues, and a rationale for not including them as valued components. Mitigation measures and best practices are identified for these issues where applicable.

6.1 Valued Components Selected

The VCs selected for assessment are permafrost, fish and fish habitat, wildlife and wildlife habitat, vegetation and wetlands, heritage resources, and Settlement Lands.

6.1.1 Permafrost

Permafrost was selected as a VC as there is a potential interaction between permafrost and Project activities. Permafrost plays a vital role in influencing northern ecosystems and hydrological systems. Seasonal fluctuations in temperature, occurrences of wildfire, and anthropogenic activities all cause changes to the active layer of permafrost (i.e., the surface layer) (McKillop et al. 2016a). However, long-term increases in temperature in response to environmental disturbances associated with human activity can cause permanent warming and thawing of permafrost. Unmitigated disturbances to permafrost can lead to changes in drainage patterns. These changes can cause lakes or wetlands to expand or drain, and vegetation communities to change; landslides and ground slumping can result (McKillop et al. 2016a). Large-scale changes in landscape, such as ground slumping, can present challenges to northern development and create challenges for northern infrastructure integrity, specifically the long-term viability of northern highways.

There is permafrost in the vicinity of the Project which construction activities might interact with to cause an adverse effect. During meetings with First Nations and regulators, permafrost was identified as a key issue. Given the lack of resiliency for permafrost to adapt to change, maintaining the structural integrity of permafrost must be paramount for this Project.

6.1.2 Fish and Fish Habitat

Fish and fish habitat were selected as a VC as there is a potential for interaction between fish and fish habitat and Project activities. Fish are valued by First Nations and other Yukon residents; species including Arctic grayling (*Thymallus arcticus*), chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*O. keta*), burbot (*Lota lota*), northern pike (*Esox lucius*) and whitefish (multiple species; *Coregonus* spp.) are of recreational, traditional, and cultural importance. These species provide a valued food source, are of recreational value, and in the case of the salmon species, are of commercial value. The environmental components important to the health of fish species include suitable habitat, surface water quality, and the presence of benthic invertebrate and phytoplankton populations that provide food sources for the fish species.

6.1.3 Wildlife and Wildlife Habitat

Wildlife and wildlife habitat were selected as a VC as there is a potential for interaction between wildlife and wildlife habitat and Project activities, wildlife and wildlife habitat are valued as important ecological components, for aesthetic and cultural reasons, and as a food source, among other reasons. Sensitive species and/or habitats will be given special consideration within this VC. The indicators used to describe and evaluate potential Project-related effects on wildlife and wildlife habitat include habitat loss and reduced habitat effectiveness, mortality, and barriers to movement.

6.1.4 Vegetation and Wetlands

Vegetation and wetlands were selected as a VC because there is a potential for interactions with Project activities, and because of their role supporting biodiversity and wildlife habitat. Further, they are valued by First Nations and local residents who may rely on certain species as a subsistence and economic resource. Project activities may disturb, change, or remove vegetated areas, including riparian habitat, habitat containing traditional and medicinal plants, and ecological communities that may host rare plants or wetlands. Project activities will generate emissions and fugitive dust which may decrease vegetation health through increases in trace metal concentrations, and activities may introduce or spread invasive plant species.

6.1.5 Heritage Resources

Heritage Resources were selected as a VC because of the value of heritage sites and historic resources rests within their context in the land in which they are located and there is potential for interactions with Project activities. Once disturbed or removed, that value cannot be restored. The term “heritage resources” is used here to refer to archaeological resources, historical resources, and paleontological resources collectively (i.e., all are considered to be types of heritage resources). In Yukon, the *Historic Resources Act* (RSY 2002, c.109) and Archaeological Sites Regulation contain legislation that mandates the management and protection of Yukon archaeological, historical, and paleontological resources. This legislation applies to heritage resources on both private and public land that are older than 45 years. Archaeological, historical, and paleontological resources are protected from unpermitted surveys, disturbances, alterations, or excavations.

6.2 Other Considerations

Other valued components considered in our report but not included in the effects assessment include air quality, tourism and aesthetics, land use and recreation, natural resource harvesting, transportation, and communication services.

6.2.1 Air Quality

Air quality was considered as a potential VC for the assessment. However, given the remoteness of the Project site, the relatively short duration of the Project, and the progressive nature of construction, the air quality along the Dempster Highway will not deteriorate with the installation of the fibre line. The construction phase of the Project will involve burning of fossil fuels to operate the equipment to install the line. Emissions from equipment will be relatively low and localized to the areas of active construction. Additionally, the construction phase of the Project is only projected to last two years at which point air quality will return to baseline conditions and will not have a lasting effect on local air quality. Therefore, air quality was not considered further in this effects assessment.

6.2.2 Tourism and Aesthetics

Tourism and aesthetics were considered as a potential VC due to the Klondike and Dempster Highway's use as a popular tourism route in the territory. Tourism and aesthetics were not carried forward in the assessment because the Project activities likely to affect tourism and aesthetics will be limited to the construction period, will be localized to the areas of active construction, and will return to baseline conditions following the end of the construction period.

Some infrastructure will be visible once construction is complete such as handholes, warning signs, marker posts, and surface laid cables. In addition, maintenance work may also be required over the 20-year lifespan of the project. Potential effects to tourism and aesthetics will be minimal to negligible given the fibre lines location within the highway ROW. Additionally, during consultation activities, input was received from TH on the design of warning signs and marker posts to be used during construction and to permanently mark the Project components once construction is complete. TH is interested in warning signs and marker posts that provide safety for motorists and land users, but that minimize intrusiveness to animal migration and wilderness tourism. As final decisions are made on Project markers, the Proponent will engage in further discussions with TH specific to warning signs and marker posts.

6.2.3 Land Use and Recreation

Land use and recreation were considered as a potential VC given the high volume of traffic along the Klondike and Dempster Highways and use of the area for traditional land use activities, recreational purposes, and economic activities (e.g., oil and gas exploration, mineral exploration, tourism operators, etc.). The Project will be adjacent to:

- TH Settlement Land parcels;
- VGFN Settlement Land parcels;
- Trapping Concessions ID#: 406, 27, 54, 30, 31, 23, 29, 20, 21, 16, 3, 387, 401;
- Outfitting Concession ID#: 1, 3, 2;
- Tombstone Territorial Park;
- Numerous placer claim blocks near Dawson; and,
- Quartz claim blocks along the entire route.

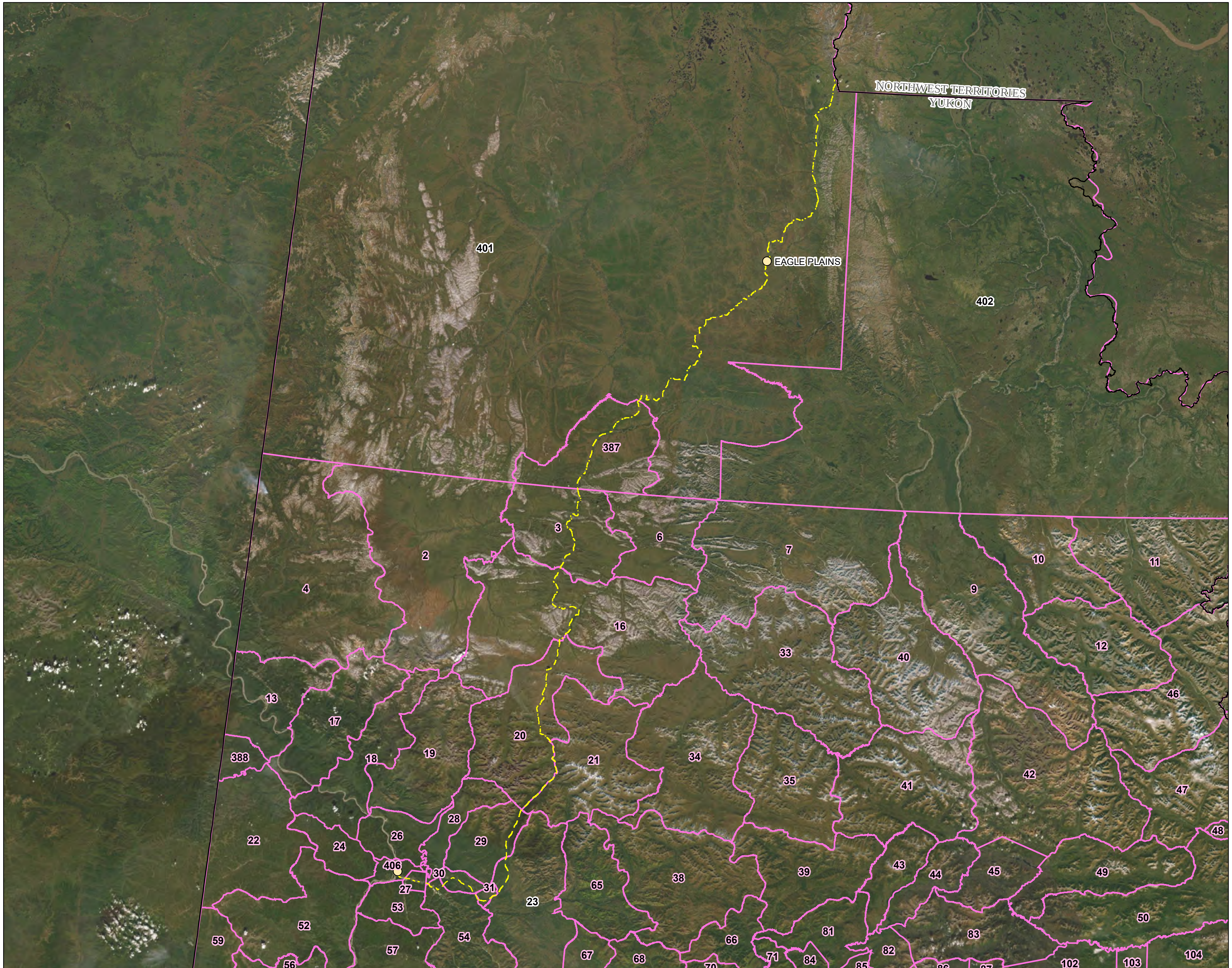
Trapping and outfitting concessions are shown on **Figure 6-1** and **Figure 6-2**, respectively. Trapline and outfitting concessions are not granted within Highway ROWs, though they may be adjacent. Trappers and outfitters may also use the ROW as a travel corridor. The Proponent will work with Environment Yukon to notify trappers and outfitters prior to construction activities adjacent to their concessions.

The Project is not likely to overlap with land use and recreation activities in the Klondike and Dempster Highway corridors. While other land users use the Klondike and Dempster Highways for access, land use and recreation activities mostly occur outside of the highway ROW. As the proposed fibre line will be located primarily within the highway ROW, the extent of effects interaction will be limiting access to areas of use. Some recreational traffic occurs along the Dempster Highway off the roadway but within in the ROW. Once the fibre line is installed, it is anticipated that the ability for recreational travel in the highway ROW will improve due to the vegetation clearing activities to make room for the equipment. In addition, the Proponent is committing to the following mitigations which will address potential interactions with other land users:

- A Traffic Management Plan will be developed by the contractor and the Proponent.
- At a minimum, one lane will always be open to allow traffic to continue to circulate.

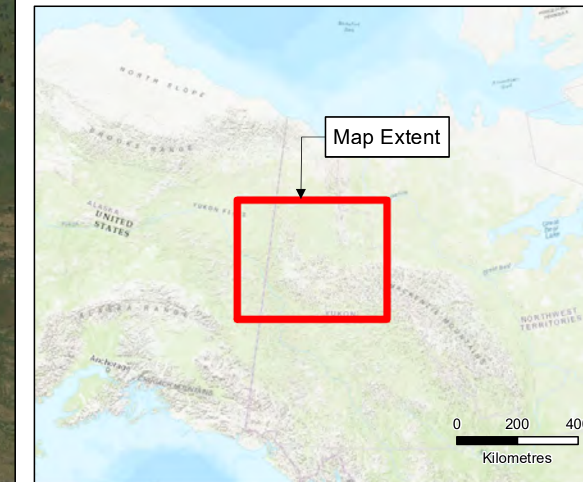
- Signage will be installed to direct recreational traffic within the ROW around or through construction areas.
- Permanent infrastructure (e.g., handholes, aerial poles, etc.) within the Highway ROW will be clearly marked to avoid collisions.

Effects will be localized to the areas of active construction within the ROW. Furthermore, the construction phase of the Project is only projected to last two years at which point access along the Klondike and Dempster Highways will return to baseline conditions. Therefore, it is not expected that Project activities will have lasting interactions with land use and recreation beyond the Project's construction schedule and is therefore not considered further in this assessment.



Dempster Fibre Project

Trapping Concessions



Legend

- Community
- Dempster Fibre Project - Yukon Portion
- Territorial Boundary
- Trapping Concession
- 387 Trapping Concession Number

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licenced under the Open Government Licence - Government of Yukon
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Topographic Map

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Highways and
Public Works

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NORTHWEST TERRITORIES
YUKON

EAGLE PLAINS

DAWSON CITY

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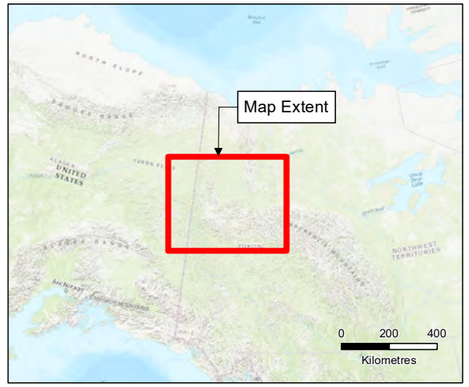
Dempster Fibre Project

Outfitting Concessions



Legend

- Community
- Dempster Fibre Project - Yukon Portion
- Territorial Boundary
- Outfitting Concession
- 1 Outfitting Concession Number

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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103469-01	Production Date: Jun 28, 2019	Figure 2

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6.2.4 Fish and Wildlife Harvesting

Fish and wildlife harvesting were considered as a potential VC given the importance of this activity for both traditional and subsistence purposes. In this context, harvesting includes hunting, fishing, and berry picking. Harvesting is important for First Nations to maintain their connections to their Traditional Territories and helps to preserve and enhance their culture, identity and values. Since the fibre line will be located primarily in the highway ROW, it is anticipated that the effects to opportunities to practice harvesting caused by Project activities will be minimal. During the fall and early winter, many hunters use the Dempster Highway ROW for hunting and travel purposes. If construction activities along the Dempster Highway overlap spatially and temporally with the Porcupine Caribou Herd migration, there could be potential interactions between Project activities and caribou hunters, specifically human health and safety. Negative effects caused by these interactions will be mitigated by the measures implemented in **Section 7.3.3**. Furthermore, potential effects to access restrictions and hunter/worker overlap will be mitigated through the Traffic Management Plan. Therefore, fish and wildlife harvesting were not considered further as a VC in this assessment.

6.2.5 Transportation

Transportation was considered as a potential VC because of the importance of the Klondike and Dempster Highways as transportation corridors for communities in the Yukon and the Northwest Territories. The Dempster Highway is the only all-weather road connecting the western Arctic to the national highway network. Project activities are projected to occur primarily within the highway ROW and will not affect the passage of vehicles on the Klondike or Dempster Highways. A Traffic Management Plan will be developed by the contractor and the Proponent that will address requirements for signage, anticipated traffic volumes, and worker safety. As harvesting of caribou is common along the Dempster corridor, signage will be placed in areas where workers are present to minimize safety concerns from hunting activities (e.g. stray bullets).

The Project will not require road closures. At a minimum, one lane will always be open to allow traffic to continue to circulate. Therefore, transportation was not considered further as a VC in this assessment.

6.2.6 Communication Services

Communication services were considered as a potential VC given the nature of the Project and the requirement to connect the fibre line to existing communication facilities. The existing NWTel microwave facilities along the proposed route will remain in place; however, they will be modified to serve as in-line amplifiers for the fibre optic line. During installation of the fibre line and following completion, current internet users will not experience effects to their internet performance. Installation of the Dempster fibre line will create a redundant fibre loop within Yukon and Northwest Territories, improving communication services in the north. As such, communication services was not considered further as a VC in this assessment.

7.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT

7.1 Permafrost

Most of the Dempster Highway is underlain by permafrost, ground that remains below 0°C for two or more years. Permafrost is a VC in the context of its contribution to ground stability and conditions to which other VCs are adapted. The active layer, the uppermost layer of permafrost that freezes and thaws annually, is an equally important element. The distribution and thickness of the active layer and underlying permafrost along the Dempster Highway relate to many factors including latitude, elevation, aspect, surficial material, drainage, snowpack, and vegetation (Williams and Burn 1996; Bonnaventure et al. 2012; McKillop et al. 2016a).

Changes in the ground thermal regime (near-surface temperature), whether from natural causes (e.g. climate change) or anthropogenic disturbance (e.g. installation of infrastructure), can affect the distribution and thickness of the active layer and underlying permafrost. Changes that result in warming of the ground can lead to warming and ultimately degradation, or thawing, of permafrost, a reduction in its extent and/or thickness. For example, stripping or compaction of organic cover can reduce the insulative properties of soil and trigger permafrost degradation. Changes that result in cooling of the ground can slow permafrost degradation or even initiate permafrost aggradation (formation), an increase in the extent and/or thickness of permafrost. In particularly cold regions (e.g., mean annual air temperature below -6°C), permafrost commonly rises (aggrades) into the base of gravel highway embankments.

Permafrost may or may not contain ice. The sensitivity of permafrost to natural and anthropogenic disturbances depends on its temperature and ice content (Burn 2004). All other things being equal, warm, ice-rich permafrost is most sensitive to disturbance. Cold, ice-poor permafrost is least sensitive to disturbance. Although there is no formal definition of ice-rich and ice-poor permafrost, permafrost with excess ice (i.e., the volume of ice is greater than the volume of voids in a thawed condition) is hereinafter considered ice-rich.

Ice-poor permafrost is comparatively insensitive to disturbance. Degradation of ice-poor permafrost tends not to manifest changes in ground surface topography, erosional processes or instability. Thawing of relatively dry material, or interstitial ice restricted to pre-existing voids, yields little to no settlement. As such, emphasis in the discussion that follows is necessarily given to sensitive, ice-rich permafrost.

Ground disturbance in areas of thaw-sensitive permafrost can trigger or exacerbate thermokarst, differential ground settlement that occurs in response to thawing of ice-rich permafrost. Physical effects of thermokarst can include alteration of surface and near-surface hydrology (including soil moisture content), mechanical and thermal erosion and consequential downslope sedimentation, and initiation or acceleration of mass movement processes. In turn, thermokarst can affect fish and fish habitat, vegetation communities, wildlife and wildlife habitat, heritage resources and aesthetics. Thermokarst also poses a risk to infrastructure such as the Dempster Highway or the proposed fibre optic line itself.

Understanding the potential effects of fibre optic line installation and maintenance on permafrost and, in turn, risk to infrastructure and other VCs requires an understanding of the distribution of thaw-sensitive permafrost along its proposed alignment and the installation and maintenance strategies available to mitigate significant, adverse effects. The following characterization of existing conditions, identification of potential effects and opportunities for mitigation, and evaluation of residual effects aligns with expectations outlined in YESAB's guideline document, *Geohazards and Risk: A Proponent's Guide to Linear Infrastructure* (Guthrie and Cuervo 2015).

7.1.1 Description of Existing Conditions

7.1.1.1 Overview

Permafrost occurs in all of Yukon's ecoregions (Smith et al. 2004), but its thickness and extent generally increase northward (Burn 2004). **Plate 7-1** provides a schematic representation of the variability in the approximate distribution and thickness of permafrost and overlying active layer, analogous to a north-south subsurface profile beneath the Dempster Highway corridor. Understanding of the distribution and characteristics of permafrost along the Dempster Highway corridor is based a number of sources of information, representing conditions from a national to a site scale (**Table 7-1**).

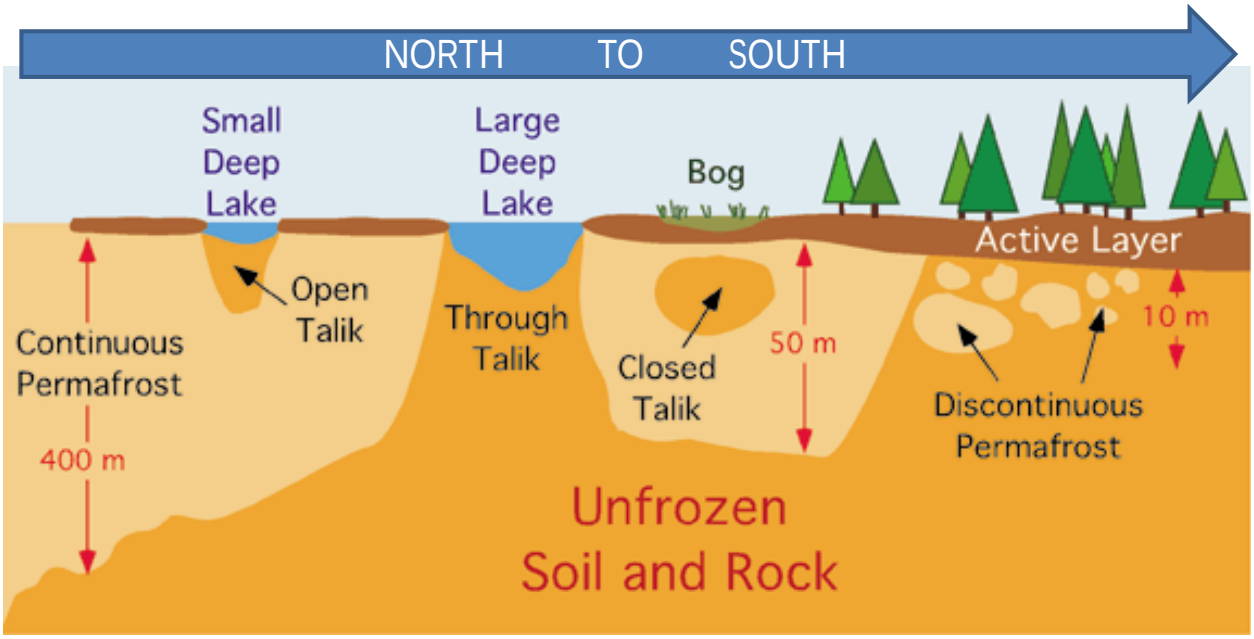


Plate 7-1 Schematic representation of the variable distribution and thickness of permafrost and the overlying active layer (modified from Pidwirny 2006). The profile can be visualized as illustrating the idealized trends along the Dempster Highway corridor, from the Richardson Mountains (left) to the turn-off at the North Fork River valley (right).

The southernmost portion of the Dempster Highway, along the North Klondike River valley up to North Fork Pass (km 82), is in the extensive discontinuous permafrost zone, where permafrost is estimated to underlie 50-90% of the ground (Heginbottom et al. 1995; Bonnaventure et al. 2012; Idrees et al. 2015; McKillop et al. 2016a). Once the highway crosses the continental divide, north of the Ogilvie Mountains and continuing beyond Eagle Plains, the highway traverses a region of continuous permafrost, where permafrost is estimated to underlie 90-100% of the ground (Heginbottom et al. 1995; Idrees et al. 2015; McKillop et al., 2016a). Permafrost may be locally absent in taliks (an area of unfrozen ground surrounded by permafrost) immediately below and alongside waterbodies that do not freeze to their bottoms in winter (**Plate 7-1**) (Smith et al. 2004).

The active layer varies spatially at regional and local scales. The active layer along the Dempster Highway is generally 1 to 2 m thick, becoming thinner to the north. A thicker active layer, up to several metres thick, occurs in areas severely burned by wildfire and/or altered by anthropogenic disturbances. Well drained, coarse-grained soils tend to have thicker active layers than poorly drained and fine-grained areas. In areas

of thick, mossy organic cover, active layers may be as shallow as just a few tens of centimetres (McKillop et al. 2016a). Active layer thickness also varies seasonally, typically beginning to thaw in spring and reaching its maximum thickness in mid-September. It also varies over a long temporal scale in response to climate change and other forcing mechanisms.

Evidence of permafrost degradation in association with climate change is widespread along the Dempster Highway corridor and across northern Canada. Increases in mean annual air temperature translate into warming and eventually degradation of permafrost. Increases in summertime rainfall totals and intensities further contribute to permafrost degradation by introducing more water into the active layer than its thickness is adapted to, thereby gradually transferring heat into underlying permafrost. Permafrost degradation has been accelerated by construction and operation of the Dempster Highway, primarily through (i) removal or compaction of organic material below the embankment, (ii) repeated and persistent accumulation of plowed snow along the toe of the embankment, and (iii) highway-edge ponding due to disruption of surface and near-surface drainage patterns.

7.1.1.2 Geographic Characterization

Regional differences in the characteristics and relative sensitivities of permafrost along the Dempster Highway can be described according to five sections of the corridor:

- ***Section 1: North Fork River Valley (km 0 to km 85)*** – This section of highway corridor gradually ascends the broad North Fork River valley, which was at least partly carved by glaciers draining the southern Ogilvie Mountains and then filled by outwash deposited by deglacial meltwater. Along much of its length, particularly in the south, the highway is constructed on remnant outwash terraces comprising sand and gravel. As the valley narrows toward North Fork Pass, the highway traverses lower slopes of the adjacent mountains and crosses numerous, large alluvial fans. Permafrost is discontinuous, but extensive, along this section of the highway corridor. It is interpreted to shallowly underlie nearly all poorly drained terrain where insulated by a thick organic cover. It is either absent or below a depth of relevance to fibre optic line installation within the outwash terraces and gravelly alluvial fans. Permafrost may be locally ice-rich, where present, but likely only near the base of the active layer in the form of pore and segregated ice. Evidence of thermokarst is isolated and rare.
- ***Section 2: Southern Ogilvie Mountains (km 85 to km 130)*** – This section of highway corridor descends till-mantled ground from its crest at North Fork Pass to the Chapman Lake area, which is characterized by its broad, pond-punctuated valley bottom underlain by fine-grained, morainal material and ice-contact stratified drift deposited at the margin of southward-retreating and stagnating glacial ice during the late Pleistocene. Buried glacial ice is interpreted to be preserved in the Chapman Lake area. Ice-wedge polygons are widespread on level ground. Chapman Lake and some surrounding ponds may have originated as kettles, during deglaciation, but have enlarged considerably over the Holocene through thermokarst subsidence and retrogressive thaw slumping. Ice-rich permafrost underlying the Chapman Lake area is actively degrading, in response to climatic warming and effects of highway construction (e.g. km 124, Idrees et al. 2015), and is particularly sensitive to disturbance.

- ***Section 3: Northern Ogilvie Mountains (km 130 to km 220)*** – This section of highway corridor parallels meandering creeks and rivers, locally confined by steep mountainsides, and crosses windswept mountain passes. The region is unglaciated. Permafrost is absent or at depth within sand and gravel recently deposited by fluvial processes, but present and shallow within inactive areas of floodplains and on terraces. Meanders are particularly dynamic along Engineer Creek, which drains steep, sparsely vegetated mountains mantled in colluvium and weathered bedrock, and have locally exposed ice-rich permafrost beneath the highway embankment. Ice-rich permafrost is likely relatively thin, where present, and restricted to the boundary with the active layer.
- ***Section 4: Eagle Lowland (km 220 to km 410)*** – This section of highway corridor crosses an unglaciated lowland dissected by millennia of fluvial erosion, colluviation and periglacial processes. The highway commonly follows broad ridges separating the dendritic headwater drainages, except at its crossing of the Eagle River. The ridge crests comprise thin, fine-grained regolith soils weathered from underlying sedimentary bedrock. The active layer is thin where moisture is retained by fine-grained soils but commonly extends into weathered bedrock on summits and other convex terrain features. Permafrost is likely ice-poor, as a broad generalization, but locally ice-rich based on the expression of ice-wedge polygons on some of the broader ridge shoulders and passes.
- ***Section 5: Richardson Mountains (km 410 to km 465)*** – This section of highway corridor gradually ascends the base of the western foothills of the Richardson Mountains toward the border with the Northwest Territories. The region is unglaciated. The highway crosses an apron of fine-grained alluvial and colluvial material formed by the coalescence of fans draining the Richardson Mountains. Underlying bedrock is exposed where the highway crosses incised streams and gullies. Permafrost is continuous and shallow within the fine-grained apron, as demonstrated by the prevalence of slopewash runnels (‘water tracks’) and extensive ponding along the upslope side of the highway embankment. A proliferation of shrubs alongside the highway reflects active layer thickening caused by snow plowing (inhibits cold penetration in winter and delays thaw in spring), disruption of surface and near-surface drainage (warms underlying permafrost), and fertilization by road dust (e.g. km 421, Idrees et al. 2015). Surface expressions of ice-wedge polygons and incipient retrogressive thaw slumps alongside the highway indicate permafrost is at least locally ice-rich and sensitive to disturbance.

7.1.1.3 Permafrost Mapping

An understanding of the local- to site-scale distribution and characteristics of sensitive permafrost along the Dempster Highway corridor is required to inform planning for the installation and maintenance of the proposed fibre optic line. McKillop et al. (2016b) completed preliminary mapping of permafrost-related ground movement potential following unmitigated disturbance within 50 m of the entire Dempster Highway. The mapping was based on interpretation of high-resolution orthophotography and LiDAR-derived elevation data from 2013/2014, with reference to other available data sources for calibration and regional context (**Table 7-1**). The classification is based on consideration of observed or potential lateral (e.g. solifluction, active-layer detachments) and/or vertical (thermokarst) ground movements following hypothetical disturbance from fibre optic line installation without application of measures to mitigate risk to permafrost. An interpretation of the relative thickness of the active layer is also included. This mapping provides advance knowledge of sections of the proposed alignment most sensitive to disturbance, where changes in the ground thermal regime initiated or exacerbated by cable installation or maintenance could affect permafrost and related ground stability and, through effects pathways, other VCs. It also establishes a basis for developing and prioritizing measures to mitigate risks to permafrost (**Section 7.1.3**).

Table 7-1 Primary Sources of Information on Permafrost Along the Dempster Highway (generally ordered from national (top) to site scale (bottom)).

Scale	Description	Pertinence	Limitations	Source(s)
National	Permafrost map of Canada	Generalized distribution and ice content of permafrost	Accuracy and precision inconsistent based on availability of source data	Heginbottom et al. 1995
National	Sensitivity of permafrost to climate warming in Canada	Mapping and characterization of the physical and thermal response of permafrost in Canada to warming.	Accuracy and precision inconsistent based on availability of source data	Smith and Burgess 2004
National	New ground ice maps for Canada	Refined ground ice maps based on paleogeographic modelling	Input data validity, conceptual validity and calibration of input values	O'Neill et al. 2019
Regional	Permafrost probability model of southern Yukon	30 m-gridded raster model of permafrost probability (0.0 to 1.0) based on latitudinal and topographic modelling and basal snow temperature measurements	Disregards influence of surficial material and vegetation	Bonnaventure et al. 2012
Regional	Permafrost and Ground Ice Conditions of Northwestern Canada	Generalized distribution and ice content of permafrost where data available	Accuracy and precision inconsistent based on availability of source data	Heginbottom and Radburn 1992
Regional	Quaternary geology of the North Klondike and upper Blackstone River systems (Dempster Highway km 0-139)	Mapping of terrain classification, sensitivity and engineering properties, based on field-checked aerial photograph interpretation	Only limited field checks for calibration of remote interpretations	Ricker 1968, 1977
Regional	Climate-driven thaw of permafrost preserved glacial landscapes, northwestern Canada	Semi-automated, raster-based identification of concentrations of retrogressive thaw slumps (indicators of ice-rich permafrost) in association with former glacial limits	Raster map grid cells 15 km x 15 km, and identification based on limited to no field checks	Kokelj et al. 2017
Regional to Site	Seismic shothole driller's lithostratigraphic log database and permafrost-related interpretations	Widespread direct or indirect (inferred) documentation of ground ice presence, depth, thickness and/or form	Accuracy dependent on permafrost characteristics and related knowledge and experience of drillers; no scientific verification	Smith and Lesk-Winfield 2012; Smith 2015
Local	Terrain evaluation of the Dempster Highway across the Eagle Plain and along the Richardson Mountains, Yukon Territory	Characterization of terrain, including permafrost, based on field-checked aerial photograph interpretation	Based on aerial photograph interpretation and field reconnaissance with little to no subsurface data	Richardson and Sauer 1975
Local	Preliminary mapping of permafrost conditions along the Dempster Highway for fibre optic line planning	Desktop-based interpretive mapping of permafrost-related ground movement potential following unmitigated disturbance within 50 m of the highway	No field validation, excludes characterization within areas of anthropogenic disturbance (e.g. highway embankment, borrow pits, side roads), and does not consider influence of previous alterations to ground thermal regime	McKillop et al. 2016b
Local to site	Inventory of geohazards along the Dempster Highway, Yukon	Identification, characterization and risk evaluation of sites with geohazards related to mass movement, permafrost and/or fluvial erosion, based on desktop interpretation (LiDAR, imagery) and limited field reconnaissance	Limited field validation and focused on sites of existing instability as opposed to sections of highway predisposed to similar instability	McKillop et al. 2016a
Local to site	Permafrost characterization of the Dempster Highway, Yukon and Northwest Territories	Permafrost temperature ranges and generalized segmentation of the highway corridor according to the principal types of terrain hazards	Only brief examples of conditions and hazards representative of the diversity along the highway corridor	Burn et al. 2015
Local to site	Granular evaluation, Dempster Highway corridor, Yukon and Northwest Territories	Documentation of ground ice observations in association with gravel sourcing	Limited, opportunistic field observations of visible ice	EBA Engineering Consultants Ltd. 1990
Local to site	Recent Effects of Climate Change on Permafrost and Road Stability, Dempster Highway, Northwest Territories/Yukon	Presentation of permafrost-related engineering challenges for highway operation and maintenance	Cursory overview of representative site conditions	EBA Engineering Consultants Ltd. 2013
Local to site	Drivers of tall shrub proliferation adjacent to the Dempster Highway, Northwest Territories, Canada	Characterization of the interactions among embankment construction, slow plowing, drainage alteration, active layer thickening and shrub growth alongside the Dempster Highway	Field sites along the portion of the Dempster Highway in the Northwest Territories	Cameron and Lantz 2016
Site	Sinkhole Site Characterization, Dempster Highway, Yukon Territory	Inventory and characterization of sinkholes along the Dempster Highway based on desktop analysis of available information	No targeted field investigations	SRK Consulting (Canada) Inc. 2014
Site	Dempster Highway Permafrost Assessment	Borehole logs and ground temperatures at select sites along the Dempster Highway	Site-specific conditions without characterization of representativeness or broader applicability	Northern Climate ExChange 2014
Site	Monitoring permafrost conditions along the Dempster Highway	Permafrost monitoring at four long-term sites to determine baseline thermal conditions and to follow changes in ground temperature driven by climate change.	Data collected is first year of a long-term monitoring project.	Idrees et al. 2015
Site	Permafrost degradation adjacent to snow fences along the Dempster Highway, Peel Plateau, Northwest Territories	Documentation of active layer thickening due to persistent accumulation of snow beside snow fences alongside the Dempster Highway	Field sites along the portion of the Dempster Highway in the Northwest Territories	O'Neill and Burn 2015

* **Bolded** descriptions represent primary information sources for planning fibre optic line installation and maintenance along the Dempster Highway.

7.1.2 Project Interactions and Potential Effects

Installation and maintenance of the proposed fibre optic line are likely to interact with the active layer and underlying permafrost within the Project area (**Table 7-2**). The Project may interact with permafrost through site preparation (e.g. brushing, organic compaction, rutting), cable installation method(s) (e.g. conventional plow, shallow burial, surface lay, horizontal directional drilling), and geotechnical drilling. These interactions could affect the stability of sensitive, ice-rich permafrost and, in turn, the ground conditions to which other biophysical or socio-economic VCs are adapted. This section defines the Project interactions and characterizes the potential effects of installation and/or maintenance of the proposed fibre optic line on ice-rich permafrost. Also addressed in this section are the potential effects of climate change on the Project, through its influence on permafrost.

Table 7-2 Potential Interactions Between Project Activities and Permafrost.

Activity	Project Interactions	Potential Effects
Establishment and operation of temporary camps and staging areas	· Vegetation removal · Ground compaction · Use of equipment	· Permafrost degradation · Erosion and sedimentation · Alteration to hydrology
Site Preparation	· Vegetation removal · Ground compaction · Use of equipment	· Permafrost degradation · Erosion and sedimentation · Alteration to hydrology
Cable Installation Methods and Geotechnical Drilling	· Vegetation removal · Ground compaction · Drilling · Trenching/Plowing · Use of equipment	· Permafrost degradation · Erosion and sedimentation · Alteration to hydrology

7.1.2.1 Permafrost Degradation

The removal or compaction of organic ground cover alongside the highway would reduce the insulative properties and erosion resistance of the soil, especially if left exposed. Reduced insulation would warm the ground surface and, in turn, could warm and ultimately degrade underlying permafrost (i.e. active layer thickening). Actual exposure of soils could accelerate warming and surface erosion. Active layer thickening could initiate or exacerbate thermokarst and/or thaw-related mass movements, thereby promoting settlement of the highway embankment. More frequent and/or costly maintenance of highway infrastructure could be required.

7.1.2.2 Erosion and Sedimentation

Installation and maintenance of the proposed fibre optic line, especially across ice-rich permafrost, have the potential to increase in-stream sedimentation. If the extent, severity and rates of soil erosion by sheetwash, rilling and gullying increase, whether due to exposure of soils or unnatural concentration of runoff, then the rate of delivery of fine-grained sediments to fish-bearing creeks, rivers and lakes could increase. Unnaturally high rates of deposition of fine-grained sediments in waterbodies can reduce the biological productivity of aquatic ecosystems. Excessive deposition can impact fish feeding (by sight) and growth, egg development and survival, and habitat cover and risk of predation (by infilling or embedding of gravelly substrates). Fish are adapted to periods of increased suspended sediments and localized deposition but could be impacted or displaced if rates or duration exceed their resiliency.

7.1.2.3 Alteration to Hydrology

The excavation or cutting of a trench along which to lay the fibre optic cable would disrupt natural, or pre-existing, surface and near-surface drainage patterns. Runoff that originally flowed diffusely downslope could be intercepted, concentrated and diverted by the trench. The concentrated flow could increase the potential for mechanical erosion of soils where their resistance to entrainment is exceeded, as well as thermal erosion, where heat is transferred from the flowing water into the underlying soil. On level ground or where the highway acts like an impoundment berm, concentrated flow could increase ponding and initiate or accelerate thermokarst. Any appreciable alterations to surface or near-surface drainage patterns that are triggered by fibre optic line installation could increase or decrease soil moisture along and adjacent to the alignment. Exposure of the highway embankment to erosion or differential settlement, which could necessitate more frequent and/or costly maintenance, is the primary concern associated with alteration in drainage patterns.

7.1.2.4 Effects of Climate Change on Permafrost

Climate change affects permafrost and, in turn, can affect northern infrastructure such as the proposed fibre optic line in several ways:

Differential settlement and creep – Climatic warming combined with increases in annual precipitation degrades relatively warm (near 0ºC) permafrost and, where ice-rich, can initiate or accelerate thermokarst. Permafrost is generally warmer than -4ºC along most of the Dempster Highway (Burn et al. 2015) and locally ice-rich (McKillop et al. 2016b). Thermokarst results in the differential settlement of ground underlying (highway) or containing (fibre optic line) infrastructure. Retrogressive thaw slumps are an extreme manifestation of thermokarst on gentle to moderate slopes. The potential for thermokarst-related damage to infrastructure depends on the rate and amount of settlement, as well as the resiliency of the infrastructure to vertical displacements and changes in support by soil. Climate change can also accelerate rates of solifluction (downslope creep of the active layer) on slopes, with more water available in the soil, so infrastructure must accommodate some degree of lateral displacement. A cable has a high degree of flexibility and should accommodate differential settlement relatively well. Periodic maintenance may be required in the few areas of retrogressive thaw slumps or active solifluction along the proposed alignment (McKillop et al. 2016b).

Thermal erosion – Widespread ponding and flow of water has been observed along the upslope side of the Dempster Highway since its construction in the 1970s. The prevalence of water is attributed to increased availability of water, due to degradation of ice-rich permafrost and at least local increases in annual precipitation, and the disruption to natural surface and near-surface drainage paths by the highway embankment. Standing and flowing water can transfer heat into surrounding permafrost, driving thermal and fluvio-thermal erosion processes, respectively. The proposed fibre optic cable could be at risk of damage from thermal erosion if it becomes suspended above anomalously deep gullies or other water-filled cavities that are not adequately accommodated by its design.

Active-layer detachments – Climate change can result in increased saturation of the active layer. Active layers on moderate to steep slopes are more susceptible to failure during periods of elevated saturation (e.g. Coates and Lewkowicz 2005). Sections of the proposed alignment of the fibre optic line prone to active-layer detachments, as preliminarily identified by McKillop et al. (2016b), may be at risk of damage from sudden slippage and displacement of the active layer across or within which the cable is proposed to be installed. Consideration may need to be given to installing the cable in permafrost, through horizontal directional drilling, where the proposed alignment crosses the transport zone and not just the runout zone of potential active-layer detachments.

Icings – Climatic warming and increases in annual precipitation have at least locally contributed to an increase in the distribution, thickness and persistence of icings in regions of permafrost. *Icings*, also locally known as glaciations, are sheet-like masses of accretionary ice that form from successive flows of groundwater during freezing temperatures. Icings have become more of a maintenance challenge along the Dempster Highway in recent years, as warmer winters have slowed the freeze-up of active layers and, in some cases, have even allowed an unfrozen portion to persist year-round. Groundwater within the unfrozen bottom portion of the active layer continues to flow downslope and form icings where it emerges at surface. The fibre optic line must anticipate and be resilient to the formation and adjustment of icings in areas where it is laid across the ground surface.

7.1.3 Mitigation Measures

To eliminate, reduce or control potential effects of Project activities on sensitive, ice-rich permafrost and other VCs it supports[2], the Proponent has committed to the following mitigation measures:

General Mitigation Measures related to Permafrost

- Installation of the fibre optic line will occur within ROW of existing roads or highways, with only a few exceptions, to reduce effects on surrounding permafrost.
- Any brushing (clearing) of vegetation in advance of installation will be limited to trees and tall shrubs, with deliberate avoidance or minimization of disturbance to surface organic cover.
- Every effort will be made to minimize the extent, severity and duration of ground disturbance, including compaction, during cable installation.
- Cable installation through conventional plowing will be restricted to the long sections of highway corridor south of Tombstone Park (~km 0 to 85) where permafrost is absent, at a depth unaffected by cable installation (e.g. in thick sand/gravel outwash terraces), or ice-poor and relatively insensitive to disturbance.
- Where permafrost is continuous, comparatively shallow and locally ice-rich, shallow burial or surface laid cable installation will be used. Shallow burial involves laying the cable along the base of a thin, shallow (~150 mm) “slice” into or slightly below surface organics at the top of the active layer of permafrost. Penetration into permafrost will be avoided.
- Surface-laid cable installation will be prioritized along the most challenging sections of the alignment, such as those crossing thermokarst terrain and wetlands with standing water at surface.
- The plow slot will be backfilled sufficiently. Where necessary, backfill and re-contour plow slot.

[2] The maintenance challenges on the Mackenzie Valley Fibre Link have resulted in lessons learned for fibre installations in sensitive permafrost areas that are being carefully reviewed and taken into account by the design and permitting teams for the Project.

- The width and footprint of disturbance for fibre line installation will be kept to an absolute minimum.
- Cable installation will be accomplished using small equipment with only minimal and temporary compaction of organics and little to no potential for rutting. No stripping of surface organics is planned.
- Fibre optic cable installation will be seasonally timed to minimize the potential for ground disturbance.
- Shallow burial installation will occur in summer, when at least the upper portion of the active layer is thawed, so that the required slice and placement of the cable can be accomplished.
- Surface-laid cable installation will occur in winter, while the active layer and any shallow standing water are frozen, so that small equipment can advance across snow and ice with little to no disturbance of underlying vegetation.
- A Permafrost Protection Plan will be developed by the contractor prior to initiation of construction to align their construction plans and equipment with appropriate mitigation measures.
- Additional geotechnical data will be obtained as needed if subsurface conditions can't be accurately identified based on existing information.
- Installation of the fibre line will be monitored on a full-time basis by a third-party design engineer contracted to the Proponent. One of the engineer's primary responsibility will be to monitor for consistency in the depth of the shallow plow installation. Inconsistencies in plow depth can occur due to terrain features and can lead to an increase in erosion and other issues.

Mitigation Measures related to Geotechnical Drilling

- Geotechnical drilling will use a lightweight track-mounted rig where possible to minimize compaction of organics, and potential for ruts to form.
- Contractor will use a spade to cut and save the organic mat surface, before drilling, then allow the hole to backfill and cap it with that pre-cut organic mat.
- Any ruts that form will be filled with soil/organics.
- The footprint of cuttings/spoil from the borehole will be minimized.
- Water use will be avoided or minimized to the extent possible.

7.1.4 Effects Characterization and Significance

After the mitigation measures listed in **Section 7.1.3** have been applied, it is predicted that Project activities will not result in significant effects to permafrost. Despite efforts to minimize the extent, depth and severity of disturbance during installation and maintenance of the proposed fibre optic line, local adjustments are anticipated to the ground thermal regime and, in turn, sensitive, ice-rich permafrost. All effects are expected to be minor and largely indistinguishable from decades of adjustment in permafrost conditions within the ROW and previously disturbed areas.

The residual effects of the Project are expected to be low in magnitude, localized, infrequent, and unmeasurable or minor in comparison to ongoing effects of climate change on permafrost. The duration of the effect is a long-term alteration to the ground thermal regime, recognizing that conditions will re-equilibrate and any changes will be overwhelmed and masked by responses to ongoing climate change. The geographic extent of Project-related effects is limited to the immediate vicinity of the proposed alignment within the already-disturbed highway right-of-way, which is negligible in comparison to the extensive discontinuous to continuous permafrost of the region. Given the sensitive nature of permafrost, especially in consideration of climatic trends, the probability of effects is likely, and irreversible. However, low-impact installation methods and optimal timing will moderate the potential for adverse effects on permafrost. As well, the surface or near-surface installation of the fibre optic line within the active layer will substantively attenuate any changes in the ground thermal regime at the depth of underlying permafrost.

7.2 Fish and Fish Habitat

The fish and fish habitat assessment area for the Project focuses on habitats located within 100 m of the centerline of the Dempster Highway (i.e., the fish and fish habitat Study Area). The fish and fish habitat Study Area follows the Klondike Highway and/or the Yukon Energy Corporation Transmission Line poles for approximately 40 km before the Dempster Highway turnoff. From here the fish and fish habitat Study Area follows the Dempster Highway ROW for approximately 460 km as it traverses the North Klondike River Valley, Blackstone Uplands, Ogilvie River Valley, Eagle Plains and the Richardson Mountains to the Yukon/Northwest Territories border.

The size of the fish and fish habitat Study Area was considered appropriate to characterize baseline fish habitats and assess potential impacts to fish due to the localized nature of the Project, and the Project confinement within established highway and/or YEC ROWs. Aside from water features in the fish and fish habitat Study Area which may provide direct and/or indirect habitat to fish, terrestrial (riparian) fish habitats of associated water features were also considered as part of the assessment. These riparian habitats adjacent to the streams, rivers, lakes, and wetlands with fish habitat value provide important functions and features for fish such as bank stabilization, sediment filtration, food and nutrient input, shade and cover, and temperature regulation.

In total, the Dempster Fibre Project crosses approximately 1,200 culverts between Dawson and the Yukon/Northwest Territories border (Stantec 2019). The Project will cross three major watersheds between Dawson City and the Northwest Territories border, which includes the Yukon, Peel, and Porcupine. Within these watersheds, the major watercourses that fall within the fish and fish habitat Study Area are:

- Yukon River (Central Yukon Watershed, Klondike Highway);
- Klondike River (Central Yukon Watershed, Klondike Highway);
- North Klondike River (Central Yukon Watershed, Dempster Highway);
- East Blackstone River (Peel Watershed, Dempster Highway);
- Blackstone River (Peel Watershed, Dempster Highway);
- Ogilvie River (Peel Watershed, Dempster Highway);
- Eagle River (Porcupine Watershed, Dempster Highway); and,
- Rock River (Porcupine Watershed, Dempster Highway).

These major watercourses exhibit general characteristics typical of drainages in a subarctic environment with terrain characterized by mountainous and discontinuous permafrost. The hydrology is influenced by permafrost, glacial melt, snowmelt, precipitation, and groundwater. Many of the larger watercourses are characterized by braided channels and are impacted by high bedloads. Substrates throughout the watercourses are mixed, ranging from large boulders to glacial silt, clay, and mud (ADFG 2006).

There are also small tributaries to the major watercourses that cross, or are parallel to, the Klondike and Dempster highways. In addition, there are several wetlands, and small lakes (e.g., Chapman Lake and Two Moose Lake), that are present with the fish and fish habitat Study Area, particularly along the section of the Dempster Highway paralleling the East Blackstone River, and a small section of the Klondike River.

The following sections describe the known existing conditions, the potential effects resulting from Project activities, mitigation measures to reduce or eliminate those effects, and a characterization of the significance of the residual effects to fish and fish habitat.

7.2.1 Description of Existing Conditions

The following section provides an overview desktop review of the fish and fish habitat values associated with the fish and fish habitat Study Area. In the Yukon, several fish habitat studies have been undertaken within the fish and fish habitat Study Area (EDI 2004; EDI 2006; Barker et al. 2011; McHugh 2013). Based on a compilation of fish species identified during other assessments, 18 fish species were identified as having potential to be present in watercourses along the Klondike and Dempster Highways between Dawson City and the Northwest Territories border (**Table 7-3**). Species listed in this table are not found in every watershed and sampling has not occurred at all watercourse crossing locations in the fish and fish habitat Study Area. Therefore, for Project planning purposes, fish presence is assumed possible at all watercourse crossing locations (including ephemeral drainages and intermittent streams when water is present).

Table 7-3 Potential Fish Species Within the Fish and Fish Habitat Study Area (Environment Yukon 2019c)

Common Name	Watershed	Presence in Study Area	Description of Freshwater Habitat Use	Notes[1]
Salmonids (Salmoninae)				
Salmon and Char – CRA Species				
Chinook Salmon (*Oncorhynchus tshawyscha)*	Yukon, Porcupine	Potential	· Juveniles occupy flowing water and migrate to smaller streams to feed and over-winter · Anadromous, migrating to the ocean in their second year · Spawns in late summer/early fall on gravel and cobble beds in river/stream habitats, and lake outlets	Documented in Yukon River and Rock River drainages intersecting the fish and fish habitat Study Area (EDI 2004; Bradford et al. 2008).
Chum Salmon (*Oncorhynchus keta)*	Yukon Porcupine	Confirmed	· Anadromous, with very short freshwater residency, migrates to the ocean shortly after emergence · Spawns in fall/early winter in areas with groundwater discharge or upwelling, often in small to medium side channels	Documented in the Klondike River intersecting the fish and fish habitat Study Area (EDI 2004; Bradford et al. 2008).
Coho Salmon (*Oncorhynchus kisutch)*	Yukon, Porcupine	Potential	· Juveniles occupy relatively still water habitats (e.g., side channels) · Anadromous, residing for one to four years in freshwater before migrating to the ocean · Spawns in late fall/early winter in clear water habitats	Documented in the Yukon River and Porcupine River, limited potential for presence in the fish and fish habitat Study Area (EDI 2004; Bradford et al. 2008). **Conservation Rankings:** ▫ Global: Secure ▫ National: Apparently secure to secure breeding populations; secure nonbreeding and migrant populations ▫ Subnational: Vulnerable to secure
Dolly Varden (*Salvelinus malma malma)* Western Arctic population)	Peel	Confirmed	· Occupies lakes, and deep, clear-water runs/pools in well-oxygenated streams/rivers with good cover · Overwinters in areas with groundwater upwelling · Anadromous forms migrate to the ocean in their third year; however, there are also freshwater residents · Spawns in the fall in gravel beds of high gradient headwater streams/rivers, typically associated with groundwater upwelling	Documented in the Blackstone River and potentially Ogilvie River drainages rivers intersecting the fish and fish habitat Study Area (EDI 2006). **Conservation Rankings:** ▫ SARA Schedule 1: Special Concern ▫ COSEWIC: Special Concern ▫ Global: Secure ▫ National: Apparently secure to secure breeding populations; secure nonbreeding and migrant populations ▫ Subnational: Vulnerable to secure
Arctic Grayling (*Thymallus arcticus)*	Yukon, Peel, Porcupine	Confirmed	· Occupies lakes, large rivers, and small streams · Rears in small streams with slow currents and overwinters in deep pool habitat in streams, rivers, and lakes · Spawns in the spring in flowing water in small streams with sand/gravel/rock substrates	Widely distributed throughout Yukon, documented in several watercourses intersecting the fish and fish habitat Study Area (EDI 2004; EDI 2006; Bradford et al. 2008).
Whitefish – CRA Species				
Broad Whitefish (*Coregonus nasus)*	Yukon, Porcupine	Potential	· Occupies rivers and streams, occasionally found in lakes · Anadromous and freshwater forms · Spawns in the fall/early winter in flowing water, likely under the ice	Documented in the Yukon River drainages and Porcupine River intersecting the fish and fish habitat Study Area (EDI 2004; Bradford et al. 2008)
Lake Whitefish (*Coregonus clupeaformis)*	Yukon, Peel, Porcupine	Potential	· Occupies cold lakes and large rivers · Spawns in the fall/early winter in gravel, cobble, rock and/or sandy bottoms in shallow areas of lakes and rivers	Documented in rivers and drainages intersecting the fish and fish habitat Study Area (EDI 2006; Bradford et al. 2008). Documented in Chapman Lake (McHugh 2013).
Round Whitefish (*Prosopium cylindraceum)*	Yukon, Peel	Potential	· Occupies lakes, rivers, and streams, preferring clear water habitats · Spawns in the fall in lakes and rivers	Documented in rivers and drainages intersecting the fish and fish habitat Study Area (EDI 2006; Bradford et al. 2008; McHugh 2013).

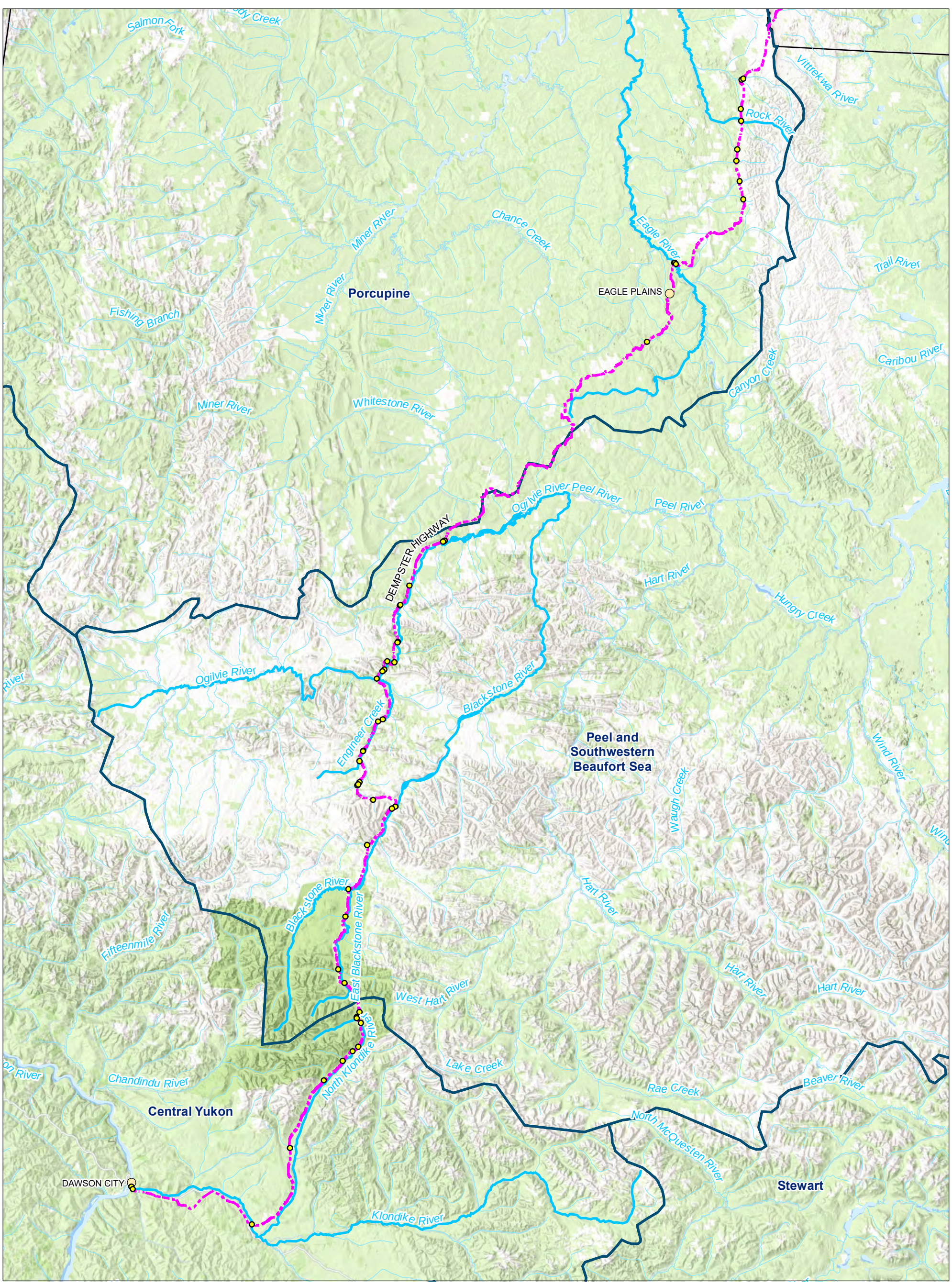
Common Name	Watershed	Presence in Study Area	Description of Freshwater Habitat Use	Notes[1]
Bering Cisco (*Coregonus laurettae)*	Yukon	Unlikely	· Largely unknown habitat requirements but likely migrates to spawn in the Yukon River in Canada (COWEWIC 2017) · Anadromous species that has a short freshwater residency period · Spawns in the fall, likely using gravel/sand substrates in the Yukon River mainstem	Documented in the Yukon River and may not be found in within the fish and fish habitat Study Area (Bradford et al. 2008). **Conservation Rankings:** ▫ SARA: under consideration ▫ COSEWIC: Special Concern ▫ Global: Apparently Secure ▫ National: Vulnerable breeding and migrant populations ▫ Subnational: Vulnerable
Least Cisco (*Coregonus sardinella)*	Yukon, Porcupine	Potential	· Occupies lakes, rivers and tributary streams · Freshwater and anadromous forms · Spawns in fall/early winter in shallow, turbid water over gravel	Documented in the Yukon River and portions of the Porcupine River drainages (e.g., Eagle River) in the fish and fish habitat Study Area (EDI 2004; Bradford et al. 2008)
Inconnu (*Stenodus leucichthys)*	Yukon, Porcupine	Potential	· Occupies muddy rivers and lakes · Freshwater and anadromous forms · Spawns in the fall/winter in tributary streams	Documented in the Yukon and Porcupine River drainages (e.g., Eagle River) intersecting the fish and fish habitat Study Area (EDI 2004; Bradford et al. 2008)
Cods (Gadidae) – CRA Species				
Burbot (*Lota lota)*	Yukon, Peel, Porcupine	Potential	· Occupies deep lakes, and eddies of large rivers and streams, moving from shallower water in fall/winter to deeper waters in the summer · Juveniles occupy shores of lakes/tributary streams · Spawns in the winter/early spring over sand/gravel substrates, usually under the ice in shallow water	Documented in rivers and drainages intersecting the fish and fish habitat Study Area (limited potential for Eagle/Rock River drainages) (EDI 2004, EDI 2006; Bradford et al. 2008)
Pikes (Esocidae) – CRA Species				
Northern Pike (*Essox Lucius)*	Yukon, Porcupine	Potential	· Occupies shallow weedy area close to lake shores, and calm rivers; often overwintering in deep rivers and lakes · Spawns in the spring in shallow water with vegetation	Documented in rivers and drainages intersecting the fish and fish habitat Study Area (EDI 2004; Bradford et al. 2008) Absent in the Upper Peel Watershed
Suckers (Catostomidae)				
Longnose Sucker (*Catostomus Catostomus)*	Yukon, Peel, Porcupine	Potential	· Occupies warm, shallow, turbid rivers and lakes, with juveniles often near vegetation, · Overwinters in lakes/large rivers · Spawns in the spring in sand/gravel substrates in shallow, slow-moving streams/rivers; although occasionally spawning along rocky shorelines and lake shallows	Documented in rivers and drainages intersecting the fish and fish habitat Study Area (EDI 2004; EDI 2006; Bradford et al. 2008)
Trout-Perch (*Percopsidae*)				
Trout Perch (*Percopsis omiscomaycus)*	Porcupine	Potential	· Occupies quiet backwaters of large muddy rivers and sandy lake beaches · Spawns in the spring/early summer in shallow rocky streams or in sand/gravel in lake shallows	Documented in Eagle River/Rock River drainages intersecting the fish and fish habitat Study Area (EDI 2004)
Minnows (Cyprinidae)				
Lake Chub (*Couesius plumbeus)*	Yukon, Peel, Porcupine	Potential	· Occupies lakes, rivers, and streams typically in benthic habitats with water clarity ranging from clear to turbid · Spawns in the early summer in tributary streams and rivers	Documented in rivers and drainages intersecting the fish and fish habitat Study Area (EDI 2004; EDI 2006; Bradford et al. 2008)

Common Name	Watershed	Presence in Study Area	Description of Freshwater Habitat Use	Notes[1]
Sculpins (Cottidae)				
Slimy Sculpin (*Cottus cognatus)*	Yukon, Peel, Porcupine	Potential	· Occupies benthic habitats along sand/rock or cobble-bottomed streams or lakes · Spawns in the spring in shallow water under rocks or woody debris	Documented in rivers and drainages intersecting the fish and fish habitat Study Area (EDI 2004; EDI 2006; Bradford et al. 2008)
Lampreys (Petromyzontidae)				
Arctic Lamprey (*Lampetra japonica)*	Yukon	Unlikely	· Juveniles occupy muddy margins and backwaters of rivers and lakes; adults can be found in lakes and may migrate through streams/rivers · Mostly anadromous · Spawns in the spring/summer in clear water off-channel gravel riffles/runs	Documented in the Yukon River drainages and may be found within the fish and fish habitat Study Area (Bradford et al. 2008).
[1]Conservation Rankings provided by Yukon's Conservation Data – Animal Track List (Updated February 2019) (Environment Yukon 2019*b*)				

Within the fish and fish habitat Study Area, Dolly Varden (Western Arctic Population) are the only federally-listed fish species under the *Species at Risk Act* (S.C. 2002, c.29) with potential to be present. They are listed as a SARA Schedule 1 species of Special Concern, and COSEWIC species of Special Concern. This species has a limited occupancy associated with a limited number of spawning and overwintering locations. The Western Arctic population is only found in Canada in drainages that flow into the Beaufort Sea, with the species being documented in the Upper Peel Watershed in the East Blackstone and Blackstone Rivers (EDI 2006, McHugh 2013).

The Klondike Highway and the southern half of the Dempster Highway parallels sections of the Klondike, North Klondike, East Blackstone, Blackstone, and Ogilvie rivers, as well as Engineer Creek. The highways cross these major watercourses, in addition to several smaller tributaries of these watercourses. However, after the Dempster Highway diverges from the Ogilvie River (approximately 245 km north of the Klondike Highway junction on the Dempster Highway), the highway largely follows ridgelines until the Dempster Highway crosses the Northwest Territories border (approximately 215 km north on the Dempster Highway). In the northern section of the fish and fish habitat Study Area (within and near Eagle Plains), watercourse crossings are less common; the only large watercourse crossings are Eagle River and Rock River. The watercourses paralleling or crossing the fish and fish habitat Study Area are shown in **Figure 7-1** and **Appendix F**.

These major watercourses and their tributaries provide features such as spawning gravels, deep pools, large woody debris and undercut banks which provide for suitable spawning, rearing and overwintering habitats for a variety of large and small-bodied Commercial, recreational, and Aboriginal fisheries (CRA) fish. The CRA species documented in these watercourses are provided in **Table 7-3.** The documented CRA species include, but are not limited to, Arctic Grayling, Burbot, Chinook Salmon, Dolly Varden, Inconnu, Least Cisco, Northern Pike, Round Whitefish.



Legend

- Community
- Watercourse Crossing
- Dempster Fibre Project Center Line
- Territorial Boundary
- Highlighted Watercourse
- Watercourse
- Waterbody
- Watershed

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licenced under the Open Goverment License - Government of Yukon
- Basemap: ESRI World Topographic Map

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Dempster Fibre Project

Watercourses Paralleling or Crossing the Project Alignment

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Table 7-4 Watercourses with Documented Fish Presence Paralleling or Crossing the Project

Watercourse Name	Fibre Line Crosses Watercourse	Approximate Length of Parallel Interface within the Study Area (km)[1]	Documented CRA Species	Watercourse Habitat
Yukon Watershed				
Klondike River	No	0.9	Arctic Grayling and Chinook Salmon (McHugh 2013)	· Pools, riffles, and glides · High-value fish habitat for rearing, over-wintering, and spawning life phases for various fish species (McHugh 2013)
North Klondike River (a tributary of Klondike River)	Yes	4.8		
Peel Watershed				
Blackstone River	Yes	2.5	Arctic Grayling, Dolly Varden, and Burbot (EDI 2006)	· Suitable spawning and rearing habitat for Dolly Varden · High potential to provide overwintering habitat due to the presence of ice-free sections during the winter (EDI 2006)
East Blackstone River (a tributary of the Blackstone River)	Yes	1.3		
Ogilvie River	No	6.8	Arctic Grayling, Burbot, and Round Whitefish (EDI 2006)	· Suspected significant overwintering areas. · Significant habitat for various species and excellent Arctic grayling habitat of all types. (EDI 2006)
Engineer Creek (a tributary of Ogilvie River)	Yes	4.0		
Porcupine Watershed				
Eagle River	Yes	N/A	Arctic Grayling, Inconnu, Least Cisco, Northern Pike, and Round Whitefish (EDI 2004)	· Rearing habitat potential, overwintering habitat throughout the mainstream (EDI 2004)
Rock River	Yes	N/A	Chinook Salmon, Arctic Grayling, and Round Whitefish (EDI 2004)	· Spawning, rearing, and overwintering in the mid-reaches of the river (EDI 2004)

[1]Lengths calculated for the sections of watercourse located within 100 m of the centerline of the Dempster Highway (i.e., the Study Area) using spatial data obtained under the Open Government License – Government of Yukon

7.2.2 Project-Interactions and Potential Effects

Installation of cable/conduit along the Project alignment may impact fish and fish habitat. These include impacts to habitats associated with both flowing water (i.e., lotic) and still water (i.e., lentic) habitats (including riparian vegetation) as identified in **Table 7-5**. Watercourse interactions will involve perpendicular watercourse crossings, including both flowing (i.e., lotic) and still water (i.e., lentic) environments, and parallel interactions (e.g., as identified for six of the larger watercourses: Klondike River, North Klondike River, East Blackstone River, Blackstone River, Engineer Creek, and Ogilvie River in **Table 7-4**). Potential impacts resulting from the proposed construction methodology on fish habitats are described below.

For the majority of the alignment in the Yukon (potentially excluding an approximately 41 km long section which may involve aerial cable installation on existing YEC poles), the cable will be installed outside the existing highway road prism, but within 15 to 20 m of the road centerline. The preferred method for cable installation in the Study Area will be to shallow bury the cable to depths of 100 to 400 mm to avoid disturbance to the active permafrost layer. Where the organic layer is not deep enough to accommodate the burial depth, the cable will be surface laid (potentially using conduit). To facilitate installation outside the road prism, temporal vegetation clearing will be required within an approximate 2 m wide alignment (to accommodate working space for machinery and/or personnel). This may include temporal clearing of riparian vegetation.

In general, for lotic systems and known (or suspected) fish-bearing water features (including fish-bearing lentic systems), HDD will be the preferred method to minimize potential impacts to fish and fish habitat (followed by aerial construction if HDD is not suitable). The exception is for existing bridge crossings where cable will be preferentially installed on the existing bridge/structure if feasible. Given that the alignment is proposed outside the road prism, most cable crossing areas will not interface with existing highway stream crossing structures (e.g., culverts, bridges, etc.). The drill access pit and HDD equipment will be positioned outside the riparian area (typically considered to be within 30 m of the high-water mark). The HDD entry and exit points will be located away from the banks of the watercourse. The proposed HDD construction methodology generally reduces the potential negative effects to fish habitat. However, one of the main construction-associated risks of HDD watercourse crossings relates to the inadvertent release of drill mud (bentonite and clay) into the aquatic environment (e.g., via a frac-out). In the unlikely event that HDD cannot be successfully used for cable installation at a lotic crossing, the design team will consider an aerial crossing of the feature.

If fish are known, or suspected, to occur within any of the lentic waterbodies that interface with the alignment (including lakes, ponds and wetlands), HDD will be the preferred crossing method if the feature cannot first be avoided (i.e., by installing the cable on the opposite side of the highway using HDD to cross under the road prism). For non-fish bearing lentic crossings, if the cable cannot be installed on the opposite side of the highway, the cable will likely be installed via surface laying (preferably with the cable only, or conduit if required for additional protection), followed by HDD or aerial crossings as alternative options. Temporal impacts to riparian and in-water habitat may occur for any lentic systems with riparian fish habitat values where surface laying of cable is proposed (e.g., an ephemeral wetland that is seasonally connected to downstream fish-bearing habitats). Surface installation of cable may involve the installation of geotextile sandbags or cable weights to anchor the line. In addition, hand trenching may also be required to transition from wet to dry areas and vice versa in lentic environments. These trenches would generally occur to a maximum depth of 300 mm and would range from 50 to 75 mm in width. Minor localized increases in sediment levels would be anticipated to occur for the duration of any in-water hand trenching.

For parallel interactions with fish and fish habitat (e.g., where the cable is proposed for installation along areas near the banks of watercourses), installation of the cable may be undertaken on the opposite side of the road, or by via trenching in the existing road base if installation is limited by topography (e.g., where the alignment is bound by a river on one side, and a steep mountain slope on the other).

As outlined in **Section 3.2.5.3**, small drill rigs (which are anticipated to be used for all HDD crossings) will require a daily freshwater supply between 20 m^3 and 40 m^3. While water sources for HDD have not been confirmed, Ecofor identified 28 potential water sources in the Yukon that would not require development of access roads/infrastructure for HDD operations (**Appendix A**). Many of these sites appeared to have been used for existing or historic water withdrawals on rivers or streams, some were old gravel or borrow pits, and some were sites that did not appear to have been used for water withdrawals but had suitable access.

The potential for impacts to fish are largely associated with temporal construction-related activities (e.g., due to the use of machinery and potential for inadvertent releases of deleterious substances to watercourses/waterbodies), and temporal removal of riparian vegetation to facilitate placement of the cable. Use of machinery increases the potential for spills and leaks from machinery and equipment and can result in contaminant toxicity, destabilization of stream banks, mobilization of sediment, and in extreme cases, fish mortality. Riparian vegetation provides many benefits to fish and fish habitat including overhead cover, temperature regulation, bank stabilization, nutrient input, and provision of habitat complexing features (e.g., from large woody debris inputs). The majority of riparian vegetation impacts are anticipated to be temporal (e.g., to provide workspace for equipment). Vegetation clearing may impact fish and fish habitat along watercourses during construction activities due to the loss of natural habitat-forming material, overhead cover and shade (which may increase the amount of light reaching a stream), increased stream temperatures, decreased in-stream nutrient input, and increased potential for bank erosion and resulting sedimentation to occur in adjacent watercourses and wetlands. However, the cable is not anticipated to directly interface with fish-bearing watercourses/waterbodies and therefore there is limited potential for alteration of in-stream/in-water fish habitat. Cable may, however, be surface laid in lentic systems that provide indirect fish habitat (e.g., via food and nutrient input) to downstream fish-bearing habitats. In addition to potential riparian, food and nutrient, and water quality effects, there are potential impacts to water flow (i.e., changes in timing, duration and frequency of flow) that could result from fresh water extraction which will be required when installing cable with drill rigs using HDD methodology.

Without appropriate mitigation measures in place, Project activities have the potential to negatively affect fisheries resources, for example due to vegetation clearing, increased potential for erosion and sedimentation, potential for frac-outs, etc. Fisheries and Oceans Canada (DFO) has defined pathways of effects for typical pre-mitigation construction activities, which are used to describe development proposals in terms of the activities that are involved; the type of cause-effect relationships that are known to exist; and the mechanisms by which stressors ultimately lead to effects in the aquatic environment (DFO 2014). DFO has also developed a reference document when working near water, authored by Cott and Moore (2003). **Table 7-5** considers pathways of effects and their potential to result from the Project prior to mitigation.

Table 7-5 Description and Pre-Mitigation Likelihood of Effects on Fisheries Resources Associated with the Fish and Fish Habitat Study Area

Potential Residual Effect	Adapted DFO Description	Watercourse/Waterbody Interaction					Pre-mitigation Likelihood of Effects
		Crossing				Parallel	
		Horizontal Directional Drilling	Aerial Crossings	Bridge Attachments	Surface Lay/ Shallow Trenching	Shallow Burial	
Change in sediment concentrations	Increased sediments, which contain nutrifying elements and can capture or absorb contaminants, are suspended or else settle and collect in waterways affecting physical processes, structural attributes, and ecological conditions such as water clarity (by reducing visibility and sunlight, and damaging fish gills) and reducing the availability and quality of spawning/ rearing habitat (through infilling).	X	X	X	X	X	**Possible**. While minimal in-water works are anticipated (currently only proposed for lentic environments), increased potential for soil erodibility and resulting sedimentation may temporarily result due to adjacent use of machinery (e.g., HDD drills) and riparian vegetation clearing. In addition, pumps placed in watercourses or waterbodies for water extraction purposes may elevate sediment concentrations (e.g., if placing a pump on soft sediment). Due to the number of crossings proposed and potential for frac-outs associated with HDD, in addition to potential water extraction sites, there is a **low to moderate** risk of significant impacts from increased sedimentation.
Change in contaminant concentrations	An increase in concentrations of toxins and pollutants in sediments and waters can breach the range of chemical parameters that support healthy aquatic communities, seriously affecting fish and fish habitat. The ecological effects can range from direct fatality to organisms, alteration of the ecosystem structure through changes in the abundance, composition, and diversity of communities and habitats, and persistence and progressive accumulation in sediments or biological tissues (bioaccumulation, bio-magnification). Deformities, alterations in growth, reproductive success, and competitive abilities can result.	X	X	X	X	X	**Possible.** Machinery will be used adjacent to watercourses to facilitate cable installation which could result in unintentional releases of fluids (e.g., drill mud), fuel, or other deleterious substances. As machinery is proposed to be located outside the riparian area (typically considered to be 30 m of the high-water mark), and HDD entry and exit points will be located away from the banks of the watercourse, there is a **low** risk of significant impacts from elevated contaminant concentrations.
Change in habitat structure, cover, and food and nutrient supply	The addition of in-stream organic structure and soils can affect the capacity of a watercourse to maintain a dispersed and diverse community of aquatic organisms by restricting habitat connectivity and the opportunities for organisms to use, colonize, and move between existing aquatic environments. The removal of in-stream vegetation can reduce channel stability, cover and protection from predators and physical disturbances, and the availability of diverse and stable habitats. The aquatic food supply must be plentiful and diverse to sustain the productivity of a watershed. An increase or decrease in the quantity or composition of the food supply, beginning with plants and organic debris that fall into a waterway, can alter the structure of the aquatic community. Some activities may cause an increase in nitrifying elements such as nitrogen and phosphorus and mineral compounds such as ammonia, nitrates, nitrites, and orthophosphates. This can lead to eutrophication which consumes oxygen, depleting it from bottom waters. The resulting low dissolved oxygen concentrations drive fish from their preferred habitat and can cause other organisms to die.	X	X		X	X	**Possible.** Temporary removal of riparian vegetation will be required to facilitate some watercourse crossings. Some in-water alteration may also occur in areas where cable is placed directly on the surface of the watercourse (e.g., for wetlands). Riparian clearing may alter habitat structure, cover, and food and nutrient supply food to fish-bearing water features (e.g., due to changes to litter fall and insect drop). However, the potential impacts to riparian vegetation are temporal in nature, there is a narrow width required for cable installation, and the construction methodology is relatively low risk. Excessive water extraction (e.g., in small waterbodies) has the potential to result in temporal impacts to fish habitat (including structure, cover and food and nutrient supplies) if water levels are impacted. However, water extraction supply sources for the Project will target non-fish bearing water features where feasible, such as isolated gravel or borrow pits, which minimizes the potential for water levels to be affected in fish bearing watercourses. The risk of significant impacts to fish habitat, cover, and food and nutrient supply is considered **low**.

Potential Residual Effect	Adapted DFO Description	Watercourse/Waterbody Interaction					Pre-mitigation Likelihood of Effects
		Crossing				Parallel	
		Horizontal Directional Drilling	Aerial Crossings	Bridge Attachments	Surface Lay/ Shallow Trenching	Shallow Burial	
Change in water temperature	Water temperature directly affects many of the physical, biological, and chemical characteristics of a waterway. In elevated temperatures, many coldwater fish, such as trout and salmon, could experience reduced reproductive activity or direct mortality, including egg mortality. High temperatures also encourage the microbial breakdown of organic matter, leading to a depletion of dissolved oxygen in the water body.	**X**	**X**		**X**	**X**	**Possible.** Riparian vegetation clearing may impact crown cover and shading over watercourses in the fish and fish habitat Study Area, which may increase in-stream exposure to sunlight and increase water temperatures. However, the majority of watercourse crossings are proposed via HDD away from the banks of the creek, with minimal permanent alteration Excessive water extraction (e.g., in small waterbodies) has the potential to result in changes in water temperatures resulting from lower water volumes. However, water extraction supply sources for the Project will largely target non-fish bearing water features (e.g., isolated gravel or borrow pits), and large water features, where feasible. Significant changes in water temperature are considered to be **low to negligible**.
Displacement or stranding of fish, and/or changes in migration patterns	Reduced flow can result in the stranding of fish and may affect fish populations by preventing normal migration between feeding, rearing, and spawning areas.	**X**					**Possible.** Irresponsible water extraction for HDD can result in the dewatering of downstream areas, obstruction of fish passage, and entrainment or impingement of fish on pump screens. However, water extraction supply sources for the Project will largely target non-fish bearing water features (e.g., isolated gravel or borrow pits), and large water features, where feasible, which reduces the likelihood of dewatering and potential for fish stranding. The risk of displacement or stranding of fish, and/or changes in fish migration patterns is considered to be **low**

7.2.3 Mitigation Measures

To eliminate, reduce or control potential effects to fish and fish habitat caused by Project activities, the Proponent has committed to the following mitigation measures:

General Mitigation Measures related to Fish and Fish Habitat

- The contractor will be responsible for developing a Project-specific Construction Environmental Management Plan that outlines the specific permit conditions and best management practices for works in and around water, including the Preferred Practice of Works Affecting Yukon Waters (Yukon Government 2019).
- A qualified Environmental Monitor will conduct monitoring (including water quality assessments), with an emphasis on those works with the greatest potential to impact fish habitat (e.g., stream crossings).
- Construction work that will occur in a stream crossing that is considered high risk for fish or fish habitat, should be scheduled to occur during the least-risk timing window for in-water activities (**Table 7-6**).

Table 7-6 Species-specific Least Risk Timing Windows for each of the Watersheds Overlapping the Fish and Fish Habitat Study Area

Watershed	Fish Species	Least Risk Timing Window
Central Yukon Watershed	Chinook Salmon	June 10 to July 5
	Chum Salmon	June 1 to August 15
	Lake Trout, Whitefish species	April 15 to September 1
	Arctic Grayling	July 1 to April 15
Peel Watershed	Dolly Varden	May 1 to September 1
	Arctic Grayling	July 15 to May 1
Porcupine Watershed	Chinook Salmon	June 1 to July 15
	Chum Salmon	June 1 to September 1
	Arctic Grayling, Northern Pike	July 15 to May 1
	Whitefish species	May 1 to September 1

Mitigation Measures related to Upland and Riparian Habitat

- Avoid cable placement in heavily vegetated areas (where possible and subject to other constraints including highway infrastructure and topographical features).
- Minimize areas of riparian disturbance and only remove vegetation that is necessary for installation of the cable.
- Design and construct watercourse crossings such that the cable is perpendicular to the banks of the watercourse to minimize loss and disturbance of riparian vegetation.
- Use existing roads and/or trails to access areas around watercourses, and do not disturb areas outside the existing ROW.

- The drill access pit and HDD equipment will be positioned outside the riparian area (typically considered to be within 30 m of the high-water mark). The HDD entry and exit points will be located away from the banks of the watercourse. To the extent possible, clearing in riparian zones will be limited to hand slashing to minimize riparian disturbance and prevent soil compaction.
- Where tree or large shrub removal is required, use techniques such as pruning, mowing, girdling, and topping to keep the root system intact and stabilize the soil. If possible, retain large woody debris and the stubs of large diameter trees on site.

Mitigation Measures related to Erosion and Sediment Control

- Install erosion and sediment control measures as appropriate (e.g., by constructing small settling basins/berms at drill entry and exit points for HDD crossings).
- Ensure temporary erosion and sediment control measures (e.g., sediment fencing) are removed following ground stabilization.
- Cover any soils exposed as a result of Project activities, and/or implement other erosion protection or sediment control measures until such time that permanent stabilization occurs. Avoid placing stockpiles within the riparian area.
- Direct any sediment-laden flow to stable vegetated areas at least 30 m away from any watercourses to allow for infiltration back into the ground.
- Where possible, schedule works around watercourses to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- Develop an Erosion and Sediment Control Plan for Project Operations prior to construction.

Mitigation Measures related to Contaminant Management

- Ensure machinery operates from above the top-of-bank and high-water mark and not within the active channel of any watercourse.
- Wash/refuel/service machinery and store fuel and other materials away from watercourses. Keep spill kits at every refuelling station.
- Store fuel in a temporary tank placed in a containment basin (able to contain 120% of tank capacity), at least 30 m away from any watercourses. Do not refuel or service equipment within 30 m of any watercourse.
- Ensure that any machinery brought to site is in good operating condition, free of leaks, excess oil and grease. Ensure that equipment is free of invasive species and noxious weeds.
- If practical, use biodegradable fluids in heavy machinery associated with works near streams.
- Follow measures described in the Spill Contingency Plan (**Appendix H**), including ensuring basic spill kits are available within every vehicle and piece of equipment operating within the Study Area.

Mitigation Measures related to Horizontal Directional Drilling

- All HDD operations will adhere to DFO's former Operational Statements for High-Pressure Directional Drilling and Punch and Bore Crossings (DFO 2007) and Canadian Association of Petroleum Producers (CAPP) Guideline of Planning Horizontal Directional Drilling for Pipeline Construction (CAPP 2004).

- All water withdrawals will conform to DFO's Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut (2010), Fish Screen Design Criteria for Flood and Water Truck Pumps (2011), and Freshwater Intake End-of-Pipe Fish Screen Guideline (1995), if applicable.
- Drilling will only be conducted by experienced HDD contractors.
- Ensure the drilling fluid used is benign (e.g., a mix of bentonite and water) and has appropriate properties to promote wall cake and sealing of the formation.
- Ensure drill depths are appropriate to minimize the risk of frac-outs or exposure of the cable or conduit (e.g., due to natural stream scouring).
- Dispose of drilling mud, cuttings, and other waste materials at appropriate facilities and/or on-site at suitable locations away from watercourses and sensitive receptors.
- Develop an emergency frac-out response plan in the event of a drilling mud spill. The plan will include measures to stop work, contain the drilling mud, and prevent its further migration into the watercourse and to notify all applicable authorities, including the closest DFO office in the area. Ensure all material and equipment needed to contain drilling mud released on site are readily accessible and that applicable authorities are notified.

Mitigation Measures related to Site Restoration

- Remove construction materials and supplies from the site following construction completion.
- Restore disturbed soils (including drill entry and exit points) as soon as possible to prevent erosion and potential sedimentation into adjacent watercourses.
- In areas where natural revegetation may be inhibited revegetate riparian areas with native grasses, shrubs, and/or trees, (e.g., with willow cuttings) to prevent erosion and help seeds germinate.

7.2.4 Effects Characterization and Significance

Key factors in the consideration of effects to fisheries resources includes likelihood of an effect, the duration of the effect, the geographic extent of the impacts, the availability of similar habitats nearby, dependency of fish on the affected habitats, magnitude of the effect, whether there is a localized effect (e.g., reduced productivity of populations), and the anticipated residual effects to fish. A summary of these effects for the fish and fish habitat Study Area as they relate to fish and fish habitat is provided below.

Construction interactions at each watercourse crossing are considered short term (i.e., days). The majority of riparian impacts (with the exception of areas overlapping permanent infrastructure such as poles for aerial crossings) will be temporal to facilitate construction (anticipated to span over approximately two years). While it could take multiple years for riparian vegetation to regenerate, with a combination of restoration planting and natural regeneration of riparian vegetation, it is anticipated these impacts will be reversible with the majority of riparian areas returning to full functionality following construction.

Water extraction activities associated with HDD operations will be limited to areas that do not require access road development, thereby limiting the amount of temporal disturbance to riparian vegetation. Water extraction supply sources for the Project will target non-fish bearing water features where feasible, such as isolated gravel or borrow pits, which reduces the likelihood of impacts to fish. Some water extraction activities (e.g., placement of pump intakes) may occur within fish-bearing watercourses or waterbodies; however, the intakes will be screened to appropriate specifications to prevent entrainment of impingement

of fish, and placed in a manner that avoids negative impacts to fish habitat (e.g., off the bottom of the watercourses, and in areas with relatively low concentrations of fish).

While the fish and fish habitat Study Area extends for several hundred kilometres within the Yukon, it is located within an existing ROW, primarily along the Dempster Highway and Klondike Highway. Given the small size of the trench and cable, the limited disturbance within existing ROWs, and the limited interface with fish habitat, the geographic impacts to fish and fish habitat is considered site-specific with a negligible to low magnitude of impact at each crossing.

The Project is anticipated to impact a relatively small area, with the majority of disturbance occurring in areas adjacent to existing highways. Due to the adjacent existing infrastructure and disturbance, the condition of nearby fish habitat (e.g., riparian vegetation) is anticipated to be of similar or higher quality than the areas that will be disturbed to facilitate construction.

Given the small-scale of impacts to fish habitat caused from this Project, localized effects on fish populations or stocks are not anticipated to occur. Water extraction activities are not expected to overlap with fish habitat, and most of the watercourse crossings will not involve in-stream works. Furthermore, many of the watercourse crossings that are required are anticipated to occur at areas where fish may not be present (e.g., due to ephemeral and seasonal conditions, high gradients, downstream constraints, and barriers, etc.). Dolly Varden is the only federally-listed fish species under the *Species at Risk Act* with potential to be present in the fish and fish habitat Study Area (in the Peel Watershed). However, the Project is not anticipated to negatively impact Dolly Varden habitat. Focused restoration of riparian vegetation around streams where Dolly Varden may be present, should occur.

Based on the Project design, and with implementation of appropriate mitigation measures, the potential Project-related effects to fish and fish habitat including changes in habitat structure and function (such as cover, food and nutrient supply, and temperature regulation), and water quality (e.g., from increased sedimentation or spills) is not likely to be significant. Any effects are predicted to be low in magnitude, short-term in duration, isolated, and rapidly reversible.

7.3 Wildlife and Wildlife Habitat

The Project will traverse many wildlife habitat types including boreal forests, alpine tundra, mountain slopes, and riparian areas. Many of these areas are known to support concentrations of wildlife, either spatially or temporally, and as such have been designated as Wildlife Key Areas (WKA) by the Yukon Government. A desktop review of WKA along the proposed route, as well as a review of technical reports, has identified the most likely wildlife species expected to be affected by Project activities. The North Yukon Regional Biologist and Porcupine Management Caribou Board also provided input on potential effects of this Project to wildlife species and their associated habitat along the Dempster Highway; that information has been incorporated into this assessment. Species identified during First Nation consultation meetings were also included in this assessment. Based on these information sources, the following wildlife and wildlife habitat has been included as VCs for this assessment: caribou (*Rangifer tarandus*) (both Porcupine and Hart River herds), moose (*Alces alces*), grizzly bear (*Ursus arctos*), thinhorn sheep (*Ovis dalli dalli*), birds (songbirds, waterfowl, and raptors), and a known wolf (*Canis lupus*) den.

Habitat selection by each of these species (or groups of species) varies spatially throughout the year. Because of this spatiotemporal relationship with habitat the timing of Project activities will be critical to

reduce Project effects on these VC's. The following sections describe the known existing conditions, the potential effects resulting from Project activities, mitigation measures to reduce or eliminate those effects, and a characterization of the significance of the residual effects for each VC and their associated habitat.

Other species considered, but not included for assessment were furbearers, pika (*Ochotona princeps*), and bats. These species were not included in this assessment because the Project is not expected to cause significant adverse effects to them. For example, the Project footprint is not anticipated to spatially overlap with pika or bat habitat; therefore, effects to pika and bats are not expected. Furthermore, effects to furbearing species are not anticipated since Project activities are expected to occur in the highway ROW.

7.3.1 Description of Existing Conditions

7.3.1.1 Caribou (Rangifer tarandus)

The Project will travel through the ranges of both barren-ground (i.e., Porcupine Caribou Herd) and woodland caribou (Hart River Herd and Fortymile Herd) populations.

Porcupine Caribou Herd

Barren-ground populations are well-known for their large aggregations, lengthy migrations, and significant cultural and social value to northern Indigenous people and other Canadians (COSEWIC 2016). The Porcupine Caribou Herd is one of the largest migratory barren-ground caribou herds in North America. The most recent survey estimate of the herd (2017) was 218,000 animals (Yukon Government 2018b). Although barren-ground caribou were recently listed as "Threatened" in Canada, according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the Porcupine Caribou Herd is one of 13 sub-populations that are increasing (COSEWIC 2016). The herd has grown annually at a rate of 3.7% since the 2010 estimate of 169,000 (Yukon Government 2018b).

The Porcupine Caribou Herd's annual range extends approximately 250,000 km² from Alaska, through Yukon, and into the western edge of Northwest Territories. The herd undertakes large seasonal migrations that are well-defined, moving between habitat types necessary for key aspects of their life-cycle (e.g., calving and overwintering). During the spring, the females from the herd congregate on the north slope of Yukon and Alaska to calve. The bulls also congregate during spring but do so separately from the cows during this time. In the fall, the herd ranges south from the Arctic National Wildlife Refuge and Ivvavik National Park to overlap with the Dempster Highway. Members of the herd overwinter in the vicinity of the Dempster Highway, north of Dawson, until spring when the animals make their annual migration back to the calving grounds in the north. Collared animal data has shown that caribou tend to occupy the area near the Dempster Highway from August until May, depending on annual biotic and abiotic factors (Porcupine Caribou Management Board, n.d.).

Hart River Caribou Herd

The Hart River Herd is a discrete herd of Northern Mountain caribou found in central Yukon. The herd is one of the most northern herds of the Northern Mountain ecotype of woodland caribou found in Yukon. The Dempster Highway bisects the herd's annual range from approximately km 55 to 140 (**Figure 7-2**). The range boundary is slightly different in the figure but practically speaking on the ground, this is how it translates along the Dempster (M. Suitor, pers. comm., June 7, 2019). Known fall rut and traditional winter ranges exist nearest to the highway corridor; however, caribou may be expected to occur wherever

appropriate habitat exists within their known range. Northern Mountain caribou are known to shift between habitat types during seasonal changes; alpine and upper subalpine in the summer months to valleys and lower slopes in the winter. The Dempster Highway traverse's high alpine habitat from km 70 near the North Fork Pass to km 90 at Surfbird Creek; therefore, caribou are likely to be found near the highway during the summer months. The population estimate of the Hart River Herd was estimated at 2,660, according to a survey conducted in 2015 (Environment Yukon 2016). The population trend for the herd was classified as stable. In 2014, Mountain Woodland caribou were assessed by COSEWIC as Special Concern (COSEWIC 2014).

Fortymile Caribou Herd

The Fortymile Caribou Herd once numbered in the hundred of thousands and had an annual home range that extended from Fairbanks, Alaska, to Whitehorse. By the 1970s, the herd had declined to 4,000 caribou because of a combination of harvest, predation, climate, and habitat changes. Since then, the herd has been rebounding and they are expanding their annual movements into their former ranges, including portions of the Dawson region (Barker and Hegel 2012). Beginning in 2002, caribou from the Fortymile herd began returning to Yukon. The herd's winter range now extends into areas west of Dawson, in the vicinity of the Forty Mile, Sixty Mile and Ladue rivers. The most recent estimate gives the Fortymile herd size as 43,000 animals, on either a stable or slightly declining trend (Barker and Hegel 2012). Fortymile caribou may be encountered between Dawson City and the Dempster Highway junction, and the lower portion of the Dempster Highway, anytime between September and May (M. Suitor, pers. comm.).

7.3.1.2 Moose (Alces alces)

Moose are common throughout Yukon and are expected to occur year-round in all appropriate habitat types near the proposed Project Area. In Yukon, moose populations are secure; there are an estimated 70,000 animals across the territory. Moose densities throughout Yukon generally range between 100 and 250 moose for every 1,000 km² of suitable habitat (Milligan 2018). Suitable habitat for moose is that which provides an abundance of browse and herbaceous plants, including low valleys, riparian areas, subalpine shrublands, recent burns, wetlands and lakeshores (Environment Yukon 2018a). Habitats that provide visual cover, and access to forbs, grasses, and aquatic plants constitutes suitable summer habitat. Late-winter habitat provides moose with easy access to suitable browse species, relief from deep snow and allows them to avoid vulnerability to predators during a time of increased energetic costs and has been identified as especially important for moose survival (EDI 2015). As shown in **Figure 7-2**, wildlife key areas for late-winter moose habitat have been identified along the Klondike Highway between Dawson City and the Dempster Highway junction, and along the Dempster Highway from km 0 to 70 (Environment Yukon 2019a). Furthermore, riparian areas surrounding major rivers along the Dempster Highway, specifically the Ogilvie and Blackstone, are important habitat for moose calving (M. Suitor, pers. comm). Mineral licks are an important year-round resource for moose, but especially in winter. Identified licks that overlap with the proposed Project occur at the junction of the Dempster and Klondike highways, and along the Dempster Highway at km 160 and 180 (**Figure 7-2**) (Environment Yukon 2019a).

7.3.1.3 Grizzly Bear (Ursus arctos)

Since grizzly bears occur at low densities, but are wide ranging, they are expected to occur throughout the Project Area. Environment Yukon identifies the Dempster Highway as one of the most likely places for roadside viewing of grizzly bears in the territory (Environment Yukon 2018b). Furthermore, Benson (2014) reports that grizzly bears are observed particularly often around the Yukon-Northwest Territories border on the Dempster Highway. Grizzly bears are most common in open tundra and subalpine terrain, but also range through the boreal forest. They den in winter and enter hibernation for up to 7 months (October to April), with lengths of hibernation related to latitude (COSEWIC 2012). Their diet varies by region based on available food in the area, but generally includes roots, berries, grasses, sedges, moose, caribou, and small mammals (Environment Yukon 2018b). Grizzly bears were assessed by COSEWIC as Special Concern (2012) and are ranked as Vulnerable in Yukon (Environment Yukon 2018b). The population estimate of grizzly bears in Yukon is 6,000 – 7,000 animals (COSEWIC 2012). It is estimated that the density of grizzly bears in the Richardson Mountains is 19 bears/1,000 km^2 (COSEWIC 2012).

7.3.1.4 Thinhorn Sheep (Ovis dalli dalli)

Thinhorn sheep (also referred to as Dall's sheep) occur in the Ogilvie and Richardson mountains in the Yukon and Northwest Territories and have populations that are considered Secure. They occur year-round in Yukon within defined seasonal ranges near the proposed Project Area. Dall's sheep commonly spend their entire lives within a single well-defined mountain block or range (ENR 2019), remaining primarily within the subalpine and alpine zones. In summer, Dall's sheep favour high alpine meadows, and slowly move to their traditional winter ranges at lower elevations as snow accumulates Environment Yukon 2018c). Low plateaus and ridges, particularly wind-swept south-facing slopes are preferred winter habitat (Environment Yukon 2018c). Sheep use traditional routes to access their summer and winter ranges. There are known sheep movement corridors across the Dempster Highway at approximately km 80, 84, 90, 178, 185, 200, and 224 (**Figure 7-2**) (Environment Yukon 2019a). Typically, Dall's sheep occupy rugged terrain to escape from predators, and females will seek isolated high cliffs and ridges to lamb. Lambing occurs from May to early June (Environment Yukon 2018c). Lambs and ewes are vulnerable during the lambing period, and lambing locations are known to occur at various locations along the Dempster Highway. Angelcomb Mountain, near km 85 is particularly sensitive as it occurs in an area where the highway traverses through suitable, alpine habitat for lambing. Mineral licks are also an important habitat feature, particularly for ewe groups post-lambing, but are regularly visited throughout the snow-free period.

7.3.1.5 Wolf (Canis lupus) Den

A known active wolf den is located along the Dempster Highway near Engineer Creek (M. Suitor, pers. comm). The den is located on the east side of the highway, close to the ROW, and is therefore vulnerable to disturbance caused from Project-related construction activities. The exact location of the den is not provided in this report in order to avoid additional human disturbance to the den. The den has been monitored by government biologists and it is known that the den has been used in consecutive years. A second known active wolf den has been identified on the west side of the highway near the Blackstone River bridge (M. Suitor, telephone call).

7.3.1.6 Birds

There are approximately 134 species of birds (raptors, waterfowl/waterbirds, and songbirds) that can be found within the proposed Project Area (**Appendix H**). Most of these species are only found in this region during the summer months when they migrate to this part of the Yukon for the purposes of breeding. In addition to those local breeding species, many arctic tundra nesting species (e.g., geese, swans, shorebirds, etc.) use habitats along the Project Area as a staging area during their spring/fall migration, only occupying habitats for a short period of time before they continue their migration. The timing of the migration varies for individual species; however, spring migration is assumed to begin by early April. Raptors and waterfowl are first to arrive in April, followed by songbirds in May. The fall migration period extends from late summer to early fall, as migrants gradually begin flying south by early to mid-August. The breeding season begins mid-May and concludes mid-August.

Raptors

Raptors are a diverse group of bird species (eagles, ospreys, owls, hawks, falcons) with varying distributions and habitat requirements. There are eighteen raptor species known to occur within the proposed Project Area (**Appendix H**). Of the 18 species, 11 species are migratory leaving the territory in the fall, while the remaining 7 remain in the territory year-round. Among the 18 species, only the Short-eared Owl (*Asio flammeus*) has special conservation status according to COSEWIC, as it is listed as Special Concern. Both *anatum* and *tundrius* subspecies of the Peregrine Falcon (*Falco peregrinus*) were reassessed by COSEWIC in 2017 and designated as Not at Risk. However, the Peregrine Falcon and Gyrfalcon (*Falco rusticolus*) are listed as “specially protected” species according to the *Yukon Wildlife Act*. Peregrine Falcons have been recorded along the Dempster Highway corridor, and several Wildlife Key Areas specific to Peregrine Falcon are known (Environment Yukon 2019a). Peregrine Falcons may occur near the proposed corridor from May to August for the purposes of nesting. Peregrine Falcon nests occur on cliffs adjacent to or near bodies of water, most frequently on rocky cliffs along major rivers (Sinclair et al. 2003). In addition to designated Wildlife Key Areas for Peregrine Falcon, there are numerous Wildlife Key Areas that are known nesting areas for Gyrfalcon, Bald Eagle (*Haliaeetus leucocephalus*), and Golden Eagle (*Aquila chrysaetos*) along the Dempster Highway between km 0 and the Northwest Territories border (**Figure 7-2**). The exact locations of raptor nests are not displayed in the Wildlife Key Areas data due to concerns of poaching eggs and fledglings.

Waterfowl/Waterbirds

There are many species of waterfowl/waterbirds (i.e., ducks, geese, swans, loons, shorebirds, gulls) that can be found within the proposed Project Area during the summer months. Waterfowl/waterbirds can be expected to occur and breed wherever their habitat requirements are met, including throughout much of the low-lying habitats and productive shallow waters of lakes, ponds, wetlands, rivers, and streams. Specific nesting habitat requirements vary with species, and can range from tree cavities, mats of vegetation in the water or at the water’s edge, and on the ground in wooded uplands. In general, waterfowl/waterbirds have a high fidelity to breeding sites, returning to the same nest site each year in the spring. There are no designated Wildlife Key Areas specific to waterfowl/waterbirds near the proposed Project Area.

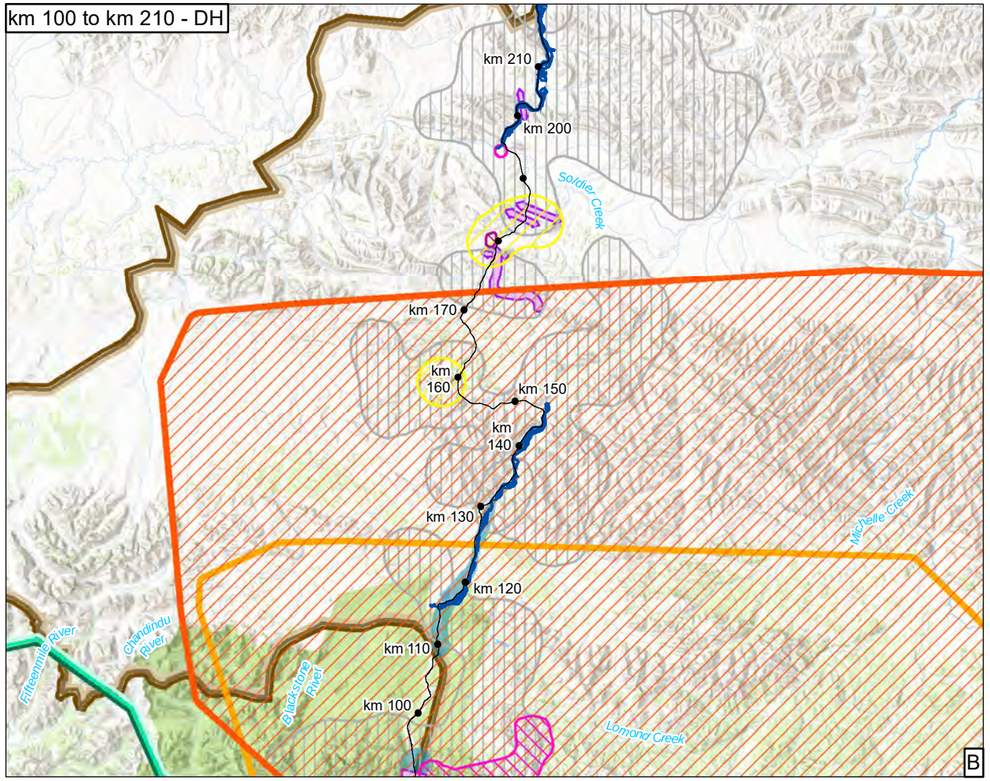
There are four species of waterfowl/waterbird known to occur in the Project Area that have some level of conservation status. Horned Grebe (*Podiceps auritus*) and Red-necked Phalarope (*Phalaropus lobatus*) are listed as Special Concern by COSEWIC; Lesser Yellowlegs (*Tringa flavipes*) is listed as Species Under Review by COSEWIC; and Trumpeter Swan (*Cygnus buccinator*) is listed as "specially protected" according to the *Yukon Wildlife Act*. Horned Grebes prefer small ponds and wetland habitats with marshy shorelines (including man-made borrow pits), whereas, Lesser Yellowlegs, Red-necked Phalarope, and Trumpeter Swans prefer the habitats found in a wide variety of waterbodies including lakes, rivers, streams, wetlands, and ponds (Sinclair et al. 2003). All four species can be expected to occur in the Project Area from May to October and have been previously recorded along the Dempster Highway (Sinclair et al. 2003).

Passerines/Forest Birds

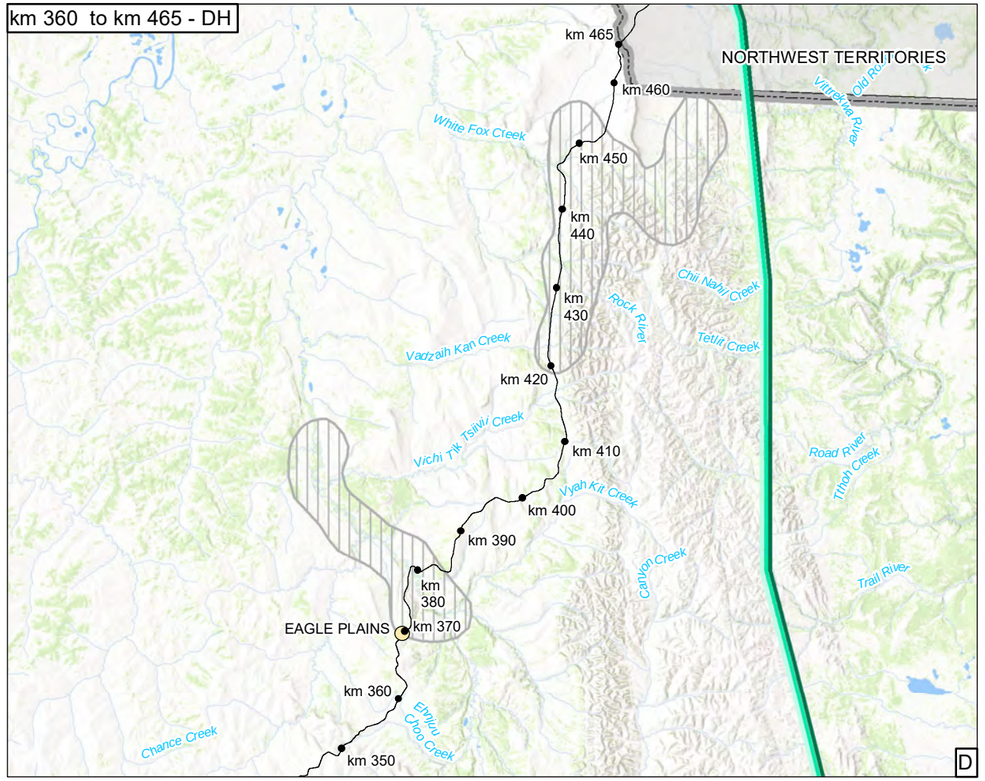
There are many species of passerines, as well as forest birds (e.g., woodpecker, kingfisher, grouse, nighthawk) that occur near the proposed Project Area. While most species are migratory and arrive for the purpose of breeding, a few species are year-round residents (e.g., woodpeckers, chickadees, jays, ravens). Species vary widely in distribution and abundance and can be found in all terrestrial habitat types near the proposed Project Area. Among the species that may be found in the Project Area, four are listed as species at risk with COSEWIC: Bank Swallow (*Riparia riparia*) (Threatened), Common Nighthawk (*Chordeiles minor*) (Special Concern), Olive-sided Flycatcher (*Contopus cooperi*) (Special Concern), and Rusty Blackbird (*Euphagus carolinus*) (Special Concern).

The entire proposed Project Area is within the range of the Bank Swallow (Sinclair et al. 2003). They excavate nests into exposed soil banks along eroded watercourses and lakeshores, in sand and gravel pits/quarries, and road embankments (Sinclair et al. 2003). The Project Area is at the northern extent of the Common Nighthawk range, so it is possible they may be observed during Project activities. Olive-sided Flycatcher can be found along the entire Project Area; however, they are uncommon in central Yukon (Sinclair et al. 2003). Typical nesting habitat for Olive-sided Flycatcher is open spruce forests, including forest edges, along burns, and adjacent to wetlands (Sinclair et al. 2003). Rusty Blackbird can be expected to occur within the entire proposed Project Area from April to October. Their presence is most commonly associated with coniferous wetland habitats, usually along the edges of ponds or lakes with dense marsh grasses, shrubs, and usually scattered standing dead trees (Sinclair et al. 2003).

km 100 to km 210 - DH

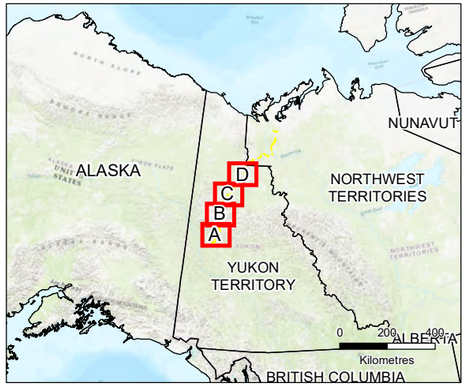


km 360 to km 465 - DH

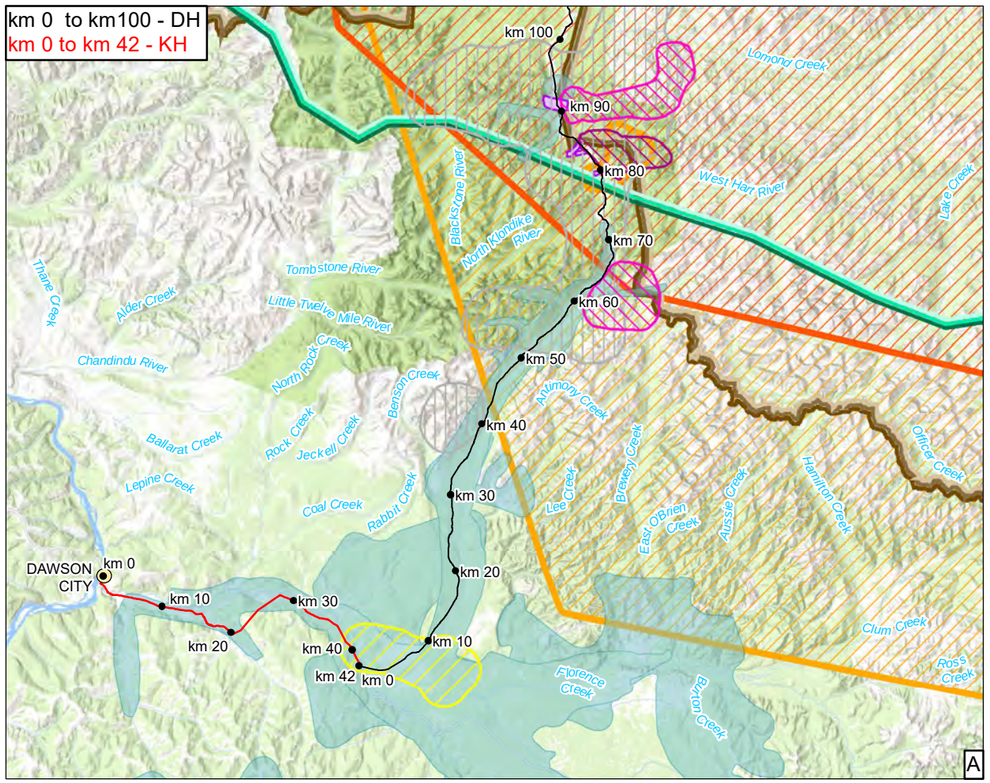


Dempster Fibre Project

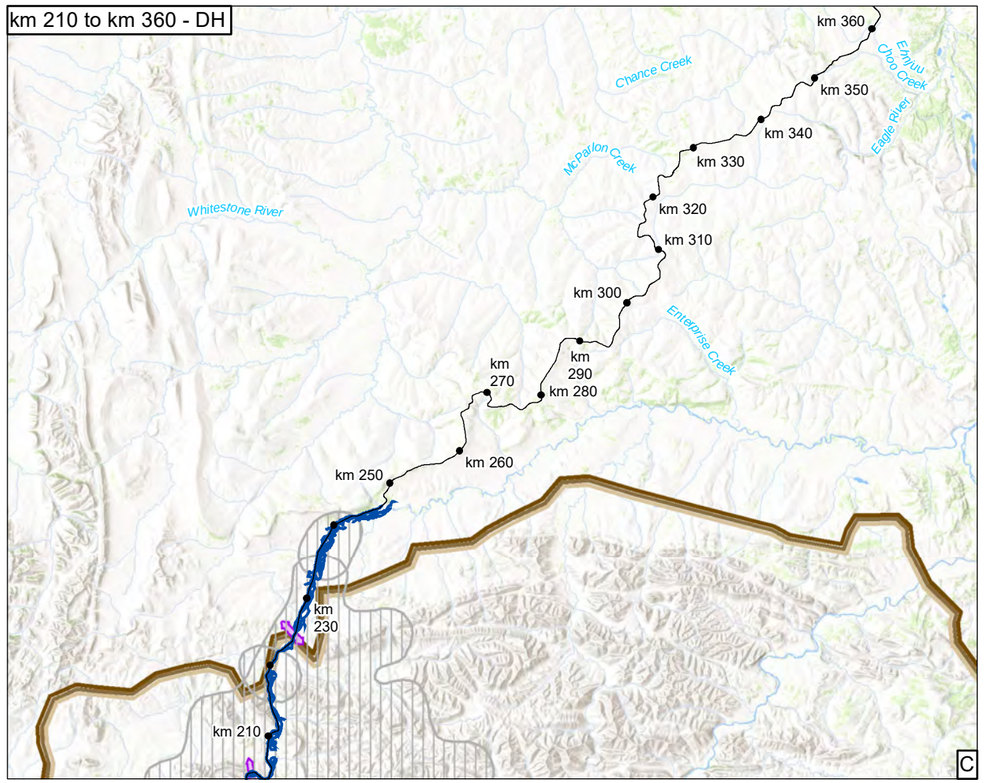
Key Areas for Wildlife and Wildlife Habitat



km 0 to km100 - DH
km 0 to km 42 - KH



km 210 to km 360 - DH



Legend

- Kilometre Marker
- Dempster Highway - DH
- Klondike Highway - KH

Caribou Range

- Porcupine Caribou Herd Range
- Hart River Caribou Herd Range
- Hart River Caribou Fall Rut
- Hart River Caribou Winter Range

Wildlife Key Area

- Moose Calving Habitat
- Moose Late Winter Range
- Thinhorn Sheep Movement Corridor
- Thinhorn Sheep Spring Lambing
- Thinhorn Sheep Winter Range
- Bird Summer Nesting
- Mineral Lick

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licenced under the Open Government Licence - Government of Yukon
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Topographic Map

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Highways and
Public Works

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7.3.2 Project Interactions and Potential Effects

Proposed Project activities are likely to interact with wildlife and wildlife habitat within the Project Area and result in potential effects. Project activities most likely to result in effects are those associated with mobilization, staging, and construction (**Table 7-7**).

Table 7-7 Potential Interactions Between Project Activities and Wildlife and Wildlife Habitat

Activity	Project Interactions	Potential Effects
Establishment and operation of temporary camps and staging areas	· Presence of a camp · Use and staging of heavy equipment · Human presence	· Sensory disturbance · Mortality
Cable Installation Methods and Geotechnical Drilling	· Vegetation Removal · Drilling · Use and staging of heavy equipment	· Habitat loss · Sensory disturbance
Ground clearing	· Vegetation removal · Use of equipment	· Habitat loss · Sensory disturbance
Light-duty vehicle traffic	· Vehicle use	· Sensory disturbance · Mortality or injury

Project activities are proposed to occur throughout the year, so there may be spatial and temporal overlap with activities and wildlife occurrence. The following table summarizes the spatial and temporal extent where Project activities will overlap with various wildlife species and sensitive life-cycle requirements (e.g., nesting, calving, lambing, denning, etc.) (**Table 7-8**).

Table 7-8 Summary of Wildlife-specific Sensitive Areas, Both Spatial and Temporal, Along the Dempster and Klondike Highways

Species	Life-cycle	Spatial Overlap	Temporal Overlap
Porcupine Caribou	Overwintering Range	Km 80 to 465 of Dempster Highway	August to May
Hart River Caribou	Herd Range	Km 70 to 230 of Dempster Highway	Year-round
Fortymile Caribou	Overwintering Range	Lower portion of Dempster Highway	September to May
Moose	Calving	Klondike, Ogilvie, and Blackstone River Corridors	May
	Late-winter	Km 5 to 42 of Klondike Highway Km 0 to 73; 88 to 95; 109 to 132 of Dempster Highway	March and April
Grizzly Bear	Summer	Yukon/Northwest Territories Border	May to October

Species	Life-cycle	Spatial Overlap	Temporal Overlap
Sheep	Lambing	Km 85: Angelcomb Mountain Km 180: Engineer Creek	May and June
	Movement Corridors	Km 80, 84, 90, 178, 185, 200, and 224 of Dempster Highway	Spring and Fall
Wolf	Den	Km 165 – 175; Blackstone River bridge	Year-round
Birds	Breeding	Entire length of Project	May 15 to August 15

7.3.2.1 Caribou

Caribou are known to occur along the Dempster Highway during certain times of the year; therefore, potential effects to caribou are only expected to occur when there is spatial and temporal overlap between Project activities and caribou occurrence. Based on a review of the literature, caribou from the Porcupine Herd are likely to be found all along the Dempster Highway from August until May (Porcupine Caribou Management Board n.d.). Caribou from the Hart River Herd can be found near the Dempster Highway all-year; however, most animals are concentrated in the area surrounding Tombstone Territorial Park between km 60 and 120 (Peel Watershed Planning Commission 2008). Caribou from the Fortymile herd may be encountered between September and May along the Klondike Highway and lower portion of the Dempster Highway (M. Suitor, pers. comm.).

Project activities that may affect caribou at various spatial and temporal locations along the proposed construction route include:

- Establishment and operation of temporary camps and staging areas;
- Horizontal directional drilling and geotechnical drilling;
- Trenching and installation of the fibre cable;
- Vegetation removal; and,
- Light-duty vehicle traffic.

Caribou are considered sensitive to land use disturbances and human presence, especially during the calving season. They may avoid nearby habitats and be disturbed by construction activities including equipment noise and the presence of camps and people. The construction activities likely to cause the largest disturbance to caribou is horizontal directional drilling (HDD). The occurrence of HDD at specific-sites and the establishment of temporary camps will create prolonged sensory disturbances such as noise and human presence. These prolonged sensory disturbances may create barriers to caribou, which may limit their natural movement patterns across the landscape. Caribou may be particularly sensitive to these disturbances, especially if they overlap spatially and temporally with their migration across the highway. Furthermore, vegetation removal and ground clearing will result in some habitat loss along the highway ROW. Injuries to caribou may also result from tripping on a surface-laid cable or on a cable trench. Caribou mortality may result from light-duty vehicle collisions due to an increased number of Project-related vehicles using the Klondike and Dempster highways.

7.3.2.2 Moose

Moose are also sensitive to land use disturbances and human presence, although considered more tolerant than caribou. The potential effects to caribou, listed above, are also relevant to moose. Specifically, sensory disturbance to moose during the calving season (i.e., May) may cause moose to abandon primary calving habitat for less ideal habitat. Primary calving habitat has been identified along the riparian areas of the Ogilvie and Blackstone Rivers (**Figure 7-2**) (M. Suitor, pers. comm.). Sensory disturbances that overlap spatially and temporally with late-winter habitat may cause moose to avoid this habitat, potentially affecting survival (EDI 2015). The North Fork Pass to Ogilvie Hill is a particularly sensitive area for late-winter moose habitat. The habitat in this area is generally narrow strips of willow along creeks surrounded largely by non-habitat. Therefore, pushing moose out of this wintering area greatly reduces their available wintering habitat. Vegetation removal and ground clearing will result in some immediate habitat loss along the highway ROW. Furthermore, the regeneration of willow along the highway ROW may lead to increased vehicle collisions with moose, as willow is a primary food source for moose. An increase in moose mortality resulting from vehicle collisions may also result from an increase in Project-related vehicles using the Klondike and Dempster highways.

7.3.2.3 Grizzly Bear

An increased risk of mortality to grizzly bears may occur as a result of the establishment and operation of temporary camps and staging areas. Temporary camps will produce food waste and garbage that is likely to attract grizzly bears. If grizzly bears are successful in locating garbage, they will often revisit the source of the garbage, which results in them being habituated to human presence. Once grizzly bears are habituated to humans, they can become dangerous, which often results in the animals being killed to avoid additional human-bear conflicts. Temporary camps established between November and March, which coincides with grizzly bears' denning period, are unlikely to encounter grizzly bears.

7.3.2.4 Sheep

Project activities may affect sheep during the lambing period (i.e., May and June) and during early spring and fall when sheep are crossing the Dempster Highway between summer and winter range habitat at identified movement corridor locations (**Figure 7-2**). Project activities most likely to disturb sheep during the lambing period are construction activities and human presence at temporary camps. These activities will result in increased equipment noise causing prolonged sensory disturbance. The prolonged increase in sensory disturbance and presence of people during the early summer period may inhibit sheep lambing in their preferred locations or cause ewes and lambs to move to alternative habitat causing stress and the potential for increased predation (Lambert Koizumi et al. 2011). Prolonged sensory disturbances may also create a barrier to sheep, limiting their natural movement patterns across the Dempster Highway at historic crossing locations.

7.3.2.5 Wolf Den

Project activities expected to occur around Engineer Creek and the Blackstone River bridge may result in disturbance to wolf dens, known to be active annually. Project activities that could disturb the dens include the establishment and operation of temporary camps and staging areas, horizontal directional drilling, installation of the fibre cable, and vegetation removal. Disturbance of the dens could include both sensory and/or physical disturbance. Sensory disturbance is only likely to occur during the spring and summer months while wolves are actively using the dens, while physical disturbance to the den could occur at any

time throughout the year. It is anticipated that the dens will be occupied from April to September so sensory disturbance outside this window should not have any impacts. However, a physical disturbance to the dens, at any time of the year, will result in the dens being unusable, causing the wolves to abandon them and relocate.

7.3.2.6 Birds

Project activities are expected to directly affect birds during the nesting season (i.e., May to August), when construction will temporally and spatially overlap with nesting birds. Project activities most likely to affect birds include construction activities resulting in ground clearing and vegetation removal, and the establishment of temporary camps. These activities will result in direct habitat loss, the potential disturbance of existing nests, and sensory disturbances resulting in the avoidance of habitat. The increase in sensory disturbance and presence of people during the breeding season may cause nesting birds to abandon existing nests or avoid nesting in high traffic areas in the short or long-term. There are existing Wildlife Key Areas for raptor nesting sites that are known to be particularly vulnerable to sensory disturbance, especially during the early summer when eggs are being laid and incubated. Project activities conducted in the winter, fall and early spring are expected to have minimal negative effects on breeding and non-breeding birds.

7.3.3 Mitigation Measures

To eliminate, reduce or control potential effects to wildlife and wildlife habitat caused by Project activities, the Proponent has committed to the following mitigation measures:

General Mitigation Measures related to Wildlife and Wildlife Habitat

- A wildlife monitoring program will be developed that will include having a wildlife monitor on-site during construction to ensure that mitigation measures are applied.
- Construction activities will minimize the volume levels, duration, and frequency of noise sources, to the extent possible.
- Camps will be located on existing cleared sites.
- Vegetation clearing will be minimized to the extent possible.
- No personnel shall carry or discharge firearms for the purpose of hunting wildlife.
- Camps and staging areas will not be placed within 1 km of known mineral licks.
- The fibre optic trench will be backfilled immediately to avoid wildlife injury.
- In ponds or wetlands where beaver or muskrat lodges are present, water withdrawal will not cause water levels to drop more than 5 cm.
- In areas where the cable is not in contact with the ground surface, sandbags will be used to weigh the cable down to reduce potential for animal tripping.

Mitigation Measures related to Caribou

- Project activities will not disturb, block or cause substantial diversion to migrating caribou.
- Project activities will not alter caribou migration habitat in a way that will prevent caribou from using it in the future.
- If any caribou are observed within a 1 km radius of a work site, all work activities will cease until the caribou have moved safely beyond the 1 km buffer. The Dawson City regional biologist will be contacted to discuss mitigation options if the caribou presence persists.

Mitigation Measures related to Moose

- Temporary camps will not be placed within 1 km of the Ogilvie or Blackstone Rivers in May, as these river corridors are known for moose calving.

Mitigation Measures related to Sheep

- Construction activities, including the establishment of camps, will be avoided within a 5 km radius of Angelcomb Mountain and Km 180 of the Dempster Highway during May and June, as these areas are known sheep lambing sites.

Mitigation Measures related to Bears

- Bear safety training will be provided to all on-site personnel.
- All waste will be managed in a way that it is not a bear attractant. It will be temporarily stored in bear-proof containers until it is properly disposed in a waste management facility.
- If bears are present near camp, a wildlife monitor will monitor the bear and notify all camp occupants of the bear's presence.
- Electric fences will be installed around all camps from April to October to avoid human-bear conflicts.
- If bears are present within 200 m of the work area, work will cease until the bears have moved safely out of the area.

Mitigation Measures related to known Wolf Dens

- The fibre optic cable will be installed on the west side of the Dempster Highway near km 170 to avoid disturbing an active wolf den located near the highway ROW.
- No drilling will occur from mid-April to mid-June in the area near km 170 and the Blackstone River bridge crossing to avoid disturbing known wolf dens.

Mitigation Measures related to Birds

- No construction activities shall take place within 300 m of an active raptor nest from April 15 to August 15.
- Breeding birds are not to be disturbed. Where possible, clearing vegetation will occur outside the migratory bird nesting season (i.e., between May 1st and August 15th). If clearing must occur after May 1st, then nest surveys shall be conducted by trained personnel prior to clearing. If active nests of migratory birds are discovered, the proponent shall postpone activities in the nesting area until nesting is complete.
- No work activities will occur between 5 am and 10 am from km 5-7 on the Dempster Highway between April 1-20, and km 4-8 on the Dempster Highway between April 21-May 4 to protect a known sharp-tailed grouse lek.

7.3.4 Effects Characterization and Significance

After the mitigation measures listed in **Section 7.3.3** have been applied, it is predicted that Project activities will not result in significant effects to specific wildlife or wildlife habitat. However, there may still be residual effects to wildlife and wildlife habitat including habitat loss resulting from ground clearing and vegetation removal, sensory disturbance resulting from various construction activities and establishment of temporary

camps, mortality resulting from vehicle collisions, and injury resulting from tripping on cable, or falls into trenches.

Habitat Loss: Vegetation removal during construction activities will result in habitat loss. The extent of habitat loss will be mitigated by limiting vegetation clearing to only within the highway ROW and scheduling the clearing to occur outside the breeding bird window. Where clearing must take place during the breeding bird window, qualified staff will perform pre-clearing nest surveys. Since all vegetation removal will occur in the highway ROW, there will be minimal habitat loss for caribou, moose, and sheep. Therefore, the effects of habitat loss are anticipated to be of low magnitude, fully reversible over the short-term once construction ceases, and are only expected to occur once.

Sensory Disturbance: Construction activities and the establishment of temporary camps will increase sensory disturbance to wildlife and decrease habitat quality. These disturbances can be mitigated by avoiding spatial and temporal overlap of certain activities with specific species during sensitive times of year (i.e., lambing, calving, overwintering, breeding). The temporal extent of the sensory disturbance to any one area is usually less than a day (e.g., horizontal directional drilling), so long as care is taken to avoid overlapping potential sensory disturbances with sensitive times of the year for specific species, the magnitude of the effect should be minimal. Furthermore, the duration of the sensory disturbance should be minimal, as the equipment and temporary camps are constantly moving as progress on the Project is made. The frequency of the sensory disturbance should be low; once the equipment is finished installing the line in one area, it will move on and not return to that area.

Mortality or Injury: Collisions with vehicles is one of the primary anthropogenic sources of wildlife mortality in Yukon (EDI 2015). Therefore, minimizing wildlife-vehicle collisions is important for both public safety and wildlife populations. The frequency of vehicle-wildlife collisions is expected to be low along the Dempster Highway. Previous data has found that only one vehicle-wildlife collision has occurred along the Dempster Highway from 2003-2014 (EDI 2015). Furthermore, the magnitude of wildlife mortality from vehicle collisions is expected to be low given collisions will likely occur with individual animals. The geographical extent and timing of highway mortalities may occur year-round, anywhere along the Klondike and Dempster Highways, but are more likely to occur during the winter when road conditions are poor, and light is limited. Construction crews will need to be extra vigilant when working in areas where high numbers of wildlife are present.

Mortality or Injury: Collisions with vehicles is one of the primary anthropogenic sources of wildlife mortality in Yukon (EDI 2015). Therefore, minimizing wildlife-vehicle collisions is important for both public safety and wildlife populations. The frequency of vehicle-wildlife collisions is expected to be low along the Dempster Highway. Previous data has found that vehicle-wildlife collisions are limited along the Dempster Highway from 2003-2014 (EDI 2015). No population level effect from wildlife mortality from vehicle collisions is expected as collision rates are low. The geographical extent and timing of highway mortalities may occur year-round, anywhere along the Klondike and Dempster Highways, but are more likely to occur during the winter when road conditions are poor, and light is limited. The area that is particularly at risk of vehicle-wildlife collisions is in the Eagle Plains plateau during winter, when snow banks are larger, and caribou are known to be present (M. Suitor, pers. comm. 2019b). Construction crews will need to be extra vigilant when working in areas where high numbers of wildlife are present.

7.4 Vegetation and Wetlands

The Project traverses through two ecozones and eight ecoregions in Yukon (**Table 7-9**). Descriptions of these ecozones and ecoregions are drawn from Smith et al. (2004). These areas include many vegetation communities: boreal forest, taiga forest, tussock tundra, alpine tundra, wetlands, and riparian areas. The following sections describe the known baseline information for vegetation and wetlands in these regions, the likely Project interactions and potential effects resulting from Project activities, mitigation measures to reduce or eliminate those effects, and a summary statement concluding the overall significance of the Project on vegetation and wetlands.

Table 7-9 Ecozones and Ecoregions Traversed by the Project from South to North

Ecozones	Ecoregion	Approx. Segment Length (km)
Boreal Cordillera	Klondike Plateau	51
	Yukon Plateau-North	26
Taiga Cordillera	Mackenzie Mountains	54
	North Ogilvie Mountains	131
	Eagle Plains	211
	British-Richardson Mountains	34

7.4.1 Description of Existing Conditions

7.4.1.1 Vegetation

The Boreal Cordillera ecozone is an extension of the boreal forest that spans across Canada and vegetation ranges from boreal forest at lower elevations to alpine tundra above the treeline. Forests are composed of black and white spruce (*Picea mariana, P. glauca*) in pure or mixed stands with some paper birch (*Betula papyrifera*), trembling aspen (*Populus tremuloides*), and balsam poplar (*P. balsamifera*). Within the Klondike Plateau ecoregion, fire is widespread, causing younger seral stands to often be more common than mature forest. Herb-bryoid communities and shrub-dominated areas are also common. Previous disturbance from placer mining is evident, especially around Dawson City. In the Yukon Plateau-North ecoregion, the cable route primarily runs through shrub-dominated and herb-bryoid communities.

The southern regions of the Taiga Cordillera ecozone contain open woodlands or taiga forest composed of white spruce and paper birch. The northern sections contain tundra tussock vegetation, including dwarf shrubs, mosses, lichens, and cottongrass (*Eriophorum* spp.) at higher elevations. Throughout the ecozone, higher elevations support alpine tundra vegetation, including shrubs, lichens, and mountain avens (*Dryas integrifolia*).

The Mackenzie Mountains ecoregion is a transition zone from boreal in the south to taiga in the north. Moving northward, herb-bryoid and shrub-dominated communities, including herb- and shrub-dominated wetlands and floodplains, are widespread in the North Ogilvie Mountains ecoregion. In the Eagle Plains ecoregion, the vegetation is a mixture of herbaceous and low shrub communities and open black and white spruce forest. Forest fires are also common, resulting in forests containing paper birch and balsam poplar. The British-Richardson Mountains ecoregion is characterized by low shrub and herbaceous tundra with balsam poplar, white spruce, and tamarack larch (*Larix laricina*) forests in some more sheltered areas.

There are three main types of roadside vegetation present: grassy tundra, regenerating shrubs, and forested bogs. The following descriptions of these vegetation types draw on information in the environmental field assessment (Ecofor 2016).

The grassy tundra includes the areas of tundra with no trees and only very low shrubs. For the most part, the grassy tundra was not disturbed during the original road construction when the roadbed fill was added directly on top of the tundra. Permafrost is near the surface in the summer and many areas remain wet. Some areas south of the Ogilvie River (km 195) are wet enough to be considered wetlands, whereas others along ridgelines north of km 246 are primarily dry.

The regenerating shrubs are primarily willow (*Salix spp*.). Shrubs in the right-of-way are frequently cleared along the Klondike Highway and occasionally cleared along the southern Dempster Highway (below km 153). North of km 153, there are some locations of dense, tall shrub regrowth that has not been mowed since the highway was constructed and, locally, trees (black spruce, tamarack, birch) reaching 10+ m tall. Clearing vegetation along the right-of-way has resulted in permafrost melting and the development of small local wetlands and ponds along the right-of-way, a feature not found in the adjacent undisturbed landscape (Ecofor 2016).

The forested bogs contain permafrost with a thin unfrozen surface layer and black spruce forest of varying densities. During highway construction, most of the trees were cleared from the right-of-way, but recent brushing has not taken place. The total area covered by bogs increases north along the highway, with the largest wetlands located in the Ogilvie and Mackenzie River delta. To the south, forested bogs are uncommon.

The Project Area is within the Klondike Highway, the Yukon Energy Transmission Corridor, and the Dempster Highway ROW, along which vegetation clearing activities have been previously assessed by YESAB and approved by the Government of Yukon. Along the Klondike Highway section, vegetation has been cleared (cut down to a maximum of 6 inches above the ground) regularly within the last five years. In the winter of 2019, approximately 20 m from either side of the centre line was cleared from km 677 to km 690.5 and from km 697.6 to km 702.1. Clearing from km 690.5 to km 697.6 and from km 702.1 to km 713.4 is planned for the summer of 2019.

Along the Dempster Highway, clearing of various widths has occurred only along some segments over the last 5 years, with only the first 10 km being cleared regularly. For the summer of 2019, clearing is planned between km 0 and km 20 (~15 m from centre line), km 170 and km 200 (~10 m from centre line), and km 350 to km 390.5 (~10 m from centre line). The segments not cleared in 2019 will be cleared over the next five years, with the full length of the highway being cleared on a six-year cycle (North Yukon Regional Biologist, Environment Yukon, telephone call).

Information on known at-risk plants along the highway ROWs was acquired from the Yukon Conservation Data Centre (YCDC 2019) (**Table 7-10**).

Table 7-10 At-risk Plants Found Along the Highway ROWs

Species	Status in Yukon[1]	Occurrence(s)	Site Description
Hudson Bay sedge (*Carex heleonastes*)	S1 - Critically Imperiled	1) Dempster Highway, near km 50.4 (Wolf Creek). 2) Dempster Highway, along a stream near North Fork Pass (in vicinity of km 76).	1) Roadside by creek. 2) Along a stream.
Boreal alpine forget-me-not (*Eritrichium boreale*)	S2S3 – Imperilled to Vulnerable	1) Dempster Highway, km 228 to 245.	1) Rocky ledges, rock bluffs, stony heathlands around the Ogilvie River.
Pink dandelion (*Taraxacum carneocoloratum*)	S1S3 – Critically Imperilled to Vulnerable	1) Dempster Highway, km 86.5 to 88.5, primarily on northeast side of highway. 2) Dempster Highway, km 106 to 109.	1) Gravel and river edges 2) River meadows and gravelly summit of esker.
Walpole's poppy (*Papaver walpolei)*	S3 - Vulnerable	1) Dempster Highway, km 175.	1) Moist calcareous seepages of limestone hills.
Yenisei River Pondweed (*Potamogeton subsibiricus*)	S2S3 – Imperilled to Vulnerable	1) Dempster Highway, lakeshore of Two Moose Lake at km 104, highway pullout on west side of highway.	1) Lakeshore in less than 2 inches of water.

[1] Statuses include the following: S3 – Vulnerable; S2S3 – Imperilled to Vulnerable; S1S3 – Critically Imperilled to Vulnerable; S1 – Critically Imperilled

There are at least 154 introduced (non-native) plant species in the Yukon, including at least 20 that are invasive (displace native vegetation and alter habitats) (Yukon Invasive Species Council 2018). Invasive plants are typically found in areas disturbed by humans, such as around communities and along highways.

Along the Klondike Highway, from the Dempster cut-off to Dawson, roadside invasive plant surveys in 2016 recorded the following species: white sweet clover (*Melilotus alba*), aisike clover (*Trifolium hybridum*), smooth brome (*Bromus inermis*), narrowleaf hawksbeard (*Crepis tectorum*), yellow sweet clover (*Melilotus officinalis*), oxeye daisy (*Leucanthemum vulgare*), and common tansy (*Tanacetum vulgare*) (Yukon Invasive Plant Council 2018). White sweet clover has also been identified along the first 30 km of the Dempster Highway (Yukon Invasive Species Council 2018).

7.4.1.2 Wetlands

Along many sections of the Klondike and Dempster Highways, wetlands are abundant and range from entirely open water to wetlands that dry completely in the summer. The wetlands vary in vegetation type from herbaceous vegetation, to shrub-dominated, to forested with spruce and/or tamarack.

Along the central section of the Dempster Highway, which follows ridgelines, the presence of wetlands is likely due to localized permafrost melt beside the highway. Along the Klondike Highway, there are many small (5-20 m long) wetlands next to the highway, often within the right-of-way (Ecofor 2016). The previous environmental field assessment (Ecofor 2016) noted that ducks and their young were present in these ponds through early August.

7.4.2 Project Interactions and Potential Effects

Project activities are expected to interact with vegetation and wetlands and result in potential effects. The effects on vegetation and wetlands will primarily be associated with the construction phase of the Project, although effects during the operations and maintenance phases are also possible. Potential effects include: loss of vegetation, alteration of vegetation and wetlands, aesthetic damage to tundra, disturbance to species at risk (two plants), creation of roadside wetlands due to permafrost melting, spread of invasive plant species, and degradation of vegetation or wetlands due to dust or spills along the right-of-way. The greatest levels of disturbance during construction are expected to be caused by the clearing/mulching of vegetation to allow for access and preparation of work areas during cable installation. Post-construction, potential effects will be limited to maintenance and emergency response activities.

7.4.2.1 Vegetation

Construction of the cable route will result in loss and alteration of vegetation. The cable route and temporary access trails within the ROW will be cleared of vegetation either through mulching or hand slashing. Mulching refers to the cutting of tall grass, shrubs, or small trees using rotating blades on a mechanized vehicle and hand slashing refers to cutting trees, branches, or brush with hand-held tools. Hand slashing will be used in sensitive environments and riparian areas.

Throughout the Project area, machinery has the potential to damage the ground surface, which would impact the aesthetics of the landscape, result in soil compaction and root damage, and potentially cause permafrost melting that may create wetlands or ponds along the edge of the highway. In some areas, the aesthetic damage would be minimal due to the presence of shrubs that would grow up and hide any damage from view.

Clearing of shrubs along the right-of-way during the Project could also lead to permafrost melting and the creation of ponds and wetlands along the right-of-way. This melting of permafrost due to machinery on the ground or shrub-clearing could cause long-term changes to the roadside vegetation. The environmental field assessment (Ecofor 2016) suggested that ponds and wetlands created through melting permafrost may continue to expand after the Project is complete. Ponds formed by the melting of permafrost have been recognized as sources of carbon emissions (Kuhn et al. 2018) and can negatively affect nearby waterbodies by introducing additional organic carbon, which reduces sunlight absorption (Wauthy et al. 2018). For a more extensive discussion of permafrost impacts, see **Section 7.1**.

The at-risk plants could also be disturbed due to clearing or machinery operation during construction. Post-construction, the chance of an impact would be low, unless the species are present along an access trail.

There is potential for the Project to introduce invasive plant species to new areas via equipment and machinery brought onsite from infested areas, or importation of gravel or fill (if required). Particular care will need to be taken in areas where invasive species have been recorded previously.

The construction phase of the Project could also result in degradation of vegetation due to spills (e.g., hydraulic fluid, fuel etc.) or dust deposition along the right-of-way.

7.4.2.2 Wetlands

Since many wetlands are located adjacent to or within the highway right-of-way, there is potential for them to be impacted by Project activities. Negative interactions between the cable route and wetlands are possible depending on the alignment of the cable route.

Installing the cable through wetlands could result in disturbance or damage to wetland vegetation and/or wildlife. Potential effects include ground and vegetation clearing, compaction of herbaceous vegetation, and soil disturbance in drier wetlands. Wetlands characterized as forested bogs are often associated with permafrost and are particularly sensitive to ground disturbance, which could lead to permafrost melting.

Many wetlands contain nesting waterfowl, thus Project activities around wetlands during summer could also disturb wetland wildlife (e.g., waterfowl/waterbirds).

7.4.3 Mitigation Measures

To eliminate, reduce or control potential effects to vegetation and wetlands caused by Project activities, the Proponent has committed to the following mitigation measures:

General Mitigation Measures related to Vegetation and Wetlands

- Existing rights-of-way and previously cleared or brushed areas will be used for cable alignment as much as possible.
- Construction equipment will be chosen with the aim of minimizing ground pressure and ground disturbance.
- When working along the ROW, heavy equipment will not leave the existing ROW.
- Trails 1-2 m wide for surface-lay cable installation will be cleared of vegetation in winter using small equipment.
- Trails 2-3 m wide for shallow plow installation will be cleared of vegetation in winter using small equipment.
- Trails larger than 2-3 m will be cleared in winter when the ground can support the weight of equipment and trees can be removed without dislodging the root balls.
- During winter construction, snow will be maintained on trails to avoid damaging underlying soil and roots.
- Proponent will re-seed areas where natural revegetation has not been established using a seed mix of native endemic plants.

Mitigation Measures related to Vegetation

- Width of vegetation cleared will be minimized and limits will be clearly flagged.
- Cutting of mature trees will be avoided to the greatest extent practical.
- Vegetation in sensitive areas (e.g., riparian areas or wetlands) will be cut by hand in the winter.
- Clearing activities will be coordinated with the regular road maintenance activities of the territorial highway authorities to minimize the mulching of undisturbed vegetation.
- Qualified biologists will conduct surveys for species-at-risk prior to activity in areas where they have previously been documented. These areas are listed in **Table 7-10**. Equipment use and cable placement will, to the greatest extent possible, avoid disturbing identified species-at-risk.

Mitigation Measures related to Wetlands

- Riparian and wetland areas will not be used as staging areas.
- In riparian or wetland areas that require removal of willows, the natural regrowth of willow will be assisted using willow cuttings.
- Wetland areas will be avoided wherever possible by moving the fibre line to the other side of the road.

Mitigation Measures related to Invasive Species

- Equipment will be inspected and cleaned before mobilization to site and before moving to new areas, particularly when leaving areas where invasive plants are known to occur.
- Areas where equipment should be cleaned will be identified prior to moving to a new site. These areas will not be located near water sources.
- Information on relevant potential invasive species will be made available to all operators to ensure adequate identification and removal during equipment inspection and cleaning.
- Efforts will be made to source native fill material for construction.

7.4.4 Effects Characterization and Significance

With the mitigation measures listed in **Section 7.4.3** applied, it is predicted that the Project activities will not result in significant effects to vegetation and wetlands. Most of the effects are low magnitude and considered reversible over the long-term. The only irreversible effect may be the potential melting of permafrost due to shrub removal or ground disturbance, which could lead to the creation of new ponds and wetlands along the Dempster Highway.

Loss or alteration of vegetation: The loss and alteration of vegetation during construction will be mitigated by primarily operating within the existing highway right-of-way, laying the cable through sparsely vegetated areas when possible, using equipment that will minimize ground pressure or disturbance, limiting the size of cleared areas to the greatest extent possible, clearing in winter to avoid damaging soil and roots, and using hand-slashing in sensitive areas. Following installation, most cleared areas will be allowed to re-vegetate naturally.

Overall, this effect is not considered significant. Vegetation loss or alteration is expected to be likely, but low in magnitude. The cable is being installed primarily along a previously cleared highway right-of-way, so the effect is similar to previous conditions. As such, the context of the VC is considered disturbed. The effect is limited in geographic extent; it will occur only within the existing ROWs. The effect will occur infrequently: throughout most of the corridor, vegetation clearing will only occur once, during construction. However, in certain areas it may also occur when access trails are cleared to maintain the cable. Most of the areas within the ROW will be allowed to revegetate so the effect is short-term and reversible.

Aesthetic damage to landscape: Potential aesthetic damage to the landscape will be mitigated by operating equipment primarily within the existing right of way and conducting as much work in the winter as possible. Snow will be maintained on trails during winter work and low ground-pressure equipment will be used for summer work.

Overall, this effect is not considered significant. Aesthetic damage is expected to be likely, but low in magnitude. The cable is being installed primarily along a previously cleared highway right-of-way, so the effect is similar to previous conditions and the context of the VC is considered disturbed. The effect is limited in geographic extent; it will occur primarily within the existing ROWs. The effect will occur infrequently: throughout most of the corridor, disturbance will only occur once, during construction. Once the cable is installed, maintenance is not expected to cause further impact to the landscape. The probability of occurrence is likely; although mitigation measures will greatly reduce the impact, some amount of ground disturbance may still occur. The potential effect is long-term, but reversible over time.

Disturbance to Species-at-Risk: Qualified biologists will search for species-at-risk (**Table 7-10**) prior to activity in areas where they have previously been documented. The cable will be routed, to the greatest extent possible, to avoid disturbing these occurrences.

With mitigation applied, this effect is not considered significant and it is expected that species at risk will not be disturbed. Any effect would be adverse but is expected to be low in magnitude as it is not expected to impact at-risk plants in the Project Area. The effect is limited in geographic extent; it will occur only within the existing ROWs. The effect will occur infrequently; it is only likely to occur during construction. However, access trails for cable maintenance should be planned to avoid known occurrences. The effect would be short-term and likely reversible (vegetation would be allowed to grow back) over time. The probability of occurrence is unlikely; surveys prior to construction will confirm locations of both species to be avoided.

Spread of invasive plants: Equipment will be inspected and cleaned prior to working on the Project and when moving to new areas to prevent the spread of invasive plants. Efforts will be made to source gravel and fill material that is devoid of invasive plants.

With mitigation applied, this effect is not considered significant and it is expected that invasive plants will not be spread. Any effect would be adverse but is expected to be low in magnitude. The right-of-way is already disturbed, and invasive species could potentially be spread, and are possibly more likely to be spread, by existing vehicular and recreation traffic. The effect is limited in geographic extent; it will occur only within the existing ROWs. The effect would occur infrequently; it is only likely to occur during construction. However, in certain areas it could also occur when access trails are used to maintain the cable. The effect would be long-term and may be irreversible (introduced plants may be spread and can be hard to eradicate). The probability of occurrence is unlikely; the mitigation should prevent the spread of invasive species.

Alteration of wetlands: The alteration of wetlands during construction will be mitigated by primarily operating within the existing highway right-of-way, surface-laying the cable through wetlands in winter, using equipment that will minimize ground pressure or disturbance, limiting the size of cleared areas to the greatest extent possible, using hand-trenching to shallowly bury cable at transitions into wetlands, and using hand-slashing when clearing vegetation near wetlands. In riparian and wetland areas, willow cutting will be used to assist with natural regrowth of cleared vegetation.

With mitigation, this effect is not considered significant. Loss or alteration of wetlands is considered adverse but low in magnitude. Surface laying the cable in winter through the wetlands is expected to cause minimal disturbance. The context of the VC is considered sensitive. The effect is limited in geographic extent; it will occur only within the existing ROWs. The effect will occur infrequently: throughout most of the corridor, vegetation clearing around wetland edges and surface laying of cable will only occur once, during

construction. However, occasionally the cable may need to be accessed for maintenance. The probability of occurrence for wetland alteration is likely; vegetation near some wetlands will have to be cleared to install the cable and modifying the route of the cable after surface laying and hand-trenching near the wetland will cause some disturbance to the wetland. Most of the areas within the ROW will be allowed to revegetate so any effect on wetland vegetation is short-term and reversible.

Creation of roadside wetlands due to melting permafrost: The creation of roadside ponds due to melting permafrost may be caused during construction by vegetation clearing or ground disturbance. These effects will be mitigated by primarily operating equipment within the existing highway right-of-way, operating from the road base when possible, conducting much of the work during the winter, using equipment that will minimize ground pressure or disturbance, and limiting the size of cleared areas to the greatest extent possible.

Creation of roadside ponds due to melting permafrost is considered adverse and moderate in magnitude. The context of the VC is considered sensitive. The effect is limited in geographic extent; it will occur only within and along the existing ROWs. The effect will occur infrequently: throughout most of the corridor, ground disturbance and vegetation clearing that may lead to ponds forming will primarily occur during construction. However, occasionally the cable may need to be accessed for maintenance. The probability of occurrence for creation of ponds/wetlands is likely; vegetation will have to be cleared to install the cable and construction is likely to cause some ground disturbance despite mitigation. It was noted by Ecofor (2016), that ponds created through disturbance continued to expand in size, thus there could be long-term, irreversible effects over small areas along the ROW.

Degradation of vegetation or wetlands due to dust: Conducting much of the construction work in the winter will mitigate impacts from dust.

With mitigation applied, this effect is not considered significant. The effect would be adverse but is expected to be low in magnitude. The context of the right-of-way is disturbed as it is already a highway corridor. The effect is limited in geographic extent; it will occur only within the existing ROWs. The effect would occur infrequently; it is only likely to occur during construction. The effect would be short-term and would be a least partially reversible. The probability of occurrence is unlikely in winter, but likely during summer.

Degradation of vegetation or wetlands due to spills: Spills will be mitigated by implementing the Spill Contingency Plan (**Appendix H**).

With mitigation applied, this effect is not considered significant. The effect would be adverse but is expected to be low in magnitude. The context of the ROW is disturbed as it is already a highway corridor. The effect is limited in geographic extent; it will occur only within the existing ROWs. The effect would occur infrequently; it is only likely to occur during construction. The effect would be short-term and would be a least partially reversible. The probability of occurrence is unlikely.

7.5 Heritage Resources

The human history of the Yukon, from the earliest Indigenous groups to the arrival of fur traders and prospectors in the 19th century and beyond, is preserved in the Yukon's heritage or historic resources.

Historic resources include historic sites, historic objects, and any work or assembly of works of nature or of human endeavour that is of value for its archaeological, palaeontological, pre-historic, historic, scientific, or aesthetic features (*Historic Resources Act*, RSY 2002, c 109).

Historical sites generally date to a time of written history (i.e., in the Yukon, the past 100 to 150 years) and typically contain examples of built heritage or structures (e.g., cabins, caches, graves, and brush camps) (Gotthardt and Thomas 2007). Archaeological sites are older (i.e., typically older than 150 years) and can be found on the surface (i.e., artifacts that have been exposed or were never buried) or buried in the ground (e.g., stone tools and chips, animal bone fragments, and remains of ancient hearths and campfires) (Gotthardt and Thomas 2007).

Archaeological sites and resources are culturally meaningful and connect community members to the past and represent a collective identity. These resources represent ways of knowing and generational knowledge which are passed on through the generations. Every Indigenous group manages their cultural heritage in a unique way, but always with respect for the past and future generations.

7.5.1 Description of Existing Conditions

This section describes the existing conditions of heritage resources within the Yukon portion of the Project Area (e.g., Klondike Highway ROW in the Yukon and Dempster Highway ROW in the Yukon). The Project Area falls within the Traditional Territories of TH, VGFN, FNNND, and the Secondary Use Area of the TGC and GTC.

Places of historical, cultural, and archaeological value were identified through a Heritage Resource Overview Assessment (HROA) completed in 2016 (covered both Yukon and Northwest Territories portions of the Project) (Mooney and Bennett 2016), a Preliminary Heritage Field Reconnaissance (PHFR) program also completed in 2016 (Bennett 2016), and additional HROAs (separate Yukon and Northwest Territories reports) completed in 2019 (i.e., summary of previous work and 2019 updating for the Project) (Bennett 2019).

The 2016 HROA identified 598 landform-based areas of potential (321 of which are located in the Yukon), 606 water feature-based (392 of which are located in the Yukon), and 33 previously recorded archaeological sites (30 of which are located in the Yukon) located within a 100 m buffer on either side of the Dempster Highway (covering Yukon and Northwest Territories portions of the Project) (Mooney and Bennett 2016, Bennett 2019). Seven historic sites recorded in the Yukon Historic Sites Inventory (YHSI) were also assessed, and three culturally sensitive areas (two in the Yukon and one in the Northwest Territories) previously raised by the GTC (Mooney and Bennett 2016, Bennett 2019).

The 2016 PHFR focused on the in-field assessment of the heritage resource potential predications made by the 2016 HROA (Bennett 2016, Bennett 2019).

The majority of the Project Area is considered to have low potential for encountering previously undocumented heritage resources. This is related to (Bennett 2016, Bennett 2019):

- High levels of previous ground disturbance within the existing Dempster Highway ROW;
- Large areas of low-lying, flat, wet, spruce dominated forest and wetland areas; and
- Large portions of the Project Area that cross side slope (especially south of Tombstone Territorial Park).

However, several areas of moderate to high potential for encountering previously undocumented heritage resources were recognized (Bennett 2019). A number of landforms and landscape features (i.e., areas of heightened heritage resource potential) can be used to help identify high potential areas, including (Bennet 2019):

- areas surrounding previously recorded heritage resource sites;
- elevated landforms (e.g., valley edges, terraces, ridges, mid-slope benches, and knolls);
- areas within close proximity to water;
- areas near lithic raw material sources;
- caves, rockshelters, and tors;
- sedimentary rock beds with the potential to contain palaeontological remains; and,
- the level of previous disturbance in the area (i.e., if an area has been severely disturbed in the past it reduces the potential of finding intact archaeological remains).

In total, PHFR fieldwork identified 13 areas of specific heritage resource concern along the Yukon portion of the Project (**Table 7-11**) (Bennett 2019).

Table 7-11 Areas of Specific Impact Concern for Heritage Resources

Identified Heritage Resource – Label	Type
Archaeological Sites LfVg-5 and LfVg-17	First Nations burial site and a small-scale lithic scatter
Archaeological Site LfVg-4	First Nations burial site
Archaeological Site LaVh-5	Abandoned miner's diversion ditch
Archaeological Site LbVh-1	Lithic scatter
Archaeological Sites Near Tombstone Territorial Park Interpretive Center	Several archaeological sites
Dago Hill Pumphouse 1 – YHSI Site 116B/03/481	Historic structure
Dawson to Fort McPherson Trail – YHSI Site 116B/16/014	Historic trail
Goring Creek – YHSI Site 116B/02/019	Heritage landscape associated with Goring Creek
Dognose Creek – YHSI Site 116B/02/020	Heritage landscape associated with Dognose Creek
Shed Alongside Hunker Creek Road	Historic structure
Trailers/Structures Alongside Hunker Creek Road	Historic structures and trailers
Gwich'in Tribal Council Areas of Cultural Sensitivity Concern	Two areas of cultural sensitivity concern: ▫ Arch Site LfVg-5 (also above) ▫ Grave site located near the Gwazhàl area upon the Ogilvie Ridge
Hunker Creek Transmission Line Corridor Diversion	Contains several areas of elevated heritage resource potential

7.5.2 Project Interactions and Potential Effects

This section presents potential interactions and potential effects of the Project on heritage resources. Project activities that may interact with heritage resources include any type of surface or subsurface disturbance of earth. Types of disturbances could include vegetation removal, topsoil removal, plowing, drilling, excavation, mobilization, and any other construction-related activity.

Additionally, installation and maintenance of the proposed fibre optic line across ice-rich permafrost, may affect heritage resources along or immediately adjacent to the alignment. The main pathway of potential effect would be thermokarst initiated or exacerbated by Project activities, whereby irregular ground subsidence obscures or damages known or undiscovered heritage resources. Such an occurrence is unlikely, however, given the rarity of preservation of heritage resources in poorly drained, ice-rich permafrost terrain.

The 2016 PHFR and 2019 HROA indicated overall low concern regarding impacts to heritage resources within the Yukon portion of the ROW alignment (Bennett 2016, Bennett 2019). However, areas of moderate to high potential were identified (Bennett 2019). Project activities that have the potential to interact with heritage resources are presented in **Table 7-12**.

Project activities are only anticipated to have potential interactions with heritage resources during the construction phase. Project activities during the operation phase are not anticipated to include ground altering activities beyond regular maintenance.

Table 7-12 Potential Project Interactions with Heritage Resources

Project Activity	Project Interactions	Potential Effects
Cable installation methods and geotechnical drilling	· Vegetation removal · Soil disturbance · Use of heavy equipment · Subsurface drilling	· Damage · Loss · Alteration
Site preparation	· Vegetation removal · Soil disturbance · Use of heavy equipment	· Damage · Loss · Alteration

7.5.3 Mitigation Measures

To eliminate, reduce or control potential effects to heritage resources caused by Project activities[3]; the Proponent has committed to the mitigation measures below. Some of the mitigation measures were recommended by the 2016 PHFR and 2019 HROA (Bennett 2016, Bennett 2019).

General Mitigation Measures

- Where the fibre line is within the ROW and more than 10 m from existing roadbed, the fibre line placement will:
  - Stay within the vegetation control zone that is within the highway ROW.
  - Avoid the tops of any elevated landforms and stay on side slopes instead.

[3] Within Dawson City, the Yukon Historical Sites Inventory indicates there are recorded historic sites within a 100m buffer of the Project Area. The mitigation measures presented assume that this Project will not impact standing structures in Dawson City.

- The drill access pit and HDD equipment will be positioned outside the riparian area (typically considered to be within 30 m of the high-water mark). The HDD entry and exit points will be located away from the banks of the watercourse. Avoid known heritage resources by maintaining a 30 m buffer around existing recorded site areas.
- All Project activities will be completed in accordance with best management practices for heritage resources (Yukon Government 2018).
- A Heritage Resource Protection Plan (or Chance Find Procedure) will be developed for the Project, which will include methods for avoiding, mitigating, reporting, and recovering artifacts or heritage resources uncovered during Project activities, including but not limited to:
  - Localized work stoppage where any artifacts or heritage resources of significance are uncovered during Project activities;
  - Contact First Nations and the Yukon Government Heritage Resources Unit if heritage resources are uncovered;
  - Ground works will not resume along the identified build front until the resources of significance have been recovered or cable is re-routed to provide a 30 m buffer; and,
  - No artifacts or objects will be removed from site by the contractor, or other individuals, other than those permitted to do so.
- Further research with Yukon Heritage and engagement with Indigenous groups will be undertaken to confirm the location of specific sites (e.g., location of the old Dawson to Fort McPherson Trail) and ensure they have the opportunity to raise heritage resource concerns associated with the Project.

Site-Specific Mitigation Measures

In addition to the general heritage resources mitigation measures, site-specific mitigation measures pertaining to the 13 identified areas of specific heritage resource concern are provided below in **Table 7-13** (Bennett 2019).

Table 7-13 Site-Specific Mitigation Measures

Identified Heritage Resource	Proposed Mitigation
Archaeological Sites LfVg-5 and LfVg-17	· Avoidance; stay within ROW, route cable alignment as far west as possible · Maintain a minimum 30 m buffer around recognized site boundaries · Ongoing consultation with TH, FNNND, and GTC
Archaeological Site LfVg-4	· Route cable alignment as far west as possible · Maintain a minimum 30 m buffer around recognized site boundaries
Archaeological Site LaVh-5	· Directional drilling beneath the ditch · Follow the general recommendation for waterways (i.e., 30 m buffer)
Archaeological Site LbVh-1	· Route cable alignment along the east side of the Dempster Highway · Maintain a 30 m buffer, or · Directionally drill beneath the site · Maintain a 30 m buffer in both directions of UTM coordinates cited in PHFR

Identified Heritage Resource	Proposed Mitigation
Archaeological Sites Near Tombstone Territorial Park Interpretive Center	· Keep alignment close to the existing highway (within 10 m) · Maintain a 30 m buffer
Dago Hill Pumphouse 1 – YHSI Site 116B/03/481	· Alignment will stay to the south side of Hunker Creek Road at this site · Provide a 30 m buffer around the pumphouse
Dawson to Fort McPherson Trail – YHSI Site 116B/16/014	· YHSI form does not include historic mapping of the trail · Further research and/or consultation with Yukon Heritage and First Nations to confirm the location of the trail and concerns
Goring Creek – YHSI Site 116B/02/019	· Further consultation with the TH will be conducted before finalizing alignment through this area
Dognose Creek – YHSI Site 116B/02/020	· Further consultation with the TH will be conducted before finalizing alignment through this area
Shed Alongside Hunker Creek Road	· Alignment will stay on the north side of Hunker Creek Road
Trailers/Structures Along Hunker Creek Road	· Alignment will stay on the south side of Hunker Creek Road
Gwich'in Tribal Council Areas of Cultural Sensitivity Concern	Arch Site LfVg-5: · Measures identified for LfVg-5 · Ongoing consultation with GTC · Have GTC representative on site during ground disturbing activities in area
	Grave site located near the Gwazhàl area upon the Ogilvie Ridge: · Alignment stays within 10 m to either side of the highway roadbed, in area previously disturbed (coordinates provided in 2016 PHFR and 2019 HROA) · Ongoing consultation with GTC, TGC, TH, FNNND, and VGFN.
Hunker Creek Transmission Line Corridor Diversion	· Proposed installation method is to suspend the cable from existing electrical transmission lines, with no need for developing additional access routes. · No impact to potential unidentified heritage resources is expected.

7.5.4 Effects Characterization and Significance

Potential interactions between Project activities and heritage resources have been identified in **Section 7.5.2**.

Project construction activities have the potential to result in the damage, loss, or alteration to previously unidentified heritage resources, through soil disturbance, such as; vegetation removal, topsoil removal, plowing activities, excavation, mobilization, and construction activities. This includes effects to both site content or site context; specifically, in areas of identified moderate to high potential. After the application of mitigation measures listed in **Section 7.5.3**, and with continued consultation and engagement with Indigenous groups, it is predicted that Project activities will not result in significant effects to heritage resources and that there will be no detectable or measurable residual effects. Therefore, no residual effects are carried forward for characterization and significance determination.

8.0 SUMMARY OF MITIGATION MEASURES

The following sections describe the mitigation measures the proponent has committed to eliminate, reduce or control potential effects of the Project to the selected valued components.

8.1 North Yukon Regional Land Use Plan

- Where applicable and relevant, the Project will follow the General Management Directions and the Best Management Practices outlined within the North Yukon Regional Land Use Plan during construction and operations.

8.2 Project Design Basis

Buried Cable

- For buried cable, metallic warning tape will be placed midway between the cable and the ground surface to provide an early warning mechanism for any excavation that may occur near the cable.
- As final decisions are made on Project markers, the Proponent will engage in further discussions with TH specific to warning signs and marker posts.

Handholes

- The Proponent will provide each handhole site with adequate signage.
- In continuous permafrost regions, the handholes will be placed at grade, not buried to any depth. This is to minimize disturbance of the organics and the active permafrost.

Clearing

- When selecting suitable locations within the existing ROW, existing disturbances will be used and cutting mature trees will be avoided to the greatest extent practical.
- Hand slashing will be utilized in sensitive environments and in riparian zones. These zones will be identified by a qualified environmental professional during the detailed design field pick up and indicated on the construction drawings.
- Where route clearing is required during the summer season, a bird nest sweep will be completed by a qualified professional (as required) in advance of the work.

Horizontal Directional Drilling

- All material excavated for development of the entry pits will be side-casted for replacement once the conduit connection is complete.
- In upland areas, the disturbed terrain will be allowed to vegetate naturally. In riparian and wetland areas, if willows naturally occur in the area, willow cuttings will be applied to the backfilled pits to facilitate natural regrowth.
- Boughs and branches may also be placed over top of the drill site to decrease the likelihood of erosion.

8.3 Transportation and Land Use and Recreation

- A Traffic Management Plan will be developed by the contractor and the Proponent.
- At a minimum, one lane will always be open to allow traffic to continue to circulate.
- Signage will be installed to direct recreational traffic within the ROW around or through construction areas
- Permanent infrastructure (e.g., handholes, aerial poles, etc.) within the Highway ROW will be clearly marked to avoid collisions.

8.4 Permafrost

General Mitigation Measures related to Permafrost

- Installation of the fibre optic line will occur within ROW of existing roads or highways, with only a few exceptions, to reduce effects on surrounding permafrost.
- Any brushing (clearing) of vegetation in advance of installation will be limited to trees and tall shrubs, with deliberate avoidance or minimization of disturbance to surface organic cover.
- Every effort will be made to minimize the extent, severity and duration of ground disturbance, including compaction, during cable installation.
- Cable installation through conventional plowing will be restricted to the long sections of highway corridor south of Tombstone Park (~km 0 to 85) where permafrost is absent, at a depth unaffected by cable installation (e.g. in thick sand/gravel outwash terraces), or ice-poor and relatively insensitive to disturbance.
- Where permafrost is continuous, comparatively shallow and locally ice-rich, shallow burial or surface laid cable installation will be used. Shallow burial involves laying the cable along the base of a thin, shallow (~150 mm) “slice” into or slightly below surface organics at the top of the active layer of permafrost. Penetration into permafrost will be avoided.
- Surface-laid cable installation will be prioritized along the most challenging sections of the alignment, such as those crossing thermokarst terrain and wetlands with standing water at surface.
- The width and footprint of disturbance for fibre line installation will be kept to an absolute minimum.
- Cable installation will be accomplished using small equipment with only minimal and temporary compaction of organics and little to no potential for rutting. No stripping of surface organics is planned.
- Fibre optic cable installation will be seasonally timed to minimize the potential for ground disturbance.
- Shallow burial installation will occur in summer, when at least the upper portion of the active layer is thawed, so that the required slice and placement of the cable can be accomplished.
- Surface-laid cable installation will occur in winter, while the active layer and any shallow standing water are frozen, so that small equipment can advance across snow and ice with little to no disturbance of underlying vegetation.
- A Permafrost Protection Plan will be developed by the contractor prior to initiation of construction to align their construction plans and equipment with appropriate mitigation measures.
- The plow slot will be backfilled sufficiently. Where necessary, backfill and re-contour plow slot.

- Additional geotechnical data will be obtained as needed if subsurface conditions can't be accurately identified based on existing information.
- Installation of the fibre line will be monitored on a full-time basis by a third-party design engineer contracted to the Proponent. One of the engineer's primary responsibility will be to monitor for consistency in the depth of the shallow plow installation. Inconsistencies in plow depth can occur due to terrain features and can lead to an increase in erosion and other issues.

Mitigation Measures related to Geotechnical Drilling

- Geotechnical drilling will use a lightweight track-mounted rig where possible to minimize compaction of organics, and potential for ruts to form.
- Contractor will use a spade to cut and save the organic mat surface, before drilling, then allow the hole to backfill and cap it with that pre-cut organic mat.
- Any ruts that form will be filled with soil/organics.
- The footprint of cuttings/spoil from the borehole will be minimized.
- Water use will be avoided or minimized to the extent possible.

8.5 Fish and Fish Habitat

General Mitigation Measures related to Fish and Fish Habitat

- The contractor will be responsible for developing a Project-specific Construction Environmental Management Plan that outlines the specific permit conditions and best management practices for works in and around water, including the Preferred Practice of Works Affecting Yukon Waters (Yukon Government 2019).
- A qualified Environmental Monitor will conduct monitoring (including water quality assessments), with an emphasis on those works with the greatest potential to impact fish habitat (e.g., stream crossings).
- Construction work that will occur in a stream crossing that is considered high risk for fish or fish habitat, should be scheduled to occur during the least-risk timing window for in-water activities (**Table 8-1**).

Table 8-1 Species-specific Least Risk Timing Windows for each of the Watersheds Overlapping the Fish and Fish Habitat Study Area

Watershed	Fish Species	Least Risk Timing Window
Central Yukon Watershed	Chinook Salmon	June 10 to July 5
	Chum Salmon	June 1 to August 15
	Lake Trout, Whitefish species	April 15 to September 1
	Arctic Grayling	July 1 to April 15
Peel Watershed	Dolly Varden	May 1 to September 1
	Arctic Grayling	July 15 to May 1
Porcupine Watershed	Chinook Salmon	June 1 to July 15
	Chum Salmon	June 1 to September 1
	Arctic Grayling, Northern Pike	July 15 to May 1
	Whitefish species	May 1 to September 1

Mitigation Measures related to Upland and Riparian Habitat

- Avoid cable placement in heavily vegetated areas (where possible and subject to other constraints including highway infrastructure and topographical features).
- Minimize areas of riparian disturbance and only remove vegetation that is necessary for installation of the cable.
- Design and construct watercourse crossings such that the cable is perpendicular to the banks of the watercourse to minimize loss and disturbance of riparian vegetation.
- Use existing roads and/or trails to access areas around watercourses, and do not disturb areas outside the existing ROW.
- The drill access pit and HDD equipment will be positioned outside the riparian area (typically considered to be within 30 m of the high-water mark). The HDD entry and exit points will be located away from the banks of the watercourse. To the extent possible, clearing in riparian zones will be limited to hand slashing to minimize riparian disturbance and prevent soil compaction.
- Where tree or large shrub removal is required, use techniques such as pruning, mowing, girdling, and topping to keep the root system intact and stabilize the soil. If possible, retain large woody debris and the stubs of large diameter trees on site.

Mitigation Measures related to Erosion and Sediment Control

- Install erosion and sediment control measures as appropriate (e.g., by constructing small settling basins/berms at drill entry and exit points for HDD crossings).
- Ensure temporary erosion and sediment control measures (e.g., sediment fencing) are removed following ground stabilization.
- Cover any soils exposed as a result of Project activities, and/or implement other erosion protection or sediment control measures until such time that permanent stabilization occurs. Avoid placing stockpiles within the riparian area.
- Direct any sediment-laden flow to stable vegetated areas at least 30 m away from any watercourses to allow for infiltration back into the ground.
- Where possible, schedule works around watercourses to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- Develop an Erosion and Sediment Control Plan for Project Operations prior to construction.

Mitigation Measures related to Contaminant Management

- Ensure machinery operates from above the top-of-bank and high-water mark and not within the active channel of any watercourse.
- Wash/refuel/service machinery and store fuel and other materials away from watercourses. Keep spill kits at every refuelling station.
- Store fuel in a temporary tank placed in a containment basin (able to contain 120% of tank capacity), at least 30 m away from any watercourses. Do not refuel or service equipment within 30 m of any watercourse.
- Ensure that any machinery brought to site is in good operating condition, free of leaks, excess oil and grease. Ensure that equipment is free of invasive species and noxious weeds.
- If practical, use biodegradable fluids in heavy machinery associated with works near streams.
- Follow measures described in the Spill Contingency Plan (**Appendix H**), including ensuring basic spill kits are available within every vehicle and piece of equipment operating within the Study Area.

Mitigation Measures related to Horizontal Directional Drilling

- All HDD operations will adhere to DFO's former Operational Statements for High-Pressure Directional Drilling and Punch and Bore Crossings (DFO 2007) and Canadian Association of Petroleum Producers (CAPP) Guideline of Planning Horizontal Directional Drilling for Pipeline Construction (CAPP 2004).
- All water withdrawals will conform to DFO's Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut (2010), Fish Screen Design Criteria for Flood and Water Truck Pumps (2011), and Freshwater Intake End-of-Pipe Fish Screen Guideline (1995), if applicable.
- Drilling will only be conducted by experienced HDD contractors.
- Ensure the drilling fluid used is benign (e.g., a mix of bentonite and water) and has appropriate properties to promote wall cake and sealing of the formation.
- Ensure drill depths are appropriate to minimize the risk of frac-outs or exposure of the cable or conduit (e.g., due to natural stream scouring).
- Dispose of drilling mud, cuttings, and other waste materials at appropriate facilities and/or on-site at suitable locations away from watercourses and sensitive receptors.
- Develop an emergency frac-out response plan in the event of a drilling mud spill. The plan will include measures to stop work, contain the drilling mud, and prevent its further migration into the watercourse and to notify all applicable authorities, including the closest DFO office in the area. Ensure all material and equipment needed to contain drilling mud released on site are readily accessible and that applicable authorities are notified.

Mitigation Measures related to Site Restoration

- Remove construction materials and supplies from the site following construction completion.
- Restore disturbed soils (including drill entry and exit points) as soon as possible to prevent erosion and potential sedimentation into adjacent watercourses.
- In areas where natural revegetation may be inhibited, revegetate riparian areas with native grasses, shrubs, and/or trees, (e.g., with willow cuttings) to prevent erosion and help seeds germinate.

8.6 Wildlife and Wildlife Habitat

General Mitigation Measures related to Wildlife and Wildlife Habitat

- A wildlife monitoring program will be developed that will include having a wildlife monitor on-site during construction to ensure that mitigation measures are applied.
- Construction activities will minimize the volume levels, duration, and frequency of noise sources, to the extent possible.
- Camps will be located on existing cleared sites.
- Vegetation clearing will be minimized to the extent possible.
- No personnel shall carry or discharge firearms for the purpose of hunting wildlife.
- Camps and staging areas will not be placed within 1 km of known mineral licks.
- The fibre optic trench will be backfilled immediately to avoid wildlife injury.

- In ponds or wetlands where beaver or muskrat lodges are present, water withdrawal will not cause water levels to drop more than 5 cm.
- In areas where the cable is not in contact with the ground surface, sandbags will be used to weigh the cable down to reduce potential for animal tripping.

Mitigation Measures related to Caribou

- Project activities will not disturb, block or cause substantial diversion to migrating caribou.
- Project activities will not alter caribou migration habitat in a way that will prevent caribou from using it in the future.
- If any caribou are observed within a 1 km radius of a work site, all work activities will cease until the caribou have moved safely beyond the 1 km buffer. The Dawson City regional biologist will be contacted to discuss mitigation options if the caribou presence persist.

Mitigation Measures related to Moose

- Temporary camps will not be placed within 1 km of the Ogilvie or Blackstone Rivers in May, as these river corridors are known for moose calving.

Mitigation Measures related to Sheep

- Construction activities, including the establishment of camps, will be avoided within a 5 km radius of Angelcomb Mountain and Km 180 of the Dempster Highway during May and June, as these areas are known sheep lambing sites.

Mitigation Measures related to Bears

- Bear safety training will be provided to all on-site personnel.
- All waste will be managed in a way that it is not a bear attractant. It will be temporarily stored in bear-proof containers until it is properly disposed in a waste management facility.
- If bears are present near camp, a wildlife monitor will monitor the bear and notify all camp occupants of the bear's presence.
- Electric fences will be installed around all camps from April to October to avoid human-bear conflicts.
- If bears are present within 200 m of the work area, work will cease until the bears have moved safely out of the area.

Mitigation Measures related to known Wolf Dens

- The fibre optic cable will be installed on the west side of the Dempster Highway near km 170 to avoid disturbing an active wolf den located near the highway ROW.
- No drilling will occur from mid-April to mid-June in the area near km 170 and the Blackstone River bridge crossing to avoid disturbing known wolf dens.

Mitigation Measures related to Birds

- No construction activities shall take place within 300 m of an active raptor nest from April 15 to August 15.

- Breeding birds are not to be disturbed. Where possible, clearing vegetation will occur outside the migratory bird nesting season (i.e., between May 1st and August 15th). If clearing must occur after May 1st, then nest surveys shall be conducted by trained personnel prior to clearing. If active nests of migratory birds are discovered, the proponent shall postpone activities in the nesting area until nesting is complete.
- No work activities will occur between 5 am and 10 am from km 5-7 on the Dempster Highway between April 1-20, and km 4-8 on the Dempster Highway between April 21-May 4 to protect a known sharp-tailed grouse lek.

8.7 Vegetation and Wetlands

General Mitigation Measures related to Vegetation and Wetlands

- Existing rights-of-way and previously cleared or brushed areas will be used for cable alignment as much as possible.
- Construction equipment will be chosen with the aim of minimizing ground pressure and ground disturbance.
- When working along the ROW, heavy equipment will not leave the existing ROW.
- Trails 1-2 m wide for surface-lay cable installation will be cleared of vegetation in winter using small equipment.
- Trails 2-3 m wide for shallow plow installation will be cleared of vegetation in winter using small equipment.
- Trails larger than 2-3 m will be cleared in winter when the ground can support the weight of equipment and trees can be removed without dislodging the root balls.
- During winter construction, snow will be maintained on trails to avoid damaging underlying soil and roots.
- Proponent will re-seed areas where natural revegetation has not been established using a seed mix of native endemic plants.

Mitigation Measures related to Vegetation

- Width of vegetation cleared will be minimized and limits will be clearly flagged.
- Cutting of mature trees will be avoided to the greatest extent practical.
- Vegetation in sensitive areas (e.g., riparian areas or wetlands) will be cut by hand in the winter.
- Clearing activities will be coordinated with the regular road maintenance activities of the territorial highway authorities to minimize the mulching of undisturbed vegetation.

Qualified biologists conduct surveys for species-at-risk prior to activity in areas where they have previously been documented. These areas are listed in **Table 7-10**. Equipment use and cable placement will, to the greatest extent possible, avoid disturbing identified species-at-risk.

Mitigation Measures related to Wetlands

- Riparian and wetland areas will not be used as staging areas.
- In riparian or wetland areas that require removal of willows, the natural regrowth of willow will be assisted using willow cuttings.

- Wetland areas will be avoided wherever possible by moving the fibre line to the other side of the road, as per recommendations in the Environmental Baseline Report.

Mitigation Measures related to Invasive Species

- Equipment will be inspected and cleaned before mobilization to site and before moving to new areas, particularly when leaving areas where invasive plants are known to occur. Machinery and equipment will not be cleaned near water sources.
- Information on relevant potential invasive species will be made available to all operators to ensure adequate identification and removal during equipment inspection and cleaning.
- Efforts will be made to source native fill material for construction.

8.8 Heritage Resources

General Mitigation Measures related to Heritage Resources

- Where the fibre line is within the ROW and more than 10 m from existing roadbed, the fibre line placement will:
  - Stay within the vegetation control zone that is within the highway ROW.
  - Avoid the tops of any elevated landforms and stay on side slopes instead.
- The drill access pit and HDD equipment will be positioned outside the riparian area (typically considered to be within 30 m of the high-water mark). The HDD entry and exit points will be located away from the banks of the watercourse. Avoid known heritage resources by maintaining a 30 m buffer around existing recorded site areas.
- All Project activities will be completed in accordance with best management practices for heritage resources (Yukon Government 2018).
- A Heritage Resource Protection Plan (or Chance Find Procedure) will be developed for the Project, which will include methods for avoiding, mitigating, reporting, and recovering artifacts or heritage resources uncovered during Project activities, including but not limited to:
  - Localized work stoppage where any artifacts or heritage resources of significance are uncovered during Project activities;
  - Contact First Nations and the Yukon Government Heritage Resources Unit if heritage resources are uncovered;
  - Ground works will not resume along the identified build front until the resources of significance have been recovered or cable is re-routed to provide a 30 m buffer; and,
  - No artifacts or objects will be removed from site by the contractor, or other individuals, other than those permitted to do so.
- Further research with Yukon Heritage and engagement with Indigenous groups will be undertaken to confirm the location of specific sites (e.g., location of the old Dawson to Fort McPherson Trail) and ensure they have the opportunity to raise heritage resource concerns associated with the Project.

Site-Specific Mitigation Measures

Table 8-2 Site-Specific Mitigation Measures

Identified Heritage Resource	Proposed Mitigation
Archaeological Sites LfVg-5 and LfVg-17	· Avoidance; stay within ROW, route cable alignment as far west as possible · Maintain a minimum 30 m buffer around recognized site boundaries · Ongoing consultation with TH, FNNND, and GTC
Archaeological Site LfVg-4	· Route cable alignment as far west as possible · Maintain a minimum 30 m buffer around recognized site boundaries
Archaeological Site LaVh-5	· Directional drilling beneath the ditch · Follow the general recommendation for waterways (i.e., 30 m buffer)
Archaeological Site LbVh-1	· Route cable alignment along the east side of the Dempster Highway · Maintain a 30 m buffer, or · Directionally drill beneath the site · Maintain a 30 m buffer in both directions of UTM coordinates cited in PHFR
Archaeological Sites Near Tombstone Territorial Park Interpretive Center	· Keep alignment close to the existing highway (within 10 m) · Maintain a 30 m buffer
Dago Hill Pumphouse 1 – YHSI Site 116B/03/481	· Alignment will stay to the south side of Hunker Creek Road at this site · Provide a 30 m buffer around the pumphouse
Dawson to Fort McPherson Trail – YHSI Site 116B/16/014	· YHSI form does not include historic mapping of the trail · Further research and/or consultation with Yukon Heritage and First Nations to confirm the location of the trail and concerns
Goring Creek – YHSI Site 116B/02/019	· Further consultation with the TH will be conducted before finalizing alignment through this area
Dognose Creek – YHSI Site 116B/02/020	· Further consultation with the TH will be conducted before finalizing alignment through this area
Shed Alongside Hunker Creek Road	· Alignment will stay on the north side of Hunker Creek Road
Trailers/Structures Along Hunker Creek Road	· Alignment will stay on the south side of Hunker Creek Road
Gwich'in Tribal Council Areas of Cultural Sensitivity Concern	Arch Site LfVg-5: · Measures identified for LfVg-5 · Ongoing consultation with GTC · Have GTC representative on site during ground disturbing activities in area
	Grave site located near the Gwazhàl area upon the Ogilvie Ridge: · Alignment stays within 10 m to either side of the highway roadbed, in area previously disturbed (coordinates provided in 2016 PHFR and 2019 HROA) · Ongoing consultation with GTC, TGC, TH, FNNND, and VGFN.
Hunker Creek Transmission Line Corridor Diversion	· Proposed installation method is to suspend the cable from existing electrical transmission lines, with no need for developing additional access routes. · No impact to potential unidentified heritage resources is expected.

8.9 Management Plans

The following management plans will be developed:

- Inspection and Maintenance Plan, as described in **Section 3.3**.
- Erosion and Sediment Control Plan for Project Operations, as described in **Section 3.3**.
- Traffic Management Plan, as described in **Section 6.2.5**.
- Permafrost Protection Plan, as described in **Section 7.1.3**.
- Emergency Frac-out Response Plan, as described in **Section 7.2.3**.
- Heritage Resource Protection Plan (or Chance Find Procedure), as described in **Section 7.5.3**.
- Construction Environmental Management Plan for contractor use that presents mitigation measures and best management practices that will be implemented

9.0 CONCLUSION

The proposed Project requires an evaluation by a YESAB Designated Office because the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* of YESAA identifies the construction, installation, operation, modification, decommissioning, or abandonment of, or other activity in relation to, a power line or a telecommunications line (Schedule 1, Part 4, Item 1) as an assessable activity. The proponent understands that the purpose of the YESAB Designated Office evaluation process in Yukon is to inform planning and decision-making by governments to avoid or minimize significant environmental and socio-economic effects while realizing development objectives. The proponent also recognizes that the YESAB Designated Office evaluation process provides an integrated means of identifying, evaluating, and mitigating a proposed project's potential adverse environmental and socio-economic effects. Valued components for the assessment were selected based on the potential for Project activities for this proposal to interact with the identified VC and result in adverse effects. Where effects assessments indicated that adverse effects could occur to a VC, the assessment proposed technically feasible and appropriate mitigation measures to avoid or minimize those effects. With the implementation of the proposed mitigation measures, Project-related residual adverse effects to the selected VCs are likely to be not significant.

10.0 REFERENCES

Alaska Department of Fish and Game (ADFG). 2006. Our Wealth Maintained: A Strategy for Conserving Alaska's Diverse Wildlife and Fish Resources. Alaska Department of Fish and Game, Juneau, Alaska.

Associated Engineering. 2017. Fluvial Geomorphological Assessments Dempster Highway, Yukon Territory. Final Technical Memorandum. Prepared for Yukon Government, Transportation Engineering Branch. 44 pp.

Barker, O., Millar, N., and Foos, A. 2011. Peel Watershed Fish Habitat Assessment. Yukon Fish and Wildlife Branch Report Tr-11-12, Whitehorse, Yukon, Canada.

Bennett, T. 2016. Preliminary Heritage Field Reconnaissance Interim Results Summary: Canada North Fiber Link – Phase 1 Dempster Highway Project. Prepared for LTS Infrastructure Services. Ecofor Consulting B.C. Ltd.

Bennett, T. 2019. Heritage Resource Overview Assessment: Dempster Fibre Project Summary of Previous Work and 2019 Updating – Yukon. Ecofor Consulting B.C. Ltd.

Benson K. 2014. Gwich'in Knowledge of Grizzly Bears. Gwich'in Social and Cultural Institute/Gwich'in Renewable Resources Board. 75 pp.

Bonnaventure, P.P., Lewkowicz, A.G., Kremer, M., and Sawada, M.C., 2012. A Permafrost Probability Model for the Southern Yukon and Northern British Columbia, Canada. Permafrost and Periglacial Processes, vol. 23, p. 52-68.

Bradford, M.J., Duncan, J., and Jang, J.W. 2008. Downstream Migrations of Juvenile Salmon and Other Fishes in the Upper Yukon River. Available at: https://www.jstor.org/stable/40513025?seq=1#page_scan_tab_contents [Accessed May 1, 2019].

Burn, C.R. 2004. Permafrost. *In*: Ecoregions of the Yukon Territory: Biophysical Properties of Yukon Landscapes, C.A.S. Smith, J.C. Meikle and C.F. Roots (eds.), Agriculture and Agri-Food Canada, PARC Technical Bulletin No. 04-01, Summerland, British Columbia, p. 32-35.

Burn, C.R., Moore, J.L., O'Neill, H.B., Hayley, D.W., Trimble, J.R., Calmels, F., Orban, S.N. and Idrees, M. 2015. Permafrost Characterization of the Dempster Highway, Yukon and Northwest Territories. Proceedings from GEOQuebec, 2015, 8 pp.

Burn, C.R. 2018. Evidence on Climate Change Effects and their Management and Investigation in the Western Arctic. Submission to the Special Senate Committee on the Arctic, March 13, 2018.

Cameron, E.A. and Lantz, T.C. 2016. Drivers of Tall Shrub Proliferation Adjacent to the Dempster Highway, Northwest Territories, Canada. Environmental Research Letters 11 (4): 045006.

Coates, J. and Lewkowicz, A.G. 2005. Effect of Forest Fire on Landsliding Over Permafrost, Steele Creek, Yukon Territory. Canadian Association of Geographers, Ontario Division Annual Conference, University of Ottawa, October 2005.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2010. COSEWIC Assessment and Status Report on the Dolly Varden *Salvelinus malma malma* (Western Arctic populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 65 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2012. COSEWIC Assessment and Status Report on the Grizzly Bear *Ursus arctos* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiv + 84 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2014. COSEWIC Assessment and Status Report on the Caribou *Rangifer tarandus*, Northern Mountain population, Central Mountain population and Southern Mountain population in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxii + 113 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2016. COSEWIC Assessment and Status Report on the Caribou *Rangifer tarandus*, Barren-ground population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 123 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2017. COSEWIC Assessment and Status Report on the Bering Cisco *Coregonus Laurettae* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 19pp.

Cott, P. and Moore, J.P. 2003. Working Near Water, Considerations for Fish and Fish Habitat. Reference and Workshop Manual. Northwest Territories Department of Fisheries and Oceans - Western Arctic Area. Inuvik, Northwest Territorites. 92 pp+Appendices.

EBA Engineering Consultants Ltd. 1990. Granular Evaluation, Dempster Highway Corridor, YT and NWT. Report to Department of Indian and Northern Affairs, Whitehorse, Yukon.

EBA Engineering Consultants Ltd. 2013. Recent Effects of Climate Change on Permafrost and Road Stability, Dempster Highway, NWT/YT. Presentation prepared by Richard Trimble, November 2013.

Environment and Natural Resources (ENR). Dall's Sheep. Available at: https://www.enr.gov.nt.ca/en/services/dalls-sheep [Accessed March 13, 2019].

Environment Yukon. 2016. Science-based guidelines for management of Northern Mountain caribou in Yukon. Yukon Fish and Wildlife Branch Report MR-16-01. Whitehorse, Yukon, Canada.

Environment Yukon. 2018a. Moose (*Alces americanus*). Available at: http://www.env.gov.yk.ca/animals-habitat/mammals/moose.php [Accessed March 12, 2019].

Environment Yukon. 2018b. Grizzly Bear (*Ursus arctos*). Available at: http://www.env.gov.yk.ca/animals-habitat/mammals/grizzly.php [Accessed April 24, 2019].

Environment Yukon. 2018c. Dall's Sheep (*Ovis dalli dalli*). Available at: http://www.env.gov.yk.ca/animals-habitat/mammals/sheep.php [Accessed March 13, 2019].

Environment Yukon. 2019a. Wildlife Key Area GIS Data Packages. Fish and Wildlife: Wildlife Key Area Inventory Program, Whitehorse, Yukon, Canada.

Environment Yukon. 2019b. Yukon Conservation Data Centre Animal Track List (Updated February 2019). Available at: Https://Yukon.Ca/Sites/Yukon.Ca/Files/Env/Env-Cdc-Animal-Track-List.Pdf [Accessed March 28, 2019].

Environment Yukon. 2019c. Yukon Freshwater Fishes. Available at: https://yukon.ca/en/yukon-freshwater-fishes [Accessed March 29, 2019].

Environmental Dynamics Inc. (EDI). 2004. Porcupine River Watershed Fisheries Information Summary Report. Available at: Http://Www.Planyukon.Ca/Index.Php/Documents-And-Downloads/North-Yukon-Planning-Commission/Resource-Assessment-Report-Maps-Posters/381-Porcupine-Watershed-Fisheries-Information-Summary-Report/File [Accessed March 28, 2019].

Environmental Dynamics Inc. (EDI). 2006. Peel River Watershed Fisheries Information Summary Report – Preliminary Assessment. Available at: Http://Peel.Planyukon.Ca/Downloads/Dmdocuments/Fisheries_Info_Summary.Pdf [Accessed March 28, 2019].

Environmental Dynamics Inc. (EDI). 2015. Large Mammal-Vehicle Collisions: Review of Mitigations and Analysis of Collisions in Yukon. Prepared for Government of Yukon. Yukon Fish and Wildlife Branch Report MRC-15-02, Whitehorse, Yukon, Canada.

Environmental Dynamics Inc. (EDI). 2015. Moose Late Winter Habitat Suitability Report. Prepared for Casino Mining Corporation. Casino Project: Supplementary Information Report. Appendix A.12C.

First Nation of Na-cho Nyäk Dun (FNNND). 2019. History. Available at http://www.nndfn.com/history/ [Accessed June 2019].

Fisheries and Oceans Canada (DFO). 2007. Punch & Bore Crossing. Available at: https://apps.neb-one.gc.ca/REGDOCS/File/Download/620567 [Accessed May 1, 2019].

Fisheries and Oceans Canada (DFO). 2014. Pathways of Effects. Available at: http://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/index-eng.html [Accessed April 15, 2019].

Gotthardt, R., and Thomas, C. 2007. Handbook for the Identification of Heritage Sites and Features, March 2005 (Revised 2007). Prepared for Yukon Tourism and Culture. Available at: http://www.tc.gov.yk.ca/pdf/Heritage_Handbook_2007.pdf [Accessed April 2019].

Guthrie, R.H. and Cuervo, V., 2015. Geohazards and Risk: A Proponent's Guide to Linear Infrastructure. Yukon Environmental and Socio-economic Assessment Board, Whitehorse, YT, 47 pp + Appendices.

Heginbottom, J.A., and Radburn, L.K. 1992. Permafrost and Ground Ice Conditions of Northwestern Canada (Mackenzie Region). National Snow and Ice Data Center, Boulder, CO, USA.

Heginbottom, J.A., Dubreuil, M.A., and Harker, P.T. 1995. Permafrost Map of Canada. *In*: The National Atlas of Canada, 5th Edition (1978-1995), Natural Resources Canada, sheet MCR 4177, 1:7,500,000 scale.

Historic Resources Act, RSY 2002, c 109. Available at: http://www.gov.yk.ca/legislation/acts/hire.pdf [Accessed April 2019].

Idrees, M., Burn, C.R., Moore, J.L., and Calmels, F. 2015. Monitoring Permafrost Conditions Along the Dempster Highway. Proceedings from GEOQuebec, 2015, 8 pp.

Kokelj, S.V., Lantz, T.C., Tunnicliffe, J., Segal, R., and Lacelle, D. 2017. Climate-driven Thaw of Permafrost Preserved Glacial Landscapes, Northwestern Canada. The Geological Society of America, https://doi.org/10.1130/G38626.1.

Kuhn, M., E.J. Lundin, R. Geisler, M. Johansson, and J. Karlsson. 2018. Emissions from thaw ponds largely offset the carbon sink of northern permafrost wetlands. Scientific Reports 8, 9535.

Lambert Koizumi, C., Carey, J., Branigan, M., and Callaghan, K. 2011. Status of Dall's Sheep (Ovis dalli dalli) in the Northern Richardson Mountains. Yukon Fish and Wildlife Branch Report TRC-11-01. Whitehorse, Yukon, Canada.

Lemay-Yates Associates Inc. 2015. Broadband and Its Impact on Economic Development in the Yukon. Prepared for the Yukon Government, Department of Economic Development. 7 pp.

McHugh, M. 2013. Fish of the Dempster Country Project 2012 Final Report. Available at: Http://Yfwet.Ca/Project_Years/2012/ [Accessed March 25, 2019].

McKillop, R.J., Brown, C.E., McParland, D.J., Sacco, D.A. and Coates, J. 2016a. Inventory of Mass Movement Geohazards Along the Dempster Highway, Yukon. Yukon Geological Survey, Miscellaneous Report 17, 61 p. plus appendices.

McKillop, R.J., Sacco, D., and Roy, L.P., 2016b. Preliminary Assessment of Dempster Highway Permafrost Conditions: Mapping to Inform the Design Basis for the Fibre Optic Cable Installation. Northern Climate ExChange, Yukon Research Centre, Yukon College, 9 p. plus appendix (map set).

M. Miles and Associates Ltd. 2011. Dempster Highway Hydrotechnical Hazard Reconnaissance. Prepared for Yukon Government, Transportation Engineering Branch.

Milligan, H.E. 2018. Licensed Harvest Trends in Yukon: 1980 to 2014. Yukon Fish and Wildlife Branch Report MR-18-05. Whitehorse, Yukon, Canada.

Mooney, J., and Bennett, T. 2016. Heritage Resource Overview Assessment: Canada North Fiber Link – Phase 1 Dempster Highway Project. Document prepared for LTS Infrastructure Services. Ecofor Consulting B.C. Ltd.

North Yukon Planning Commission. 2009. North Yukon Regional Land Use Plan. Available at: http://www.emr.gov.yk.ca/rlup/pdf/north-yukon-regional-land-use-plan-with-maps.pdf [Accessed May 27, 2019].

North Yukon Regional Biologist, Environment Yukon. March 14, 2019. Telephone Call

Northern Climate ExChange. 2014. Final Report: Dempster Highway Permafrost Assessment. 38 p.

Nugent, S. 2011. A Review of Trenchless Watercourse Crossings in Alberta with Respect to Species at Risk. Can. Manuscr. Rep. Fish. Aquat. Sci. 2947: vi + 69 p.

O'Neill, H.B. and Burn, C.R. 2015. Permafrost Degradation Adjacent to Snow Fences Along the Dempster Highway, Peel Plateau, NWT. Proceedings from the 7th Canadian Permafrost Conference, Quebec City, Quebec, September 21-23, 2015.

O'Neill, H.B., Wolfe, S.A., and Duchense, C. 2019. New Ground Ice Maps for Canada Using a Paleogeographic Modelling Approach. The Cryosphere 13: 753-773.

Peel Watershed Planning Commission. 2008. Map 12: Hart River Caribou Herd – Range, Locations & Key Areas. Peel Watershed Planning Region, Yukon

Richardson, N.W. and Sauer, E.K. 1975. Terrain Evaluation of the Dempster Highway Across the Eagle Plain and Along the Richardson Mountains, Yukon Territory. Canadian Geotechnical Journal 12(3), p. 296-319.

Ricker, K.E. 1968. Quaternary Geology of the North Klondike and Upper Blackstone River Systems, Southern Ogilvie Ranges, Yukon Territory, Canada. Geological Survey of Canada, Open File 478, 1:50,000-scale map.

Ricker, K.E. 1977. Quaternary Geology of the North Klondike and Upper Blackstone River Systems, Southern Ogilvie Ranges, Yukon Territory, Canada – Dempster Highway (km. 0-139), Supplemental Terrain Classification, Sensitivity and Engineering Legend to Accompany Geological Survey of Canada Open File 478.

Sinclair, P.H., Nixon, W.A., Eckert, C.D., Hughes, N.L. (Eds.)., 2003. Birds of the Yukon Territory. University of British Columbia Press, Vancouver.

Smith, C.A.S., Meikle, J.C., and Roots, C.F. (editors). 2004. Ecoregions of the Yukon Territory: Biophysical Properties of Yukon Landscapes. Agriculture and Agri-Food Canada, PARC Technical Bulletin No. 04-01, Summerland, British Columbia, 313 p.

Smith, I.R. and Lesk-Winfield, K. 2012. An Updated Assessment of Ground Ice and Permafrost Geology-related Observations Based on Seismic Shothole Drillers' Log Records, Northwest Territories and Northern Yukon. Geological Survey of Canada, Open File 7061. http://dx.doi.org/10.4095/290974 (1 DVD).

Smith, I.R. 2015. Seismic Shothole Drillers' Lithostratigraphic Logs: Unearthing a Wealth of Regional Geoscience Information in Northwestern Canada. GeoResJ 6: 21-29.

Smith, S.L. and Burgess, M.M. 2004. Sensitivity of permafrost to climate warming in Canada. Geological Survey and Canada, Open File 579. https://doi.org/10.4095/216137

SRK Consulting (Canada) Inc. 2014. Desktop Study – Sinkhole Site Characterization, Dempster Highway, Yukon Territory. Report prepared for Government of Yukon, November 2014.

Stantec. 2019. DFL Conceptual Design Brief – Outside Plant Engineering – Functional Design Guide. Prepared for Yukon Government, Property Management Division. 76 pp.

Tr'ondëk Hwëch'in (TH). n.d. Who we are. Available at www.trondek.ca/aboutus.php [Accessed June 2019].

Wauthy, M., M. Rautio, K.S. Christoffersen, L. Forsstrom, I. Laurion, H.L. Mariash, S. Peura, and W.F. Vincent. 2018. Increasing dominance of terrigenous organic matter in circumpolar freshwaters due to permafrost thaw. Limnology and Oceanography Letters, 3:3.

Williams, D.J. and Burn, C.R. 1996. Surficial Characteristics Associated with the Occurrence of Permafrost near Mayo, central Yukon Territory, Canada. Permafrost and Periglacial Processes 7, p. 193-206.

Yukon Environmental and Socio-economic Assessment Board (YESAB). 2010. Proponent's Guide to Project Proposal Submission to a Designated Office. Available at: http://www.yesab.ca/wp/wp-content/uploads/2017/11/YESAB-Proponents-Guide-Complete-Aug-2010.pdf

Yukon Environmental and Socio-economic Assessment Board (YESAB). 2011. Proponent's Guide to Water Information Requirements for Quartz Mining Project Proposals. Available at: http://www.yesab.ca/wp/wp-content/uploads/2014/10/Water-Info-Requirements-Guide_FINAL.pdf [Accessed March 4, 2019].

Yukon Government. 2014. Yukon Community Profiles: Dawson City. Available online at http://www.yukoncommunities.yk.ca/dawson-city

Yukon Government. 2018. Best Management Practices. Available at: http://www.tc.gov.yk.ca/bmp.html [Accessed April 2019].

Yukon Government. 2019. Preferred Practice of Works Affecting Yukon Waters. Available at: https://yukon.ca/sites/yukon.ca/files/env/env-preferred-practices-works-affecting-yukon-waters.pdf [Accessed April 4, 2019].

Yukon Invasive Species Council. 2018. Yukon Invasive Species Council. Available at: https://www.yukoninvasives.com/index.php/en/ [Accessed March 20, 2019].