QUALIFIED PROFESSIONAL STATEMENT

Stantec Consulting Ltd. ("Stantec") was retained by Coastal GasLink Pipeline Ltd. (the "Client") to prepare Section 4.0 ("Regulatory and Policy Framework"), Section 5.0 ("Literature Review"), Section 6.0 ("Implementation of the Caribou Mitigation and Monitoring Plan"), and Section 7.0 ("References") of this document titled "Caribou Mitigation and Monitoring Plan". Stantec confirms that these components have been prepared by or under the direction and supervision of Qualified Professional(s) registered and in good standing with the College of Applied Biology in British Columbia. These components have been prepared solely for use by the Client in connection with the Coastal GasLink Pipeline Project ("the Project") and in light of the scope and parameters set forth by the Client.

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STANTEC CONSULTING LTD.:

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Name: Michael I Preston

Date: October 13, 2021

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1.0 INTRODUCTION

The objectives of the Caribou Mitigation and Monitoring Plan (CMMP) are to demonstrate how Coastal GasLink will:

- avoid displacement and sensory disturbance of caribou in the Hart Ranges (KP 137.2 to KP 189.3) and Telkwa caribou herds (KP 527.7 to KP 578.0)
- achieve no net loss of caribou habitat in the Hart Ranges (KP 137.2 to KP 189.3) and Telkwa caribou herds (KP 527.7 to KP 578.0)
- avoid increased predation of caribou in the Hart Ranges (KP 137.2 to KP 189.3) and Telkwa caribou herds (KP 527.7 to KP 578.0)

These objectives are consistent with Condition 10 of Schedule B to the Coastal GasLink Environmental Assessment Certificate (EAC) (refer to Section 1.1). In addition, some BC Oil and Gas Commission (BC OGC) Section 25 permit conditions apply to the Quintette caribou herd (KP 62.5_R2 to 65.0) and require mitigation pertaining to timing restrictions, access control and habitat restoration. Therefore, the CMMP was prepared to apply to the Hart Ranges (KP 137.2 to KP 189.3) and Telkwa caribou herds (KP 527.7 to KP 578.0), consistent with Condition 10 of Schedule B to the EAC, and consistent with the BC OGC Section 25 permit conditions specific to the Quintette herd (KP 62.5_R2 to 65.0).

1.1 ENVIRONMENTAL ASSESSMENT CERTIFICATE CONDITION

The purpose of the CMMP is to satisfy Condition 10 of Schedule B to the Coastal GasLink EAC issued by the British Columbia (BC) Environmental Assessment Office (EAO) (2014), and consider the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) Caribou Program described in EAC Condition 11 of Schedule B to the EAC. Condition 10 of Schedule B to the EAC states:

> The Holder must develop and implement a Caribou Mitigation and Monitoring Plan (CMMP) in consultation with FLNR, EC and OGC for the areas identified by FLNR as the Hart and Telkwa caribou ranges (Caribou Ranges).
>
> A Qualified Professional must develop and supervise the implementation of the CMMP. The CMMP must address the following objectives (CMMP Objectives) respecting the Construction and Operation of the Project:
>
> - avoidance of displacement and sensory disturbance of caribou in the Caribou Ranges;
> - no net loss of caribou habitat in the Caribou Ranges; and
> - avoidance of increased predation of caribou in the Caribou Ranges.
>
> The CMMP must be consistent with BC's *Policy for Mitigating Impacts on Environmental Values*.

The CMMP must describe the Holder's:

- strategies for achieving the CMMP Objectives, including, but not limited to:
  - mitigation to avoid, minimize, or complete restoration in response to the adverse effects of the Project and the Project's contribution to cumulative adverse effects on caribou and high quality caribou habitat (primary mitigation); and
  - mitigation to offset residual adverse effects if the primary mitigation is not expected to achieve the objectives within five years (offset mitigation);
- plan to monitor and assess:
  - the effectiveness of primary and offset mitigation; and
  - whether the objectives are being achieved;
- adaptive management approach to respond to monitoring and assessment results;
- plan to report on the implementation of the CMMP; and
- plan to engage with Aboriginal Groups with traditional territories affected by the Project that overlap Caribou Ranges, as well as EC, OGC, and FLNR, throughout the implementation of the CMMP.

The Holder must:

- provide a reasonable opportunity to Aboriginal Groups that have traditional territories affected by the Project, that overlap Caribou Ranges, as well as EC, OGC and FLNR to review and provide input regarding the content of the CMMP; and
- prepare a report to accompany the submission of the CMMP describing how input received from Aboriginal Groups that have traditional territories affected by the Project that overlap Caribou Ranges, EC, OGC and FLNR was addressed in the CMMP.

In order to allow for 60 days review and comment, the Holder must provide the CMMP to EAO no less than 90 days prior to the Holder's planned date to commence Construction. The Holder must not start Construction in the Caribou Ranges until the Plan has been approved by EAO, unless otherwise authorized by EAO.

Once approved the Holder must provide the CMMP to FLNR, EC and OGC.

Any amendments to the CMMP as a result of the adaptive management approach must be developed in consultation with FLNR, and approved by EAO.

Condition 11 of Schedule B to the EAC states:

> Prior to the commencement of Construction, the Holder must enter into an agreement with FLNR (Caribou Agreement) that will set out the terms of the Holder's participation in a program of activities (Caribou Program) that supports the recovery, conservation and management of caribou in the Caribou Ranges. The Holder must abide by the terms of the Caribou Agreement.
>
> The Caribou Program may include any of the following:
> - monitoring of Caribou Ranges and predators of the Caribou Herds;
> - the development and implementation of population, habitat and access management measures that support the conservation and recovery of caribou in the Caribou Ranges and are additional to the measures to be implemented by the Holder under Condition 10; and
> - administration of such activities.
>
> The Caribou Agreement may require the Holder to contribute amounts of up to $1,500,000 be paid in one or more of the following manners:
> (i) in trust for purposes consistent with the Caribou Program;
> (ii) as periodic contributions to costs incurred or to be incurred in developing and implementing the Caribou Program, or
> (iii) in trust for the benefit of the Holder, as security to cover the costs referred to in (ii).
>
> The Caribou Agreement may require the Holder to review, prepare, comment on, or otherwise participate in the preparation and presentation of draft plans, final plans, and reports regarding the Caribou Program.

1.2 BACKGROUND

Coastal GasLink completed a comprehensive environmental assessment of the Coastal GasLink Pipeline Project (the Project) to identify potential adverse effects and cumulative effects on caribou, and mitigation that would be implemented to avoid or reduce those effects. This CMMP describes the mitigation in more detail, and provides additional mitigation to address the specific objectives of Condition 10 of Schedule B to the EAC. The CMMP describes how mitigation will be implemented, and how its effectiveness will be monitored and adaptively managed.

The Project intersects three caribou herd ranges: Hart Ranges (KP 137.2 to KP 189.3), Quintette (KP 62.5_R2 to 65.0) and Telkwa (KP 527.7 to KP 578.0) (Figure 1-1). These herds belong to the Southern Mountain population of woodland caribou, which are designated as Threatened on Schedule 1 of the *Species at Risk Act* (Environment and Climate Change Canada [ECCC] 2014). The Southern Mountain population is considered at risk because of rapid population declines (at least 45% in the past three generations), and increased predation because of human-caused and natural habitat change (i.e., loss, degradation and fragmentation; COSEWIC 2014). Habitat change may alter foraging habitat, resulting in higher populations of moose

(*Alces alces*), deer (*Odocoileus spp.*) and elk (*Cervus elaphus*), which in turn support a higher density of caribou predators (e.g., wolves [*Canis lupus*], grizzly bears [*Ursus arctos spp.*] and black bears [*Ursus americanus*]). Industrial development may also facilitate predator movement through the landscape by creating linear corridors (e.g., roads and rights-of-way [ROW]). Therefore, indirectly managing caribou predator density and distribution by directly managing habitat loss, degradation and fragmentation is a key element of the federal recovery strategy (ECCC 2014).

1.2.1 Interaction with the Project

The Project footprint overlaps the Quintette herd range between approximately kilometre post (KP) 64.5 and 65.5, the Hart Range (KP 137.2 to KP 189.3) herd range between approximately KP 135.5 and 189.6, and the Telkwa herd range (inclusive of WHA 6-333) between approximately KP 529.0 and 579.0 (Figure 1-1). The Project footprint is predicted to directly affect about 36.0 ha within the Quintette caribou herd range (KP 62.5_R2 to 65.0), of which 16.3 ha are attributed to the pipeline and 19.7 ha are attributed to ancillary sites. The Project footprint is predicted to directly affect about 644.5 ha within the Hart Ranges caribou herd range (KP 137.2 to KP 189.3), of which 477.3 ha are from the pipeline and 167.2 ha are from ancillary sites. Within the Telkwa caribou range (KP 527.7 to KP 578.0), the Project footprint is predicted to affect approximately 610.2 ha, of which 459.6 ha is from the pipeline footprint and 150.6 ha is from ancillary sites. The amount of area predicted to be affected is subject to change as detailed construction planning continues.

Within caribou range (and elsewhere), Coastal GasLink has focused on avoiding creating new roads, to the extent practical, by using existing access (e.g., forestry roads). However, creating new access within caribou range is necessary to construct and operate the Project. Approximately 8.4 km of new road will be required through the Hart Ranges caribou range (KP 137.2 to KP 189.3), and approximately 3.6 km of new road will be required through the Telkwa caribou range (KP 527.7 to KP 578.0). No new road access is planned through the Quintette herd caribou range (KP 62.5_R2 to 65.0).

The Project footprint intersects designated ungulate winter range (UWR u-7-003) for the Hart Ranges herd (KP 137.2 to KP 189.3). This UWR is divided into three spatially separated units: one unit (P-003) is classified as ‘high’ and is managed for no timber harvest and strict access management, and two units (P-028 and P-062) are classified as ‘corridor’ and managed for continuous old stand characteristics (greater than 100 years old) (Stevenson et al. 2003) (Figure 1-1). The Project is predicted to affect approximately 57.7 ha in this UWR, which includes 57.2 ha of pipeline ROW, 0.5 ha of ancillary sites and 6.2 km of new road (as part of the 8.4 km of total new road for the herd range). The Project also intersects a designated wildlife habitat area (WHA 6-333) for the Telkwa caribou herd (KP 527.7 to KP 578.0). The Project is

predicted to affect approximately 174.0 ha in this WHA, which includes 76.8 ha of pipeline ROW, 97.2 ha of ancillary sites and 4.3 km of new road access.

1.2.2 Linkages to Other Plans

The CMMP will be implemented in association with other Coastal GasLink management plans. Management plans that are linked to the CMMP include:

- Environmental Management Plan
  - Access Control Management Plan
  - Traffic Control Management Plan
  - Human-Wildlife Conflict Management Plan
  - Grizzly Bear Mitigation and Monitoring Plan
  - Wildlife and Wildlife Habitat Management Plan
  - Wildlife Species of Concern Discovery Contingency Plan
  - Chemical and Waste Management Plan
  - Wetlands Management Plan
- Reclamation Program
- Post-Construction Monitoring Program

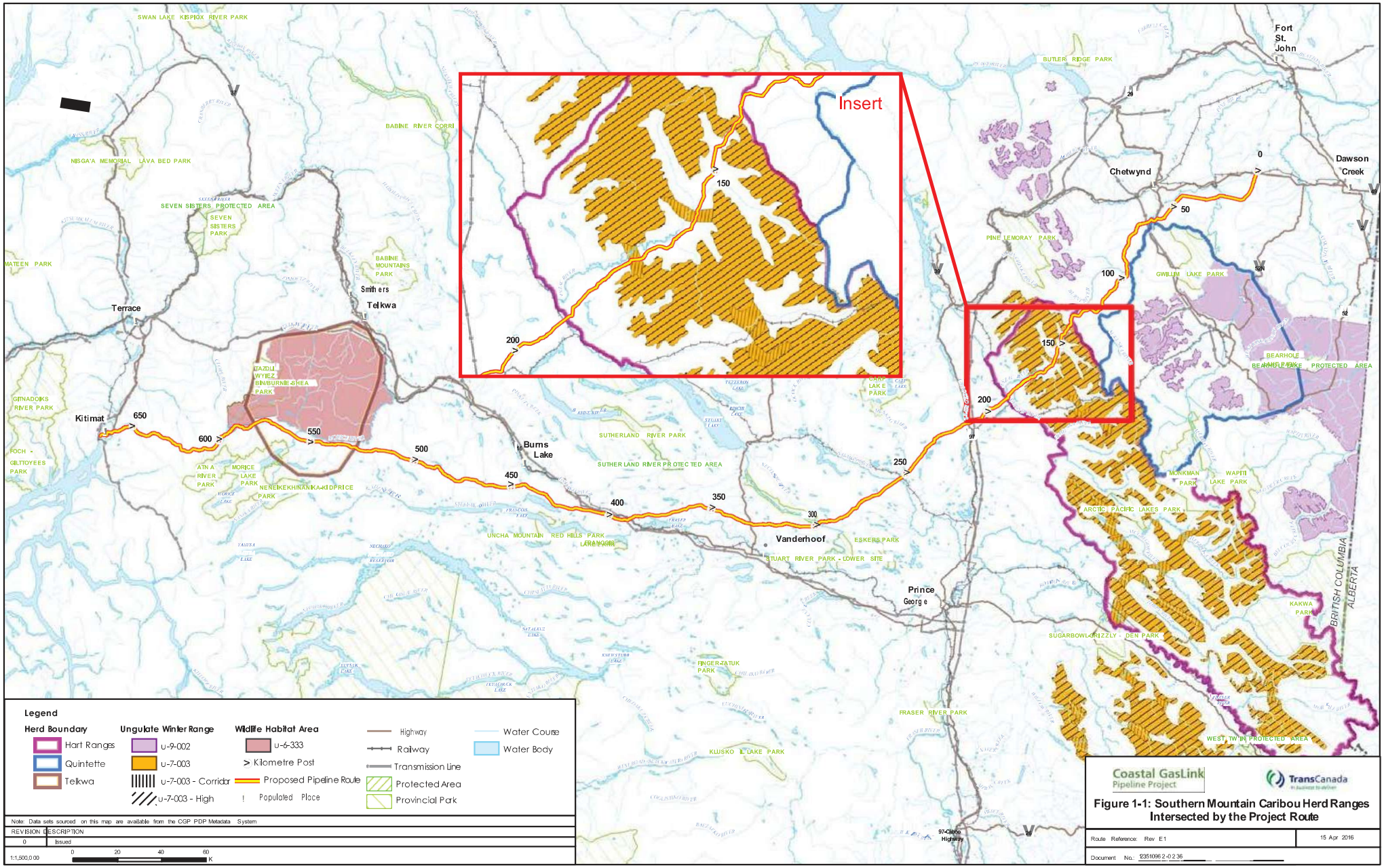
1.3 SCOPE

The temporal scope of the CMMP includes construction and five years post-construction (operations) of the Project. This is consistent with the five-year post-construction timeline required for primary mitigation strategies as stated in Condition 10 of Schedule B to the EAC, during which time the effectiveness of mitigation will be monitored. If effectiveness monitoring results indicate that remedial or additional mitigation is needed, the process for implementing these changes will be made by working through an adaptive management framework (refer to Section 6.9). Any remedial or additional mitigation implemented as part of adaptive management will be monitored for effectiveness.

The spatial scope of the CMMP applies to those portions of the Project footprint (i.e., ROW, access roads, shooflies and ancillary sites) that intersect the Quintette (KP 62.5_R2 to 65.0), Hart Ranges (KP 137.2 to KP 189.3) and Telkwa (including WHA 6-333) caribou herd ranges (KP 527.7 to KP 578.0) (Figure 1-1). In addition, the CMMP includes:

- a description and review of mitigation

- selection of candidate areas to implement mitigation (e.g., access control) to reduce mortality risk and sensory disturbance on caribou
- criteria for selecting mitigation and sites (e.g., for access control)
- methods to monitor the effectiveness of mitigation
- an adaptive management framework
- a reporting framework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BABINE RIVER CORRI
NISGA'A MEMORIAL LAVA BED PARK
SEVEN SISTERS PROTECTED AREA
SEVEN SISTERS PARK
MATEEN PARK
BABINE MOUNTAINS PARK
GITNADOIKS RIVER PARK
TAZDLI WYIEZ BIN/BURNIE-SHEA PARK
FOCH - GILLTOYEES PARK
ATNA RIVER PARK
MORICE LAKE PARK
NENEIKEKHINANKA-KIDPRICE PARK
SUTHERLAND RIVER PARK
SUTHERLAND RIVER PROTECTED AREA
UNCHA MOUNTAIN RED HILLS PARK
ESKERS PARK
STUART RIVER PARK - LOWER SITE
FINGER-TATUK PARK
KLUSKO LAKE PARK
FRASER RIVER PARK
BUTLER RIDGE PARK
PINE LEMORAY PARK
GWILLIM LAKE PARK
BEARHOLE LAKE PROTECTED AREA
MONKMAN PARK
WAPITI LAKE PARK
ARCTIC PACIFIC LAKES PARK
KAKWA PARK
SUGARBOWL-GRIZZLY DEN PARK
WEST TWIN PROTECTED AREA
CARP LAKE PARK
BRITISH COLUMBIA
ALBERTA
97-Alaska Highway
Legend
Herd Boundary
Hart Ranges
Quintette
Telkwa
Ungulate Winter Range
u-9-002
u-7-003
u-7-003 - Corridor
u-7-003 - High
Wildlife Habitat Area
u-6-333
> Kilometre Post
Proposed Pipeline Route
! Populated Place
Highway
Railway
Transmission Line
Protected Area
Provincial Park
Water Course
Water Body
Note: Data sets sourced on this map are available from the CGP PDP Metadata System
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TransCanada
Figure 1-1: Southern Mountain Caribou Herd Ranges Intersected by the Project Route
Route Reference: Rev E1
15 Apr 2016
Document No.: 1351096 2-0 2 36
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2.0 ENGAGEMENT

The development of the CMMP was informed by engagement with Environment and Climate Change Canada (ECCC), the BC MFLNRORD, the BC OGC, and Indigenous groups that have traditional territories affected by the Project that overlap the caribou ranges. Examples of topics discussed during development of the CMMP include:

- access control measures and the decision criteria for site-specific implementation
- traditional use and access to inform the determination of candidate access control points
- selection of candidate locations for site-specific implementation of access control measures
- monitoring of implemented mitigation and adaptive management
- existing caribou management programs and their effectiveness

Coastal GasLink recognizes the importance of traditional knowledge and has worked with affected Indigenous communities to review available TLU and TEK for reference during the planning and design phases of the Project. The Indigenous groups with asserted traditional territories that overlap one or more of the caribou herd ranges (i.e., Hart Ranges (KP 137.2 to KP 189.3), Telkwa (KP 527.7 to KP 578.0)) are Doig River First Nation, Halfway River First Nation, McLeod Lake First Nation, Saulteau First Nations, West Moberly First Nations, Carrier Sekani Tribal Council, Nee Tahi Buhn Band, Office of the Wet'suwet'en Hereditary Chiefs, Skin Tyee First Nation and Wet'suwet'en First Nation.

Coastal GasLink will continue engagement with Indigenous groups during construction of the Project, consistent with the approved Aboriginal Consultation Plan. This engagement will include consultation with Indigenous groups that have traditional territories affected by the Project that overlap caribou ranges regarding the implementation of the CMMP.

Ongoing engagement with Indigenous groups during the implementation of the CMMP will include the following:

- Over the duration of construction, participants in the Construction Monitoring and Community Liaison Program will have the opportunity to review and discuss with the Environmental Inspector and the Construction Manager the type and location of access control sites within their traditional territory.
- Coastal GasLink will continue to implement the Aboriginal Consultation Plan, which provides the opportunity to identify and discuss issues and concerns, including areas of particular importance (i.e., traditional use areas), with

Indigenous groups regarding the final location and implementation of access control measures within their traditional territory.

- Coastal GasLink will continue to implement the Aboriginal Consultation Plan, which provides the opportunity to identify and discuss any issues and concerns. This would include discussion about the Post-Construction Monitoring Program and annual reports for those Indigenous groups that express interest in receiving the PCMP reports.

Coastal GasLink will engage with ECCC, BC MFLNRORD and BC OGC regarding the implementation of the CMMP. Coastal GasLink will utilize available and applicable information (e.g., data, trends, results) from the Caribou Program referenced in Condition 11 of Schedule B to the EAC during implementation of the CMMP.

3.0 PLAN IMPLEMENTATION

Implementation of the CMMP will be supervised by a Qualified Professional. The CMMP will also be implemented in accordance with the environmental compliance framework of the Project, as described in Section 4.0 of the Environmental Management Plan.

4.0 REGULATORY AND POLICY FRAMEWORK

The following federal and provincial legislation, regulations, policy and mitigation guidance are applicable to the Quintette (KP 62.5_R2 to 65.0), Hart Ranges (KP KP 137.2 to KP 189.3), and Telkwa (KP 527.7 to KP 578.0) caribou herd ranges.

4.1 FEDERAL

Caribou herd ranges traversed by the Project (Quintette (KP 62.5_R2 to 65.0), Hart Ranges (KP 137.2 to KP 189.3) and Telkwa (KP 527.7 to KP 578.0)) are part of the Southern Mountain population, and are designated as Threatened on Schedule 1 of SARA, and a recovery strategy has been developed under the Accord for the Protection of Species at Risk (refer to ECCC 2014). The goal of the federal Southern Mountain caribou recovery strategy is to achieve self-sustaining populations in all local population units within their current distribution (ECCC 2014). As part of implementing the recovery strategy, the Government of Canada identified critical habitat, which is defined in Section 2(1) as "the habitat that is necessary for the survival or recovery of a listed wildlife species". The primary functions of critical habitat are security, foraging, and travel (ECCC 2014). The destruction of critical habitat is prohibited under Section 58(1) of SARA. The critical habitat necessary to achieve population and distribution objectives is identified within the Southern Mountain caribou federal recovery strategy (refer also to Section 5.1.1). The management of predator density and distribution through direct habitat management is a key strategy of the recovery strategy (ECCC 2014).

4.2 PROVINCIAL

4.2.1 Provincial Acts

Management of caribou in BC is regulated through several Acts. Under the BC *Wildlife Act*, it is an offence to capture, possess or kill caribou without an authorization permit. Under Section 103 of the *Oil and Gas Activities Act* (OGAA), caribou and its habitat may be subject to specific environmental and management regulations. Under the OGAA, the BC OGC is responsible for the protection and management of UWRs and WHAs, and for issuing permits for oil and gas activities that meet protection and management guidelines. Specifically, the BC OGC is responsible for mitigating the effects of oil and gas activities on caribou habitat by restricting industrial development within a UWR or WHA unless the development is expected to have no material adverse effect on the habitat's ability to provide for the survival of caribou (BC OGC 2018).

Provincial recovery efforts for the South Peace caribou herds (which include only the Quintette herd (KP 62.5_R2 to 65.0) as traversed by the Project) are discussed in the Implementation Plan for the South Peace Northern Caribou (BC Ministry of Environment and Climate Change Strategy [MECCS] 2013a). Elements of the Implementation Plan include strategic direction (BC MECCS 2013b) and guidance for the development of CMMPs, including habitat offsetting for direct effects on designated high elevation winter range (BC MECCS 2013c, d). The Implementation Plan contributes to the planning required under the federal *Species at Risk Act*, and addresses Treaty 8 rights regarding caribou.

Provincial caribou recovery efforts for the Hart Ranges herd (KP 137.2 to KP 189.3) are described in the Mountain Caribou Recovery Implementation Plan (BC MECCS 2007). Elements of this Implementation Plan include guidance on the development of a predator-prey management strategy, halting or reversing habitat loss and committing government to work with users to manage their activities in a manner that does not displace mountain caribou. Provincial caribou recovery efforts for the Telkwa herd are described in the Recovery Action Plan for Northern Caribou Herds in North-central British Columbia (McNay et al. 2008) and the Telkwa Caribou Population Status and Background Information Summary (Cichowski 2014). Elements of the Recovery Action Plan include recommending management actions that would lead to self-sustaining populations and keeping stakeholders informed of efficacy of recovery planning through implementing, and regular reporting on, an effectiveness monitoring program.

Controlling human access into caribou range is an important component of recovery (BC MECCS 2013c; McNay et al. 2013; Cichowski 2014; ECCC 2014). Access management can reduce human effects on caribou distribution and abundance; for example, by reducing sensory disturbance and mortality risk (e.g., hunting) to caribou. Coastal GasLink has developed an Access Control Management Plan to control human access to the ROW, and is complementary to the suite of mitigation that will be implemented as part of the CMMP.

4.2.2 British Columbia's Policy for Mitigating Impacts on Environmental Values

BC MECCS has developed two guidance documents that provide a framework for mitigating potential adverse effects on the environment. These are the Policy for Mitigating Impacts on Environmental Values (BC MECCS 2014a) and the accompanying Procedure for Mitigating Impacts on Environmental Values (BC MECCS 2014b). These documents provide guidance on the application of a hierarchical process for selecting and implementing mitigation required under existing legislation or for other commitments.

BC's Policy for Mitigating Impacts on Environmental Values (BC MECCS 2014a) outlines a mitigation hierarchy framework for avoiding and minimizing impacts on environmental values. Below is a description of the four levels in the mitigation hierarchy:

- **Avoid**: Avoid Project-related impacts on environmental values by adjusting the site of an activity, using alternative methods, adjusting the timing or schedule of an activity, or ceasing an activity altogether. Avoiding creation of new access for predators and hunters in caribou habitat is important to reducing effects on the caribou populations. Coastal GasLink has avoided Project footprint within caribou herd ranges to the extent practical.
- **Minimize**: If avoidance is not practical, Project-related impacts on environmental values can be minimized by adjusting the site of an activity, using alternative methods, or adjusting the timing or schedule of an activity. Reducing sensory effects on caribou is important to reducing effects on the caribou population.
- **Restore-on-site**: If disturbance of an environmental value cannot be avoided or minimized to an acceptable level, restoration of the value in the Project area will be considered. Restoration aims to recover the function, integrity, resiliency and self-sustainability of the disturbed environmental value. Implementing access control measures to reduce predator and hunter access to caribou habitat is important to restoring caribou habitat and reducing effects of the Project on caribou.
- **Offset (off-site or on-site)**: If, after measures to avoid, minimize and restore on-site have been applied and residual impacts are predicted to remain, then offsets will be required. The provincial policy requires an assessment of ecological equivalency of any remaining impacts, and consideration and selection of measures to offset impacts on environmental values. Condition 10 of Schedule B to the EAC states that the CMMP must include a description of the strategy for mitigation to offset residual adverse effects if the primary mitigation is not expected to achieve the objectives within five years.

5.0 LITERATURE REVIEW

Coastal GasLink reviewed the most recent and relevant published literature on Southern Mountain caribou populations, and mitigation options for reducing effects on caribou and mitigation effectiveness, by completing a literature review for the CMMP. The literature review was conducted using available reference material and a search of Google Scholar (May 2015).

Additionally, research papers presented at the 15th North American Caribou Workshop on caribou habitat restoration were key sources in the development of the CMMP (i.e., Reid 2014; Bentham and Coupal 2014; Keim et al. 2014; Saxena et al. 2014; Dickie et al. 2014; Finnegan et al. 2014; DeMars et al. 2014; Cody et al. 2014).

The literature review is organized into two sections: a review of Southern Mountain caribou ecology and habitat, including threats and limiting factors, and a review of caribou mitigation options for consideration in this CMMP.

5.1 SOUTHERN MOUNTAIN CARIBOU ECOLOGY AND HABITAT

A brief review of caribou ecology and habitat needs is provided, based primarily on recent literature reviews on Southern Mountain caribou (i.e., Festa-Bianchet et al. 2011; BC MECCS 2013a; BC MECCS 2014c; ECCC 2014).

5.1.1 Habitat

Southern Mountain caribou herd ranges are primarily located in Engelmann spruce – sub-alpine fir (ESSF), sub-boreal spruce (SBS) and boreal white and black spruce (BWBS) biogeoclimatic ecosystem classification (BEC) zones of BC. The Quintette (KP 62.5_R2 to 65.0), Hart Ranges (KP 137.2 to KP 189.3) and Telkwa ranges (KP 527.7 to KP 578.0) are primarily located in the ESSF and SBS, although Telkwa (including WHA 6-333) (KP 527.7 to KP 578.0) also occurs in the Interior Cedar-Hemlock zone, and all herds also use either the Interior Mountain-heather Alpine or Boreal Altai-fescue Alpine zones (McNay 2011; Cichowski 2014).

Terrestrial and arboreal lichen is an important food resource and component of Southern Mountain caribou habitat, particularly in winter (BC MECCS 2014c; ECCC 2014). Caribou access terrestrial lichen in winter by using areas with shallow snow cover, including high-elevation windswept ridges and low-elevation pine forests. Arboreal lichens tend to occur in older (80 to 250 year old) coniferous forests, particularly in the subalpine.

In the summer, Southern Mountain caribou migrate toward subalpine and alpine habitat in the Rocky Mountains where their diet is much more diverse, including a variety of shrubs, grasses and forbs (BC MECCS 2014c). Caribou also use subalpine and alpine habitat during calving (ECCC 2014).

The preference for lichen in winter, and use of subalpine and alpine habitats in summer, allows caribou to use less-productive habitat (e.g., subalpine conifer forest) that tends to support lower densities of other ungulate species (i.e., moose, deer and elk) and their associated predators. Other ungulates (and their predators) typically prefer more productive, lower elevation habitats (e.g., riparian areas, deciduous forests and shrublands).

In addition to high-elevation summer habitat, and high- and low-elevation winter habitat, caribou also require areas between these habitats, referred to as matrix habitat, that have relatively low predator densities (ECCC 2014). These areas allow for caribou to move between seasonal habitat patches with relatively low risk of predation and help isolate core summer and winter caribou habitats from predators (ECCC 2014).

5.1.2 Limiting Factors

Predation is a primary limiting factor for caribou (Bergerud 1974; Bergerud et al. 1984; Festa-Bianchet et al. 2011) and Southern Mountain caribou are no exception (ECCC 2014). A key life history strategy for caribou is to spatially separate from predators to reduce predation rates. This requires relatively large tracts of undisturbed habitat with low-productivity vegetation growth (e.g., coniferous forest, treed bogs) where predators occur at relatively low density.

Anthropogenic habitat change that negatively impacts the ability of caribou to maintain spatial separation from predators has become an important indirect limiting factor to caribou populations (Festa-Bianchet et al. 2011; BC MECCS2014c; Environment and Climate Change Canada 2014). Forestry cutblocks and linear features (e.g., seismic lines, roads and pipelines) are typically negatively associated with caribou distribution and abundance (DeCesare et al. 2012; ECCC 2014).

Linear features may create habitat that supports predator movement within caribou range, and can also create a relatively permeable landscape that may ultimately increase predation on caribou by increasing predator-caribou encounter rates (James 1999; James and Stuart-Smith 2000; Latham et al. 2011a; Whittington et al. 2011). For example, Tigner et al. (2014) have recently found that black bears (Ursus americanus) use seismic lines >2 m wide more than forest interior, suggesting they may use linear features to increase their ability to capture prey, including caribou. Wolves have been found to use linear features 1.3 times more than expected and to move up to 3.3 times faster on linear features than in habitats without

them (Dickie et al. 2014). Similarly, wolves in northeastern BC were found to be 1.5 and 3 times more likely to move toward seismic lines and roads, respectively, than to other habitats, and travelled 4.2 times faster on roads than in other habitats (DeMars et al. 2014). Linear features that support increased predator movement may be particularly problematic when they provide corridors into previously isolated caribou range (Latham et al. 2011b). For example, linear features that connect low-elevation valley bottoms to high-elevation areas may increase predation risk on caribou. Although the link between predator movement and caribou mortality has not been mechanistically determined, these results support the theory that linear features may contribute to increased caribou mortality risk by increasing landscape permeability for predator species.

Linear features may also create food habitat for ungulates, such as moose, elk and deer (Festa-Bianchet et al. 2011; BC MECCS 2014; Environment and Climate Change Canada 2014). Conversion of conifer forest to open habitat supports the growth of forbs, grasses, shrubs and deciduous trees, and, therefore, may support higher densities of ungulates through increased provisioning of preferred foods. This may then support higher densities of predators in caribou range. However, forestry, which creates early seral habitat at large scales, likely has a greater effect on caribou mortality in a region than linear features do (DeCesare et al. 2012; Apps et al. 2013).

5.2 MITIGATION

The pace and breadth of research on caribou mitigation has increased rapidly over the past decade in response to the decline in caribou populations across Canada. Primary mitigation for lessening adverse effects on caribou is habitat restoration. However, the lack of long-term monitoring of restoration methods means that there is a lack of conclusive information and relatively high uncertainty on appropriate mitigation to use, particularly regarding restoring caribou habitat (Golder Associates Ltd. [Golder] 2012; Vinge and Pyper 2012).

The CMMP focuses on measures for controlling human and predator access to caribou areas. General information on the approach to revegetation is included in Section 11.3 of the Reclamation Program, and revegetation measures and areas for implementation will be provided in the detailed Reclamation Plans. Revegetation is not discussed in detail here. The following is a summary of the state of knowledge on access control, both in relation to the management and recovery of caribou.

Access control can be targeted to predators, humans or both. The objective of access control is three-fold:

- minimize predation risk to caribou
- minimize sensory disturbance to caribou

- minimize disturbance to vegetation

The Access Control Management Plan (Appendix D.3 of the Environmental Management Plan [EMP]) describes the objectives of access control and the mitigation that will be implemented to meet those objectives. The CMMP describes implementation of access control measures specific to mitigating effects on caribou in caribou range. The CMMP and Access Control Management Plan are designed to be complementary. However, in caribou range, the CMMP takes precedence over the Access Control Management Plan. Access control measures specific to the CMMP can be divided into two types: physical barriers and line-of-sight barriers. Details of each are described in Section 5.2.1 and 5.2.2.

5.2.1 Physical Barriers

Physical barriers are intended to deter humans or wildlife from travelling along a ROW, and include gates, berms, coarse woody debris and site preparation (e.g., excavator mounding and slope stabilization). The type of barrier used depends on whether the objective is to deter human use or predator movement, or both. Physical barriers may successfully deter human use, in turn promoting native vegetation recovery, reducing hunting and illegal take, and reducing sensory disturbance to caribou (Switalski and Nelson 2011).

Access control using physical barriers can be challenging in areas with high levels of existing human use. For example, if the Project is intersected by several other linear features it may be difficult to apply access control at all access points. Similarly, it may not be practical to deter access where the Project parallels existing linear features that do not have access control in place.

Gates

Gates reduce human access to linear features, while still allowing access to wildlife (e.g., Switalski and Nelson 2011). If successful at deterring human use, barriers, such as gates, could later be removed once forest vegetation on restored areas reaches a pole sapling or young forest structural stage (Sherrington 2003).

However, gates have not been proven completely successful in addressing human access. Hammer (1986) found that gates were ineffective in preventing vehicle access in 32% of cases, because of vandalism, detouring and being unlocked. Havlick (1999) found that when use by authorized personnel was discounted, 46% of gates were not effective in preventing vehicle access to closed roads. Gates are frequently subverted by breaking locks, by creating new access around the gate for off-road vehicles, or they may be left open intentionally or inadvertently by administrative users (Havlick 1999; Hamilton and Wilson 2001; Crichton et al. 2004). Additionally, gated areas are still open to authorized motorized users (Havlick 1999). Gates may be more

effective and less prone to vandalism when placed in visible, trafficked sites, in areas where natural features or bridges prevent detouring, and when paired with information signs (Eos 2009).

Coarse Woody Debris

Spreading coarse woody debris (i.e., rollback), such as logs and stumps, along linear features can be an effective method of reducing human and wildlife travel in the treated area. Trees felled across seismic lines successfully reduced wolf travel along the lines in Alberta's Little Smokey herd range (Neufeld 2006). In northeastern BC, wolves used seismic lines with coarse woody debris significantly less than seismic lines without coarse woody debris (DeMars et al. 2012). Very high densities of salvage logs placed on linear features reduced human use of linear features by 100%, wolf use of linear features by 90%, and deer use of linear features by 50%, throughout the year (Keim et al. 2014). In Saskatchewan, rollback of all woody material along access roads has been found to be extremely effective at deterring recreation access and promoting regeneration (Vinge and Pyper 2012). The effectiveness of coarse woody debris can be improved by ensuring that the debris spread is large (e.g., large slash, stumps or large lumps of debris) and that it is applied for up to 400 m past the closure point (Eos 2009).

Deactivation

Road decommissioning or deactivation uses physical measures (e.g., bridge removal, road base ripping or road re-contouring) to close roads. Prescriptions to deactivate roads also often restore or maintain drainage patterns, address slope stability and minimize the risk of sediment transport (Bagley 1998, BC MOF 2002, Dunkley et al. 2004, Switalski et al. 2004, Weston 2010). Hunt and Hupf (2014) found that combining deactivation with road closure techniques was significantly more effective at reducing traffic than closure alone. Decommissioned roads in Idaho's Clearwater National Forest showed no evidence of vehicle use, even though the gates at the entrance of some roads were inadequate to prevent use by off-road vehicles (Eos 2009).

Ripping is the most common form of road deactivation. Ripping involves decompacting the road base to a depth of 30 to 90 cm using a bulldozer dragging a plow (Switalski et al. 2004). Using v-plowing to rip the road bed was effective in preventing access by trucks and off-road vehicles, and it is recommended that ripping and removing culverts and bridges is done for at least 1.6 km of a road (Crichton et al. 2004).

Other Barriers

Other physical barriers, such as berms, mounding and boulders, may also be used to deter human access to linear features, while still allowing wildlife access. Havlick (1999) found that placing large boulders was effective in preventing vehicle access on 50% of closed roads. Berms and boulders are generally sufficient to deter access by four-wheel drive vehicles, but off-road vehicles are generally able to circumnavigate them (Eos 2009). Excavations ranging from shallow ditches to deep excavations with steep sides are similarly effective; however, they are subject to weathering and can pose a safety risk to off-road vehicle users (Eos 2009). Plastic snow fencing or flags (i.e., fladry) can be effective, but potentially limiting to implement on a wide scale (Musiani et al. 2003).

5.2.2 Line-of-Sight Barriers

Line-of-sight barriers have been implemented as a tool to mitigate increased risk of predation and hunter-take in the short-term while linear features revegetate. Line-of-sight barriers may deter humans or wildlife from travelling on a ROW because they cannot see where the ROW goes and may mitigate human and predator interactions with caribou. Line-of-sight barrier techniques include doglegs or bends in the linear feature, strategic planting of vegetation screens, and strategic mounding of berms or slash (Culling et al. 2004).

Focusing restoration in areas that are more likely to support rapid vegetation growth (e.g., productive upland habitat) is one approach to create line-of-sight barriers. Generally, coniferous species are better visual barriers than deciduous species. However, conifer forests take several decades to more than a century to reach maturity, compared to deciduous shrubs and trees that might reach maturity in fewer decades. Efforts to regenerate early seral shrubs and trees at strategic points along the ROW to act as vegetative screens should avoid creating large amounts of forage attractive to other ungulate species.

Depending on site conditions, it may take several years to decades for vegetation to grow high enough to block line-of-sight. In the interim, other line-of-sight barriers should be used, such as large boulders, soil berms and fences (BC MECCS 2011). Tree bending may be an effective means of creating line-of-sight barriers; however, its effectiveness has yet to be evaluated (Reid 2014; Cody et al. 2014). Operating practices for energy development in sensitive caribou range in BC (BC MECCS 2011) recommend implementing line-of-sight management every 200 to 500 m, depending on topography.

6.0 IMPLEMENTATION OF THE CARIBOU MITIGATION AND MONITORING PLAN

The CMMP outlines mitigation to be implemented to avoid displacement and sensory disturbance of caribou, achieve no net loss of caribou habitat, and avoid increased predation of caribou, consistent with the objectives of Condition 10 of Schedule B to Coastal GasLink's EAC (refer to Section 1.1). The mitigation hierarchy of avoid, minimize, restore on-site and offset has been, and will continue to be, implemented by Coastal GasLink as a means of reducing potential adverse effects on caribou. Mitigation is described in the sequential order that it will be implemented for the construction preparation, construction, and post-construction phases. A decision framework was developed to support the identification of appropriate mitigation (Figure 6-1). It is set up as a hierarchical decision tree for the construction preparation, construction and post-construction phases to help guide when and where access control and mitigation are appropriate and how it may be implemented. The CMMP also outlines a monitoring schedule, an adaptive management framework and a reporting framework.

6.1 CONSTRUCTION PREPARATION PHASE

The construction preparation period is when project planning, routing, and permitting occur. In addition, consultation with Indigenous groups and regulators occurs through all phases of the Project. Construction preparation mitigation is high in the mitigation hierarchy because it facilitates avoidance of caribou range and high-value caribou habitat.

6.1.1 Project Routing, Siting and Design to Avoid Caribou Range and Habitat

Avoiding caribou range circumvents the need for construction and post-construction mitigation. Coastal GasLink considered routing options as part of the environmental assessment process (Section 10.6 of the EAC Application) to minimize the portion of the Project footprint that intersects caribou range.

In addition, Coastal GasLink will seek ways through construction planning to further avoid effects on caribou range. This includes:

- using existing access to construct the ROW
- limiting access to the pipeline ROW during operation of the pipeline
- using shared workspace to limit the width of the ROW
- limiting construction of temporary workspace, where practical

For instance, the Project parallels existing linear features, where practical, to minimize the amount of forest opening and new access created by the Project. In addition, Coastal GasLink will use existing access in WHAs and UWRs to minimize

creating new access. Where roads do not exist, but are necessary for Project construction, Coastal GasLink will create temporary access roads that will subsequently be deactivated following construction in a manner that is consistent with BC OGC guidelines.

Coastal GasLink will continue to avoid effects on caribou and caribou habitat through careful planning and refinement of the Project footprint during detailed design. If a caribou mineral lick is discovered within 250 m of the Project footprint in caribou range at any time, then Coastal GasLink will follow the decision framework described in Section 4.0 of the EMP to identify appropriate action.

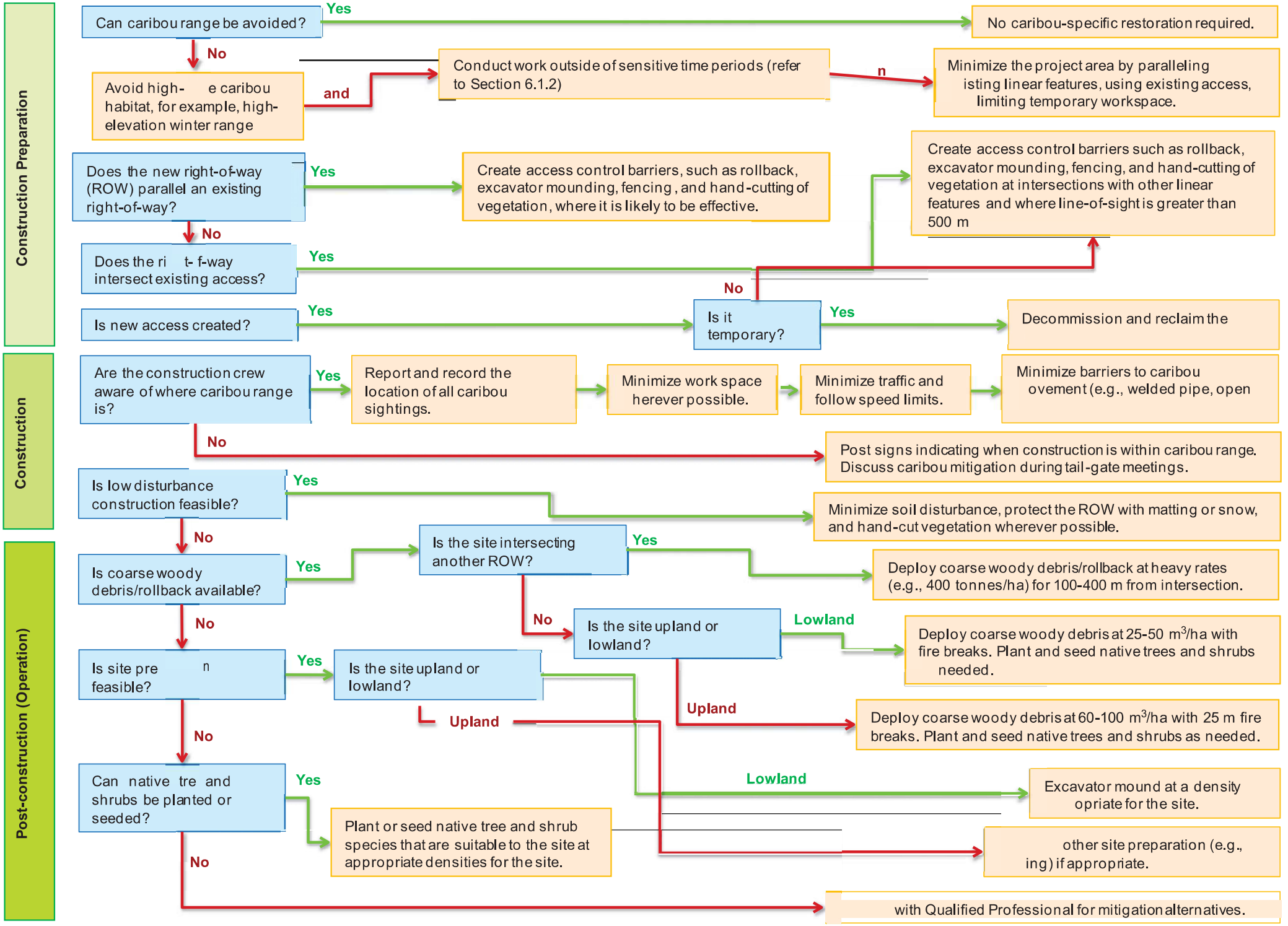


Figure 6-1: Decision Framework for Implementing Access Control and Habitat Restoration Treatments within Caribou Range

6.1.2 Project Activity Scheduling

To the extent practical, where activity in caribou range cannot be avoided, Coastal GasLink will reduce Project activities (i.e., clearing, construction and operational maintenance), during the critical timing windows of January 15 to July 15 for the Quintette (KP 62.5_R2 to 65.0), Hart Ranges (KP 137.2 to KP 189.3), and Telkwa herds (KP 527.7 to KP 578.0), December 1 to January 1 for the Telkwa herd (KP 527.7 to KP 578.0) (BC MFLNRORD 2014). Additionally, Project activities that must occur within caribou range will be scheduled outside of the period May 15 to July 15 (consistent with BC OGC permit conditions, unless otherwise authorized). Coastal GasLink will also restrict the use of aircraft over caribou range during this period. In addition, Coastal GasLink will not undertake any clearing or significant maintenance activities within UWR u-7-003 between January 15 and July 15 (consistent with BC OGC permit conditions, unless otherwise authorized) and WHA 6-333 and the Telkwa herd (KP 527.7 to KP 578.0) between May 15 and July 15 (consistent with BC OGC permit conditions, unless otherwise authorized); January 15 and July 15, and December 1 to January 1 for the Telkwa herd (BC MFLNRORD 2014) to the extent practical.

Table 6-1 provides a list of mitigation that will be implemented to increase productivity and reduce the duration of construction within caribou range, if work is expected to begin within, or extend into, the critical or cautionary periods. However, implementation of these measures may be affected by factors beyond Coastal GasLink's control, such as adverse weather conditions and safety considerations. Coastal GasLink will consult with a Qualified Professional to develop, and supervise the implementation of, alternative mitigation, if necessary.

Table 6-1: Construction Preparation Phase – Mitigation for Work Planned to Occur During Critical Timing Windows for Caribou

Activity	Mitigation
Clearing and Disposal	• Increase workforce resources to increase productivity.
Stripping Salvage and Grading	• Increase workforce resources to increase productivity.
Water Crossings	• Increase workforce resources to increase productivity.
Pipe Activities (Trenching, Stringing, Coating, Lowering-In)	• Use a wheel ditcher in place of a hoe, to increase productivity. • Increase welding workforce and equipment to increase productivity. • Increase the number of tie-in crews to increase productivity. • Increase the coating workforce to increase productivity.
Backfill	• Increase workforce resources to increase productivity.
Pressure Testing	• Begin pressure testing as soon as practical.
Cleanup and Reclamation	• Increase workforce resources to increase productivity to complete final cleanup and initial reclamation activities immediately following completion of construction.

6.2 CONSTRUCTION PHASE

Mitigation for caribou will be implemented during the construction period and will include those measures identified during the construction preparation phase (Section 6.1), such as timing restrictions, minimizing the amount of new footprint, minimizing access to caribou range and developing construction methods to minimize ground disturbance for caribou habitat restoration. Construction-specific measures are described in Table 6-2. If this mitigation cannot be adhered to, Coastal GasLink will consult with a Qualified Professional to develop additional mitigation for discussion with the relevant regulatory agencies.

Table 6-2: Construction Phase – Mitigation for Work Planned to Occur During Critical Timing Windows for Caribou

Activity/Concern	Mitigation
Education and Awareness	• Copies of the CMMP and associated documents will be made available to key Project construction and contractor staff during construction. • Personnel working on site will be made aware of Coastal GasLink's commitment to caribou conservation and the requirements outlined in this CMMP. Education and awareness will be conducted at various onsite meetings (i.e., kick-off meeting, Project orientation and daily tailgate meetings when working in caribou range). • Site-specific construction measures will be emphasized at onsite meetings and provided on the Environmental Worksheets. • Signage and bulletins will be posted at the Project trailers, alerting workers to the sensitivities associated with working in caribou range. • The Environmental Inspector will ascertain that caribou protection measures are implemented during Project construction, and a Qualified Professional will supervise the implementation. • Communicate to construction personnel the locations where wildlife are repeatedly observed, and the expectations of following speed limits along the Project access and construction footprint.
Regulatory Communication	• Coastal GasLink and the Environmental Inspector(s) will liaise with appropriate government agencies.
Scheduling	• Construction activities in caribou range will be scheduled to avoid the critical timing windows of January 15 to July 15 for the Quintette (KP 62.5_R2 to 65.0), Hart Ranges (KP 137.2 to KP 189.3) and Telkwa herd areas (KP 527.7 to KP 578.0), December 1 to January 1 for the Telkwa herd (KP 527.7 to KP 578.0) (BC MFLNRORD 2014) to the extent practical. • Aircraft use will be avoided over caribou range from May 15 to July 15, unless necessary for safety reasons. Aerial surveys must maintain a minimum 2-km distance from caribou birthing and rearing areas (BC MECCS 2008). • If work is expected to extend into critical timing windows, Coastal GasLink will implement measures outlined in Table 6-1, Mitigation for Work Planned to Occur During the Critical Timing Windows for Caribou, to increase productivity and reduce the duration of construction within caribou ranges. If work is expected to extend into the period May 15 to July 15, approval from the relevant regulatory authority will be required. • Construction progress will be continuously monitored and the mitigation will be implemented based on expectations for future construction activities and conditions.

Table 6-2: Construction Phase – Mitigation for Work Planned to Occur During Critical Timing Windows for Caribou (cont'd)

Activity/Concern	Mitigation
Reduce Habitat Loss/Area of Project Footprint	• Vegetation clearing within the ROW and temporary workspace will be limited to what is necessary to facilitate construction and as permitted by the BC OGC. • Locations where clearing is to be narrowed or avoided to retain vegetation will be clearly marked (e.g., for access control, line-of-sight barrier, material for felling/bending over the ROW to facilitate mitigation after construction).
Project-Related Traffic Management	• Speed limits will be established and enforced on all access used for the Project, per the Traffic Control Management Plan and the contractor's Traffic Management Plan. Generally, post winter speed limits of 80 km/hr on high grade roads and 60 km/hr on secondary roads in UWRs (BC OGC 2018), unless otherwise directed by an applicable transportation authority (i.e., adhere to the posted speed limit for a road if it is less than these speeds). • Multi-passenger vehicles will be used to transport workers to and from job sites. • If caribou are encountered on the road, on the ROW or within approximately 200 m of the ROW (where visibility allows), vehicles/equipment will be stopped with engine off and lights dimmed or off, and remain stopped until the caribou moves off the road or ROW to a distance more than approximately 200 m away (as visibility allows). Project personnel will not harass or attempt to move or scare caribou off the road, and will not use vehicle horns or other alarms as scare tactics. Once the animal has moved more than approximately 200 m off the road or ROW (as visibility allows), the vehicle/equipment will wait about five minutes and then proceed with caution, moving slowly (maximum 25 km/h) past the area where the animal was observed. • If caribou are encountered more than approximately 200 m from the road or ROW (as visibility allows), Project personnel will slow down (maximum 50 km/h) and proceed with caution. Others working nearby will be advised that there are caribou in the area. • If an injured caribou is encountered, the sighting will be reported to the Environmental Inspector who will contact BC MFLNRORD and the Conservation Officer Service to discuss appropriate options. • Access to the Project footprint will be restricted during construction to those specifically given authority (e.g., staff and contractors). • Any incidents with wildlife or collisions with wildlife will be reported by the Environmental Inspector to the RAPP hotline/FLNRORD. Collisions will also be reported to the local police detachment.

Table 6-2: Construction Phase – Mitigation for Work Planned to Occur During Critical Timing Windows for Caribou (cont'd)

Activity/Concern	Mitigation
Barriers to Caribou Movement during Construction	• Breaks in pipe, soil stockpiles and windrows will be created at least every 500 m if the top height of these barriers is expected to exceed 1.5 m for more than 72 hours (BC MECCS 2011). Breaks will be aligned with obvious wildlife trails to facilitate wildlife movement Breaks in set-up and welded pipe will coincide with gaps in salvaged material, graded material, trench spoil, snow and rollback windrows. Locations where gaps are appropriate will be determined in the field by the Environmental Inspector(s), with a Qualified Professional, as required. If the spacing of breaks cannot be achieved, Coastal GasLink will consult with a Qualified Professional for advice on developing additional mitigation. • The ROW, temporary workspace and access roads will be cleared of snow only as required for construction. • Gaps in snow berms will be provided at least every 500 m if snow berms reach higher than 1.5 m (BC OGC 2018) to allow wildlife movement. Gaps in snow berms will correspond to breaks in pipe, soil stockpiles and windrows, where applicable. Locations of gaps will generally align with wildlife trails, and will be determined in the field by the Environmental Inspector with a Qualified Professional, as required. If the spacing of breaks cannot be achieved, Coastal GasLink will consult with a Qualified Professional for advice on developing additional mitigation. • The amount of open trench will be minimized. Trenching will be conducted as close as practical to lowering-in and backfill operations. • A break (earthen plug) in the open trench will be provided, where appropriate, to allow wildlife to cross the trench. Locations of breaks will be determined by the Environmental Inspector with a Qualified Professional. • Any open excavations, such as sumps used for watercourse crossings, will be fenced to prevent wildlife from becoming trapped or ingesting material.
Caribou Disturbance	• Recreational use of all-terrain vehicles or snowmobiles by Project personnel on the Project footprint and Project access will be prohibited. • Multi-passenger vehicles will be used, wherever practical, to transport crews to and from job sites. • Winter speed limits of 80 km/hr on high grade roads and 60 km/hr on secondary roads in UWRs and WHAs will be posted, unless otherwise directed by an applicable transportation authority. • Project personnel will be prohibited from having pets on the Project. • Construction materials (e.g., cables, wires and fencing) will be properly stored to avoid potential hazards for wildlife. • Harassment or feeding of caribou or other wildlife by Project personnel will not be tolerated. • Recreational hunting/shooting/firearms will not be permitted on the work site. • Low elevation helicopter and fixed wing flights over UWR and WHA within the Certified Pipeline Corridor will be conducted in accordance with timing restrictions and recommended minimum separation distances specified in the *Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia* as recommended by BC MFLNRORD.

Table 6-2: Construction Phase – Mitigation for Work Planned to Occur During Critical Timing Windows for Caribou (cont'd)

Activity/Concern	Mitigation
Habitat Disturbance	• Coastal GasLink will utilize minimum disturbance construction techniques in areas where grading or blasting is required. Vegetation will be cleared above ground level and grubbing will be restricted to the trench width to maintain root layer integrity on most of the ROW. Within travel and work surfaces on the ROW, shrub and young forest areas will be identified before construction and, wherever practical, tall shrubs and tree saplings will be walked down (instead of cleared) to facilitate regeneration. Packed snow (during the winter) or matting will be used to protect surface soils and vegetation within travel and work surfaces on the ROW, to allow for quicker recovery after construction. • Where practical, and where trees with high loads of arboreal lichen are identified before clearing, efforts will be made to retain these trees. • Footprint will be narrowed, to the extent practical, in sensitive areas (e.g., watercourse crossings, wetland and riparian areas) and by utilizing shared workspace, avoiding clearing large diameter trees on the edge of the ROW and reducing extra temporary workspace (e.g., place log decks, storage areas, other temporary construction areas outside of UWRs and WHAs for caribou). • Disturbance to ground-level vegetation and root systems will be minimized by cutting or mowing shrubs and small diameter trees at ground level along portions of the ROW where grading is not required. • When conditions are appropriate, snow pack will be left on the ROW to protect ground level vegetation and surface soils. • All timber will be felled onto the ROW during clearing to minimize damage to vegetation off the ROW. Damaged or leaning trees will only be removed, if necessary, for safety concerns. • Mineral licks within caribou range will be avoided by 250 m from April through October (BC MFLNRORD 2014), unless otherwise authorized by the relevant regulatory authority. If this setback and timing restriction cannot be adhered to, Coastal GasLink will consult with a Qualified Professional to develop alternative measures for discussion with the relevant regulatory agency.
Revegetation	• Where practical, some coniferous trees will be de-limbed at the stump and limbs will be retained onsite to provide a seed source.

Table 6-2: Construction Phase – Mitigation for Work Planned to Occur During Critical Timing Windows for Caribou (cont'd)

Activity/Concern	Mitigation
Retention of Timber/Woody Debris	• Salvaged timber and coarse woody debris (slash) will be retained at locations identified for access control, line-of-sight barrier, erosion control, and to enhance seed germination and seedling survival. • Coarse woody debris will be spread at identified locations over the ROW to conserve moisture, moderate soil temperatures, provide nutrients, reduce soil erosion, provide a seed source, provide microsites for seed germination and protection for regenerating seedlings, and mitigate damage to regenerating vegetation from human use (e.g., off-road access). • Existing disturbed areas will be used for log deck sites and woody debris storage, where practical. • Slash and non-merchantable timber will be piled along the centreline of the ROW or to a side of the ROW that has been previously cleared in a manner that does not drag soil into the pile. A brush rake attachment may be used on bulldozers to facilitate preservation of surface soils. • Remaining merchantable timber will be salvaged in accordance with the applicable permits and approvals. Decked wood will be removed from the ROW, as soon as practical, to facilitate pipeline construction.
Line of Sight	• Line-of-sight mitigation may include bends in the ROW, doglegs at intersections with access roads, woody debris or earth berms, tree or shrub planting to create vegetation screens across the ROW, and avoiding clearing on the ROW. • Coarse woody debris will be retained during clearing for use as a line-of-sight barrier, where identified. Line-of-sight barriers will be constructed to a minimum height of 1.5 m across the entire width of the construction ROW. • Bored/drilled crossings of third-party dispositions will be extended, where practical, and in accordance with crossing agreements, to retain vegetation screens. • Line-of-sight breaks will be implemented every 500 m on linear features that do not share a ROW boundary with a road. • Avoid clearing construction access at bored/trenchless crossings (i.e., use existing access or the ROW from either side), or reduce the width of clearing to the trench line and the necessary workspace.
Access Control	• Access control will be implemented following methods described in Section 6.3.2. This will include using a variety of techniques, such as line blocking with available timber/woody debris (rollback or berms), excavator mounding, signage and fencing.
Soil and Slope Stability	• Disturbed erosion-prone slopes or banks will be stabilized. Bioengineering techniques (e.g., soil wraps and shrub staking) will be implemented at appropriate locations to stabilize disturbed soils and facilitate regeneration of native vegetation. Willow and poplar will only be used in caribou range where these species were naturally occurring before construction (e.g., riparian areas). • Seed mixes will be used in caribou range to minimize soil erosion, where needed (e.g., slopes, riparian areas and watercourse banks). Use only Certified No. 1 seed mix or native species in accordance with the Reclamation Program. If these measures are not feasible, Coastal GasLink will discuss alternative measures with the relevant regulatory authority.

Table 6-2: Construction Phase – Mitigation for Work Planned to Occur During Critical Timing Windows for Caribou (cont'd)

Activity/Concern	Mitigation
Mounding	• Where used for access control, areas excavated will be approximately 0.75 m deep, with the excavated material placed adjacent to the hole. Where mounding is applied for the creation of microsites suitable for tree establishment, mounds will be shallower than those for access control (e.g., approximately 0.3-0.5 m deep). • Site selection for mounding will be determined by the Environmental Inspector or construction management team in consultation with a Qualified Professional.
Cleanup and Reclamation	• Initial cleanup activities will start, as soon as practical, after backfill activities. Final cleanup will be complete within one year of construction.
Wildlife Sightings	• Coastal GasLink personnel and contractors will record all caribou sightings during construction and operation. Sightings will be compiled by the Environmental Inspector. Wildlife sighting information will be reported to BC MFLNRORD.
Documentation	• The Environmental Inspector will document construction methods, rationale, mitigation and issues encountered. If the Environmental Inspector identifies any issues with the caribou mitigation, these will be communicated to a Qualified Professional to support ongoing and future mitigation within caribou range.

6.2.1 Mitigation During Cleanup and Reclamation

Mitigation during cleanup and reclamation will be implemented during and after final cleanup of the ROW. Table 6-3 provides a general description of biostabilization and access control management measures, and additional information is provided in Section 6.3. Specifications may be adjusted by the Environmental Inspector at the time of implementation, if necessary.

Mitigation implemented during cleanup and reclamation will be guided by the decision framework (Figure 6-1), the outcome of construction and the Reclamation Program. The final decision on the location and types of mitigation will be determined by Coastal GasLink with the supervision of a Qualified Professional.

Table 6-3: Mitigation Tools for Cleanup and Reclamation

Mitigation Tool	Objectives	Specifications and Comments
Biostabilization and shrub staking	• Restore vegetation • Access control • Erosion control • Reduce line-of-sight	• Biostabilization is the use of live vegetation to revegetate a site (e.g., transplants, installing cuttings), and is often implemented in combination with slope or bank restructuring or stabilization measures, such as soil wraps. Vegetation used is typically collected either from the disturbance site (i.e., before or during clearing), or from the adjacent area, in the form of cuttings. Biostabilization is considered a medium to long-term mitigation treatment. Vegetation species and densities utilized are site dependent, however, within caribou range, willow and poplar will only be used in select sites (e.g., riparian areas) where they were growing naturally before construction, to avoid attracting other ungulates (e.g., moose), and indirectly attracting predators (e.g., wolves).
Berms	• Access control • Reduce line-of-sight • Create microsites and protection for natural seed ingress and vegetation growth	• Berms may be constructed of woody slash and timbers, or earth. Supported berms resemble log fences or walls, constructed using timber cleared from the ROW. • Feasibility of slash/timber berms may depend on approval from the relevant regulatory authority/forestry operators to retain and pile slash or timber onsite, and availability of material. Availability of source material is unlikely sufficient for earth berm construction in areas where minimal disturbance construction techniques are used. Earth berms should not be located in peatlands to avoid potential for settling and alteration of surface hydrology. Berms are effective immediately after implementation. • For effective line-of-sight breaks, berms should be constructed to an approximate height of 1.5 m. • Promote rapid shrub/tree regeneration at ends of berms (e.g., shrub staking, seedling planting) to increase effectiveness as access control.
Excavator mounding	• Create conditions conducive to tree/shrub establishment • Access control	• For the purpose of enhancing microsites for planted seedlings, mounding is a well-researched and popular site preparation technique in the silviculture industry. It is commonly used in wet, low-lying areas to create better-drained microsites for seedlings. • Mounding treed wetlands (e.g., bogs, fens) can enhance a site to promote natural revegetation over time, as higher, drier spots are created that seed can eventually settle into and germinate. • Mounding has been used as an access control measure on old roads and seismic lines to discourage off-road vehicle activity. It is effective immediately after implementation. • For access control purposes, mounds should be created using an excavator. Mounds should be approximately 0.75 m deep. The excavated material is dumped right beside the hole. Target density of mounding for access control and/or microsite creation purposes can vary from 1,400 to 2,000 mounds/ha.

Table 6-3: Mitigation Tools for Cleanup and Reclamation (cont'd)

Mitigation Tool	Objectives	Specifications and Comments
Woody debris rollback	• Control of human access during snow-free periods • Control of human and predator access during snow-covered periods • Erosion control, particularly along steep slopes • Protect planted seedlings from extreme weather, wildlife trampling and damage from off-road vehicles (human access) • Provide nutrients to introduced planted seedlings as the slash decomposes over time • Provide microsites for natural seed ingress	• Feasibility of rollback may depend on approval from provincial authorities or forestry operators to retain and pile slash or timber onsite, and availability of material. • Where rollback is the preferred mitigation, woody material will be brought to access control sites, as required, and will be stored in existing temporary workspace until needed for placement. When moving woody material, the same tree species that are present at the access control site or other acceptable species will be used, and the volume of material and potential for pest transfer and fire risk will be considered. • In an effort to reduce the risk of fire and insect pests, only larger-diameter logs should be used, and where alternative species are available, "green" spruce and Douglas-fir will be avoided for use in some Forest Districts. Pest management guidelines are included in the Forest Pest Management Plan. • Longer segments (100 to 400 m) are expected to be more effective. • Rollback logs arranged in non-random fashion, and applied in combination with large rocks and stumps, are expected to be more effective, and particularly with regard to access by snowmobiles. • Rollback can also conserve soil moisture, moderate soil temperatures and provide nutrients as debris decomposes, prevent soil erosion, provide a source of seed for natural revegetation, provide microsites for seed germination and protection for introduced tree seedlings, and protect seedlings from wildlife trampling and browsing.

Table 6-3: Mitigation Tools for Cleanup and Reclamation (cont'd)

Mitigation Tool	Objectives	Specifications and Comments
Woody debris rollback (cont'd)		• Rollback is effective immediately after implementation provided adequate material is available and properly applied. At the specified location, debris should be spread evenly across the entire footprint width at a coverage/density that will not restrict ability to plant seedlings or limit planted or natural seedling growth. Where sufficient material is available, the target woody debris coverage at selected locations is 100 m^3/ha, to both mimic natural processes and control access (Vinge and Pyper 2012). Higher volumes may be more effective at precluding access and may be considered (up to 150 m^3/ha); the amount and placement of wood needs to consider reducing ladder fuels from a forest fire perspective (Pyper and Vinge 2012). Locations where slash rollback is considered effective include the following: • on each side of an intersection with a linear feature that is not an all-season road • for 100 to 400 m on each side of roads and permanent watercourses crossed by the ROW, depending on site suitability • on segments of the ROW that deviate from paralleling existing linear features (i.e., new cut) to discourage new access trails from developing • on slopes > 10% • on temporary access (i.e., shooflies) and false rights-of-way (e.g., pull-back sections)
Planting	• Restore conifer forests • Encourage revegetation of species that are not high value forage for early seral ungulates (i.e., non-palatable) • Control access • Reduce line-of-sight	• Access control will be implemented through higher density planting of tree species and restoration of disturbed areas with fast-growing species not preferred for browse, per BC OGC permit conditions. • Species to be planted and stocking densities will be determined based on the biophysical characteristics of the site, adjacent forest stand composition and restoration objectives (e.g., low palatability for ungulates). • Seedling planting is considered a long-term restoration treatment.
Restrict activities	• Minimize sensory disturbance to caribou	• During the cleanup and reclamation phase, access along the pipeline ROW within caribou range will be limited. Monitoring and maintenance activities within caribou range will be scheduled outside of the critical and cautionary periods.

6.3 ACCESS CONTROL MANAGEMENT

Access control discussed in this section is specific to mitigating the effects of human and predator access on caribou predation risk and sensory disturbance. In addition, Coastal GasLink has prepared an Access Control Management Plan for the entire Project to address potential adverse effects of human access on wildlife in general.

Candidate access control sites, and the criteria and mitigation objectives for selecting them, are provided in Section 6.4. Site selection was completed throughout each caribou herd range where the project overlaps, and candidate access control sites include primarily those locations where the Project intersects existing access features (i.e., roads, trails, utility corridors and pipelines regularly used by recreational users), sections of the ROW that are not paralleled by existing linear features (i.e., new access routes), and watercourses and areas along the ROW where line-of-sight is greater than 500 m. In addition, as information becomes available, additional candidate sites will be added based on future industrial and recreational developments that may interact with the Project during the construction preparation and construction phases. The following sections summarize access control measures to be considered for implementation at candidate access control sites.

6.3.1 Deactivation of New Access Created for the Project

Temporary roads, shooflies and trails created during pipeline construction, with the exception of access roads required for pipeline maintenance and emergency response, will be deactivated in compliance with applicable regulatory requirements. Where appropriate and practical, access deterring mitigation, such as rollback, physical barriers or line-of-sight barriers, will be used at the ends of temporary roads, shooflies and trails where they join the pipeline ROW. This will help improve access control management effectiveness and minimize new access created as part of the Project.

Rollback

Rollback (i.e., logs, large rock and stumps arranged in non-random fashion) will be used to control year-round access and provide microsites for revegetation along the ROW. Consideration of fire risk and pest spread, and the type of off-road vehicles that could use the ROW (i.e., ATVs, snowmobiles) is important when using rollback as an access control measure. Rollback is most likely to be implemented at sites where the ROW intersects other linear features (i.e., access points), and where materials are not expected to increase fire risk or pest spread, and human access is a concern. If rollback materials are not available at a site, they will be brought to the site from another acceptable location and stored in existing temporary workspace until ready for placement. When ready for placement, Coastal GasLink will strive to implement sections of rollback that are approximately 400 m in length, but not less than about 100 m in length.

Coastal GasLink will consult with BC OGC and BC MFLNRORD regarding the proposed use of timber for access management in caribou range, with the following provisions:

- provide BC OGC and BC MFLNRORD with the locations of access control sites
- work with BC MFLNRORD to determine appropriate coarse woody debris loading densities
- identify if any mitigation will be required for fire hazard abatement
- identify if any mitigation will be required for forest health issues (i.e., pest spread)

Physical Barriers

Barriers will be used, as required, for some access control sites. Berms may be created from soil or woody debris (i.e., slash) to create physical access and line-of-sight barriers. Berm type, width and height will be determined based on available material and local site conditions. Berms will be a minimum of 1.5 m high, steep and rugged, and slightly wider than the ROW. Extending the barrier from the ROW into adjacent forest may decrease the opportunity for humans and predators to bypass the barrier. However, permission from the relevant regulatory authority may be needed to extend the width of berms outside the ROW.

Excavator mounding treatments to facilitate native vegetation regeneration along the ROW may act as short- to intermediate-term barriers to human and predator movement. Other barriers, such as gates, may also be considered.

Coastal GasLink will not plow roads, unless necessary to construct and maintain the Project, so as to discourage wolf movement and snowmobile access (i.e., to deter trucks with snowmobiles from travelling further along roads) within caribou range. If plowing is necessary, Coastal GasLink will use temporary access control measures (e.g., gate, snow berm or signage) to deter human and predator access along the plowed route.

Line-of-Sight Barriers

Line-of-sight barriers will be implemented at access points and at select locations along the ROW to discourage human use and reduce predator encounter rates with caribou. Barriers will be implemented along sections of the ROW where visibility along the ROW is greater than 500 m at 1.5 m height, and where the ROW does not parallel an existing ROW or road. Barriers will be designed appropriate to local conditions. For example, if boulders, stumps and soils are available to create barriers, then those may be used; otherwise fences may be constructed. In addition to natural regeneration, vegetation screens may be planted across the ROW.

6.3.2 Planting

The planting of tree and shrub species may be implemented for access control and to reduce line-of-sight. This includes the planting of tree species at relatively high densities to restore conifer forests and the restoration of disturbed areas with species that are less palatable as browse. Species planted, and stocking densities, will be determined based on the biophysical characteristics of the site, adjacent forest stand composition, and restoration objectives. Seedling planting is considered a long-term treatment because effectiveness can take 10 or more years to achieve.

6.4 SELECTION OF ACCESS CONTROL SITES AND MITIGATION

The CMMP and other management plans (i.e., Access Control Management Plan, Grizzly Bear Mitigation and Monitoring Plan, Wildlife and Wildlife Habitat Management Plan) describe methods for selecting access control sites and appropriate mitigation consistent with the objectives of those plans. All of the plans are designed to be complementary, but trade-offs at any given location will be necessary if access control objectives differ across plans. For access control management in caribou range, the CMMP takes precedence over objectives described in other plans in recognition of conservation priorities for caribou.

The criteria for selecting sites for access control in caribou range, and for determining the most appropriate mitigation to implement at those sites, include:

- temporary or permanent access control
- habitat type (i.e., dense forested areas are most appropriate for implementing access control)
- final decision by Coastal GasLink on which new access roads are temporary and which are long-term all-weather roads
- presence and location of new disturbance features not present at the time of the site selection (e.g., cutblocks, linear features)
- presence of trails (e.g., game trails or ATV trails)
- availability of material for access control. Where woody material for access control is not available at a given site, Coastal GasLink will obtain material from an acceptable location as required and store it in existing temporary workspace until needed for placement. When moving woody material, the same tree species as are present at the access control site or otherwise acceptable species will be used, and the volume of material and potential for pest transfer and fire risk will be considered.
- line-of-sight objectives

- revegetation objectives (e.g., enhancing microsites for seedling establishment and germination)
- ground conditions (e.g., soil drainage)
- ecosystem sensitivity to ground disturbance (e.g., equipment use)
- avoid attracting ungulates by planting unpalatable plant species
- avoid impeding wildlife movement along established game trails

The final decision on access control measures to be implemented, and the location where it is implemented, will be made by the construction management team in consultation with a Qualified Professional. This decision will include consideration of any input received from regulators, Indigenous groups that have traditional territories affected by the Project, that overlap caribou ranges, and stakeholders (e.g., trail users) during ongoing engagement before implementing the mitigation.

Access mitigation implemented as part of the overarching Access Control Management Plan, and as part of the Grizzly Bear Mitigation and Monitoring Plan and Moose Monitoring Program (refer to Section 8.4 of the Wildlife and Wildlife Habitat Management Plan), is expected to contribute toward satisfying objectives of the CMMP where objectives align across plans.

A candidate list of sites where access control measures will be implemented within caribou range is provided in Table 6-4. Access control measures are intended primarily to reduce human and predator access in caribou range. Access control measures are also intended to improve the likelihood of vegetation recovery as they reduce vegetation trampling and soil disturbance caused by motorized vehicles. The selection of access control sites was completed considering available information on local habitat conditions and using the decision framework (refer to Figure 6-1).

Candidate sites were ranked (high, medium and low) based on known local habitat conditions. Locations in mid- to high-elevation variants in the ESSF zone were ranked high because they provide spatial separation between predators and alpine areas used by caribou. Some sites in caribou range were considered ranked high because they were also good candidate sites for mitigating effects of access on grizzly bear and moose. Sites ranked as medium included low- to mid-elevation variants in the ESSF and SBS zone because these are typically more productive forest types favoured by caribou predators. Sites ranked as low included areas with high levels of existing human disturbance (e.g., within cutblocks or areas with a high-density of linear features) and low elevation variants in the SBS zone (e.g., riparian corridors).

Despite classifying access control sites into categories of high, medium, and low, Coastal GasLink will implement access control at candidate sites, barring any unforeseen circumstances that would prohibit this. If access control cannot be implemented at a candidate site, Coastal GasLink will clearly document the reasons why and present the rationale to BC MFLNRORD and BC OGC for discussion. Coastal GasLink will also implement access control at new locations opportunistically based on local conditions at the time of construction, available input from Indigenous groups (e.g., participants in the Construction Monitoring and Community Liaison Program), and on the advice of a Qualified Professional.

The ROW intersects the Quintette herd range (KP 64.5 – KP 65.5) on the west side of the Sukunka River where there have been no telemetry points recorded for caribou. However, an access control site is proposed at the ROW where it intersects an existing road to limit access to the herd range on the west side of the Sukunka River (Table 6-4).

Table 6-4: Candidate Sites and Selection Criteria for Access Control Measures

Nearest Kilometre Post	Caribou Range	Objective	Rank	Other Value
66	Quintette	Physical barrier	High	grizzly bear
127	Hart Ranges	physical barrier	High	grizzly bear
128	Hart Ranges	Physical barrier	High	grizzly bear
130	Hart Ranges	line-of-sight barrier	Medium	
130	Hart Ranges	line-of-sight barrier	Medium	
131	Hart Ranges	line-of-sight barrier	High	
131	Hart Ranges	line-of-sight barrier	Medium	
132	Hart Ranges	line-of-sight barrier	High	
134	Hart Ranges	line-of-sight barrier	High	
135	Hart Ranges	line-of-sight barrier	High	
135	Hart Ranges	line-of-sight barrier	High	
136	Hart Ranges	physical barrier	High	
137	Hart Ranges	physical barrier		grizzly bear
142_R0	Hart Ranges	physical barrier		grizzly bear
143	Hart Ranges	line-of-sight barrier	High	
143	Hart Ranges	line-of-sight barrier	High	
144	Hart Ranges	line-of-sight barrier	High	
144	Hart Ranges	line-of-sight barrier	High	
145	Hart Ranges	line-of-sight barrier	High	
146	Hart Ranges	line-of-sight barrier	Medium	
147	Hart Ranges	line-of-sight barrier	Medium	
148	Hart Ranges	line-of-sight barrier	Medium	

Table 6-4: Candidate Sites and Selection Criteria for Access Control Measures (cont'd)

Nearest Kilometre Post	Caribou Range	Objective	Rank	Other Value
149	Hart Ranges	line-of-sight barrier	Medium	
150	Hart Ranges	line-of-sight barrier	Low	
152	Hart Ranges	line-of-sight barrier	Low	
152	Hart Ranges	line-of-sight barrier	Low	
153	Hart Ranges	line-of-sight barrier	Low	
154	Hart Ranges	line-of-sight barrier	Low	
154	Hart Ranges	line-of-sight barrier	Low	
155	Hart Ranges	physical barrier		grizzly bear
156	Hart Ranges	line-of-sight barrier		
157	Hart Ranges	line-of-sight barrier		
158	Hart Ranges	physical barrier	High	grizzly bear
158	Hart Ranges	physical barrier	High	grizzly bear
159	Hart Ranges	physical barrier	High	grizzly bear
160	Hart Ranges	physical barrier	High	grizzly bear
161	Hart Ranges	physical barrier	High	grizzly bear
163	Hart Ranges	physical barrier		grizzly bear
172	Hart Ranges	physical barrier	High	grizzly bear
174	Hart Ranges	physical barrier	High	grizzly bear
177	Hart Ranges	physical barrier	High	grizzly bear
180	Hart Ranges	physical barrier	Medium	grizzly bear
182	Hart Ranges	physical barrier		grizzly bear
184_R0	Hart Ranges	line-of-sight barrier	High	grizzly bear
185	Hart Ranges	line-of-sight barrier	High	grizzly bear
185	Hart Ranges	line-of-sight barrier	High	grizzly bear
186	Hart Ranges	physical barrier		grizzly bear
187	Hart Ranges	physical barrier		grizzly bear
188	Hart Ranges	physical barrier		grizzly bear
188	Hart Ranges	physical barrier	Medium	grizzly bear
532	Telkwa	line-of-sight barrier; physical barrier	Low	
532	Telkwa	physical barrier	Low	
533	Telkwa	line-of-sight barrier; physical barrier	Low	
534	Telkwa	line-of-sight barrier; physical barrier	Low	
539	Telkwa	physical barrier	Low	
541	Telkwa	line-of-sight barrier; physical barrier	Low	
542	Telkwa	line-of-sight barrier; physical barrier	Medium	grizzly bear
543	Telkwa	physical barrier	Low	

Table 6-4: Candidate Sites and Selection Criteria for Access Control Measures (cont'd)

Nearest Kilometre Post	Caribou Range	Objective	Rank	Other Value
543	Telkwa	line-of-sight barrier	Low	
544	Telkwa	physical barrier	Low	
544	Telkwa	physical barrier	Medium	grizzly bear
545	Telkwa	line-of-sight barrier; physical barrier	Medium	grizzly bear
545	Telkwa	line-of-sight barrier	Medium	
546	Telkwa	line-of-sight barrier	Medium	
547	Telkwa	physical barrier	Medium	grizzly bear
547	Telkwa	physical barrier	Medium	grizzly bear
548	Telkwa	line-of-sight barrier	Low	
549	Telkwa	line-of-sight barrier	Low	
550	Telkwa	line-of-sight barrier	Low	
550	Telkwa	line-of-sight barrier	Low	
552	Telkwa	physical barrier	Medium	grizzly bear
552	Telkwa	physical barrier	Medium	grizzly bear
553	Telkwa	physical barrier		grizzly bear
555	Telkwa	physical barrier		grizzly bear
557	Telkwa	physical barrier	Medium	grizzly bear
558	Telkwa	physical barrier	High	grizzly bear
559	Telkwa	physical barrier	Medium	grizzly bear
560	Telkwa	physical barrier	Medium	grizzly bear
561	Telkwa	physical barrier	Medium	grizzly bear
561	Telkwa	line-of-sight barrier	Low	
562	Telkwa	line-of-sight barrier	Low	
563	Telkwa	line-of-sight barrier	Low	
563	Telkwa	line-of-sight barrier	Low	
564_R0	Telkwa	physical barrier	Low	grizzly bear
565	Telkwa	physical barrier	Medium	grizzly bear
565	Telkwa	physical barrier	Medium	grizzly bear
566	Telkwa	physical barrier	Medium	grizzly bear
569	Telkwa	physical barrier	Medium	grizzly bear
572	Telkwa	physical barrier	Medium	grizzly bear
578	Telkwa	physical barrier		grizzly bear
592_R8	Telkwa	line-of-sight barrier	Medium	

6.5 IMPLEMENTATION OPPORTUNITIES AND CONSTRAINTS

Site-specific factors may create opportunities or constraints for implementing mitigation. Factors that create limitations for implementation include:

- access to the ROW is necessary for pipeline operation and maintenance
  - The Canadian Standards Association (CSA) CSA-Z662-11 requires that the pipeline must be visible for aerial inspections and accessible for emergency and operational purposes during operation. TC Energy Corporation (TC Energy) operation and maintenance practice includes vegetation control over the pipe centreline (approximately 10-m-wide area centred over the pipeline).
- ground disturbance is restricted
  - Heavy machinery is not permitted to undertake ground disturbance within 5 m of the pipeline, subsequently limiting the application of site preparation methods such as excavator mounding over the pipeline.
- future developments by other resource users may occur within or adjacent to the Project
- seasonal constraints (e.g., some mitigation may be limited by ground conditions)
- traditional access not suitable for access control (e.g., trails traditionally used by Indigenous groups for hunting and trapping), including where the Project parallels existing access
- encroachment by non-native or non-target vegetation species from existing development areas onto the Project footprint may hamper vegetation regeneration
- it may be difficult to control human and predator access in areas where the Project parallels existing linear features, such as roads and power lines

Factors that create opportunities for implementation include:

- watercourse crossings, where extending riparian construction methods beyond the riparian area is practical
- areas where material is available to create rollback or berms
- terrain and construction requirements that allow for retaining some trees along the edge of the construction ROW, which may be bent or felled over the ROW following construction

A thorough review of site characteristics and construction methods will facilitate determination of the suitability of particular sites for access control. Experience from implementing caribou mitigation on other TC Energy pipeline projects will be considered in the decision process.

6.6 OFFSETTING MEASURES

Coastal GasLink will implement post-construction monitoring described in Section 6.7. Post-construction monitoring will assess the effectiveness of mitigation implemented during construction and final cleanup by herd range, with consideration of the different habitat designations that are intersected by the Project (e.g., UWR, WHA, and critical habitat). If effectiveness monitoring results indicate that remedial or additional mitigation is needed, the process for implementing these changes will be made by working through an adaptive management framework (refer to Section 6.7.4).

Condition 10 of Schedule B to the EAC states that the CMMP must include a description of the strategy for mitigation to offset residual adverse effects if the effectiveness monitoring program and adaptive management efforts indicate that primary mitigation is not expected to achieve the objectives (i.e., avoid displacement and sensory disturbance; no net loss of caribou habitat; and, avoid increased predation) within five years. Coastal GasLink acknowledges that caribou habitat will be affected by the Project, and that some habitat will not fully function as caribou habitat (i.e., functions as critical habitat, as defined in the recovery strategy; refer to Section 4.1) within the first five years following construction.

To determine an offset, Coastal GasLink will develop a detailed strategy as part of a project-specific Caribou Mitigation and Offset Plan (CMOP). The CMOP will be developed by a Qualified Professional, in two phases (preliminary and final), with input from BC MFLNRORD, ECCC and BC OGC. The offset strategy will be based on several factors, which are described generally below for each phase of the CMOP. These factors are important elements for determining an offset, and inherently link the results of mitigation effectiveness monitoring to offset mitigation.

The preliminary CMOP will describe as-built direct residual effects on caribou habitat (i.e., direct change to caribou habitat as a result of the actual project footprint, including permanent above-ground facilities, new roads, the pipeline right-of-way, and temporary workspace), which will be determined after construction is completed. The strategy for calculating an offset will then be based on hectares of habitat directly affected and will take into account several criteria including, but not limited to:

- Procedures for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures) (BC MECCS 2014)
- types of habitats affected and the function of those habitats (e.g., height, age, species composition)
- primary mitigation implemented for the Project (i.e., avoid, minimize, restore)
- current disturbances, including type and age, that overlap the Project
- current management actions within caribou range

- government-led caribou management initiatives

The final CMOP will take into account the actual effectiveness of primary mitigation (i.e., avoid, minimize, restore) that has been implemented, after five years of monitoring. Similar to the preliminary CMOP, the determination of offsets in the final CMOP will include criteria or thresholds related to habitat types and function, extent and age of existing disturbances, and management actions and initiatives. In addition, the final CMOP will also include, but not be limited to:

- review and interpret the results of the five-year comprehensive effectiveness monitoring report
- quantify direct residual effects on habitat, including the types of habitats affected and the function of those habitats
- review and describe other current industry activities and management actions within caribou range that overlap or interact with Project effects
- review government and Indigenous caribou management initiatives
- review opportunities for implementing additional mitigation (e.g., more access control locations, supplemental tree planting)
- review opportunities for off-site habitat restoration (e.g., linear feature management)
- review financial mechanisms to support population-level management objectives
- determine the areal extent of residual effects as they relate to no net loss of caribou habitat
- develop and implement a monitoring plan to evaluate the effectiveness of any offset mitigation that is implemented, if necessary

The reporting schedule for the CMOP is discussed in Section 6.8.

6.7 POST-CONSTRUCTION MONITORING

Two types of monitoring will be conducted to test whether the Project is influencing caribou:

- mitigation effectiveness monitoring
- direct caribou and predator monitoring

Mitigation effectiveness monitoring will be implemented by Coastal GasLink to satisfy Condition 10 of Schedule B to the EAC, as described in Section 6.7.1. Monitoring includes measuring whether vegetation is naturally recovering on the Project footprint, and whether access control measures are reducing the frequency of

use of the Project footprint by humans and predators. For example, it will test whether humans and predators use the Project ROW as a travel corridor and whether mitigation reduces human and predator use of the Project ROW. The spatial extent of the monitoring program is primarily the Project footprint that overlaps caribou herd ranges. Areas adjacent to the Project footprint will be used in the effectiveness monitoring program (e.g., access control) for the purpose of informing how well mitigation on the footprint is performing.

To satisfy Condition 11 of Schedule B to the EAC, Coastal GasLink will enter into an agreement with BC MFLNRORD to contribute to BC MFLNRORD's Caribou Program. Additional details are provided in Section 6.7.2.

Section 6.7.3 includes an adaptive management framework that, after an evaluation of mitigation effectiveness, allows for adjustments to monitoring and implementation of remedial mitigation, as required. Combined, the mitigation effectiveness programs and the adaptive management framework allow for a meaningful assessment of whether the objectives in Condition 10 of Schedule B to the EAC (Section 1.1) are being achieved.

Section 6.8 describes a reporting framework for communicating on the implementation of the CMMP, results of mitigation effectiveness monitoring and actions undertaken as a result of adaptive management. Reporting will occur annually during the construction and five-year post-construction periods.

6.7.1 Mitigation Effectiveness Monitoring

In accordance with Condition 10 of Schedule B to the EAC, Coastal GasLink has designed, and will implement, a mitigation effectiveness monitoring program for caribou. The mitigation effectiveness monitoring program includes four basic elements: compliance monitoring during construction and operation, site-specific remote camera monitoring during operation, aerial monitoring during operation and vegetation recovery monitoring during operations. Mitigation effectiveness monitoring will commence as mitigation is implemented (i.e., compliance monitoring), and continue following construction and after final cleanup for at least five years (i.e., remote camera, aerial, and vegetation recovery monitoring).

The following sections provide details on each of the four monitoring elements, but the information is organized correspondingly to the three primary objectives of the CMMP (i.e., avoid sensory disturbance, no net loss of habitat and avoid increased mortality risk). Coastal GasLink will continue to engage with relevant regulatory agencies and Indigenous groups that have traditional territories affected by the Project that overlap caribou ranges during implementation of the CMMP and associated effectiveness monitoring.

Sensory Disturbance

Coastal GasLink's effectiveness monitoring program is not designed specifically to test the effectiveness of mitigation on potential displacement or sensory disturbance of caribou. However, adherence to timing restrictions and setbacks is considered the current best practice to avoiding sensory disturbance effects. Therefore, effectiveness of mitigation for avoiding sensory disturbance to caribou will be assessed through compliance monitoring with regard to adhering to setbacks and timing restrictions. If setbacks and timing restrictions are adhered to fully, then mitigation will be considered effective. If setbacks and timing restrictions cannot be adhered to fully, Coastal GasLink will consult with a Qualified Professional to develop alternative mitigation for discussion with the relevant regulatory agency. Coastal GasLink will then implement those measures and include in its reporting (refer to Section 6.9) the assessed effectiveness of the mitigation.

In addition to Coastal GasLink's compliance monitoring of mitigation effectiveness for sensory disturbance, any results from the Caribou Program (to be administered by BC MFLNRORD) that pertain to sensory disturbance on caribou arising from the Project will be reviewed by Coastal GasLink and integrated into the implementation of the CMMP. Additionally, Coastal GasLink will review available telemetry data, pending finalization of an appropriate data sharing agreement with BC MFLNRORD, to evaluate the potential risk of sensory disturbance to caribou and the need to implement site-specific mitigation. Coastal GasLink expects that in developing a data sharing agreement, a discussion with BC MFLNRORD will include the approach to evaluation and interpretation of the telemetry data with respect to managing the risk of sensory disturbance and risk to the Project schedule.

Vegetation Monitoring

Coastal GasLink will monitor vegetation recovery based on ground and aerial surveys at years one, three and five after restoration has been implemented on the ROW following construction and final cleanup. A report will be produced at years one, three and five that provides a description and evaluation of monitoring results. It will also include details of additional restoration measures that will be implemented, if necessary, based on restoration successes on other sections of the ROW, or from other projects or restoration research. Any corrective or new actions implemented, or proposed for implementation, as a result of adaptive management will also be included in the reports.

Ground-Based Monitoring

Ground-based vegetation recovery monitoring will be implemented as part of the Reclamation Program and is, therefore, not discussed in detail here. Generally, principles of random stratified sampling will apply to vegetation monitoring.

Vegetation monitoring plots will be randomly selected by caribou range and habitat type. Measurements at vegetation plots may include species composition, density, seedling survival, distribution, and growth trajectories.

Aerial Monitoring

Aerial vegetation recovery monitoring will be implemented using high-resolution light detection and ranging (LiDAR) data in combination with georeferenced 360-degree aerial photography. Aerial monitoring provides an efficient method for the spatial and temporal assessment of vegetation recovery, and also provides a benefit to monitoring human access. Because of the large amounts of detailed biophysical data that can be collected in a short period, these technologies are becoming an increasingly popular tool for forestry and environmental assessment programs (Erdody and Moskal 2009). The benefits of aerial vegetation monitoring include:

- increasing the spatial extent of vegetation recovery monitoring along the Project ROW
- identifying localized biophysical features that may affect vegetation recovery (i.e., slope, aspect, ground roughness)
- identifying specific areas along the Project ROW that may require adjustment as part of an adaptive management process
- providing a short-duration monitoring process with reduced disturbance to vegetation or wildlife

Aerial monitoring using LiDAR will be conducted at an elevation of approximately 100 m to effectively cover the width of the Project ROW. Georeferenced 360-degree aerial photography will be used to validate LiDAR data and assess vegetation recovery.

Monitoring Targets and Schedule

The measurable targets for vegetation restoration incorporate ranges to account for variation in site conditions. The measurable targets are intended to demonstrate restoration success in terms of survival and sustained growth trends of conifer and deciduous trees five years post-construction. Targets that are not met will trigger implementation of the adaptive management framework (refer to Section 8.3). The following targets are broadly defined for the Project and will be met within the footprint available for restoration (i.e., excluding areas where vegetation will be periodically controlled for operations activities). More detailed targets will be developed in the detailed reclamation plans for specific vegetation community site series that occur within the Project footprint. Broad targets include:

- In upland and transitional forest (conifer/deciduous)

- minimum live seedling density of 1,200 to 2,000 stems/ha on sites that are not mounded
- minimum live seedling density of 800 to 1,400 stems/ha (combined planted seedlings or natural regeneration) on mounded sites (dependent on mound density)
- even distribution of live seedlings (planted seedlings and natural regeneration) ≥ 70% of the available footprint
- ≥ 70% of the tree seedlings (planted and natural regeneration) demonstrate sustained growth trends between monitoring periods (i.e., increasing values for height and percent cover)

- In treed wetlands
  - natural vegetation is regenerating, including at least two characteristic species (vascular or non-vascular; e.g., Carex sp. and Sphagnum sp.)
  - the absence of restricted weeds or invasive species (e.g., cattails or reed grass)
  - ≥ 70% cover of native vegetation species within the footprint
  - where tree seedlings are planted (e.g., mounded sites):
    - live seedling density of 400 to 1,000 stems/ha (planted and natural regeneration), dependent on mound density
    - live seedlings (planted and natural regeneration) evenly distributed ≥ 70% of the available footprint
    - ≥ 70% of the tree seedlings (planted or natural regeneration) demonstrate sustained growth trends between monitoring periods (i.e., increasing values for height and percent cover)
- In shrub/graminoid wetlands
  - natural vegetation is regenerating, including at least two characteristic species
  - the absence of restricted weeds or invasive species
  - ≥ 70% cover of native vegetation species evenly distributed within the footprint

Targets will be evaluated based on the measured density of live seedlings (planted and naturally regenerating), the height and percent cover of live seedlings, seedling vigour and vegetation community composition.

Vegetation recovery will be monitored at years 1, 3 and 5 as part of the Reclamation Program.

Monitoring of Access Control Measures

Mitigating caribou mortality as a result of predation and human use of newly developed linear features (i.e., access control) is a key objective of the CMMP. Deterring human use of the Project footprint will also mitigate the risk of sensory disturbance to caribou.

Predators and Primary Prey

The primary mechanism for how the Project may influence caribou predation risk is not necessarily direct (i.e., by influencing caribou movement), but indirect, by facilitating caribou predator (and the primary prey of those predators) movement into, and within, caribou range (refer to Section 5.1.2). Therefore, Coastal GasLink will monitor whether specific access control measures (i.e., barriers) influences predator (and their prey) use of the Project ROW, with the assumption that this may ultimately influence the effect of the Project on caribou mortality risk.

Coastal GasLink will directly monitor predator and prey use of the Project ROW where mitigation is applied. The three treatments are illustrated in Figure 6-2. Coastal GasLink will directly monitor predator and prey use of the Project ROW where access control measures are implemented (Treatment A, Figure 6-2; i.e., barrier on ROW), and compare that to predator and prey use of the ROW (or other nearby ROWs) where no access control measures have occurred (Treatment B, Figure 6-2; i.e., open ROW) and to predator and prey use of wildlife trails where no development has occurred (Treatment C, Figure 6-2; i.e., a wildlife trail through a natural opening in the forest).

Coastal GasLink expects that the amount of wildlife use of each treatment will be different, and predicts that Treatment C will have the lowest level of use and Treatment B will have the highest level of use (Figure 6-3: Predicted Relative Predator [Treatments A, B and C]).

The objective will be to test whether access control reduces predator and prey use of the ROW to levels less than that found on unmitigated ROWs (Figure 6-3: Predicted Relative Predator [Treatments A, B and C]). The prediction is that a reduction in predator and prey use of controlled ROWs compared to open ROWs will indicate that mitigation is having some effectiveness at mitigating human and predator use.

Human use of forest openings is expected to be close to zero, as humans rarely go off roads and trails. However, data on human use of wildlife trails will be collected as part of predator monitoring to confirm this assumption. On the other hand, if predator use of the controlled ROWs is similar to predator use of forest openings (i.e., no statistically significant difference), it suggests the mitigation is completely effective.

Two types of predator movement mitigation are proposed for the Project:

- physical barriers, such as coarse woody debris
- line-of-sight barriers, such as vegetation screens

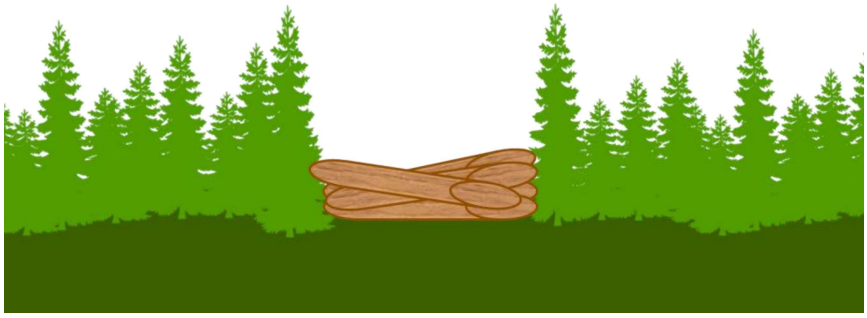
Recent research in boreal caribou range in northeastern BC suggests that physical barriers (i.e., coarse woody debris) have a greater influence on wolf use of linear features than line-of-sight barriers, but both are important (DeMars and Boutin 2014). Preliminary access control locations will be identified.

The specific types of access controls, and locations of implementation, will be determined by the construction management team in consultation with a Qualified Professional, and will take into consideration local conditions. The locations and types of treatments will be documented and their relative effectiveness will be compared as part of the monitoring design.

Human Access Monitoring

An important objective of mitigating the effects of the Project on caribou is to minimize human use of newly developed linear features (i.e., access control). Deterring human use of the Project ROW and access roads will mitigate the risk of disturbance to caribou and other ungulate species (Stankowich 2008). Coastal GasLink will directly monitor human use of the ROW where access control measures occur (Treatment A, Figure 6-2) and compare that to human use of the ROW (or other nearby ROWs) where no mitigation occurred (Treatment B, Figure 6-2). The objective will be to test whether access control reduces human use of the ROW to levels less than that found on unmitigated ROWs (Figure 6-2). A reduction in human use of access-controlled ROWs compared to open ROWs suggests the access control measure is having some effect at mitigating human use. Human use of forest openings (Treatment C) is expected to be close to zero, as humans rarely go off roads and trails. However, data on human use of wildlife trails will be collected as part of predator monitoring to confirm this assumption.

A. Barrier on ROW



B. Open ROW

C. Natural Opening

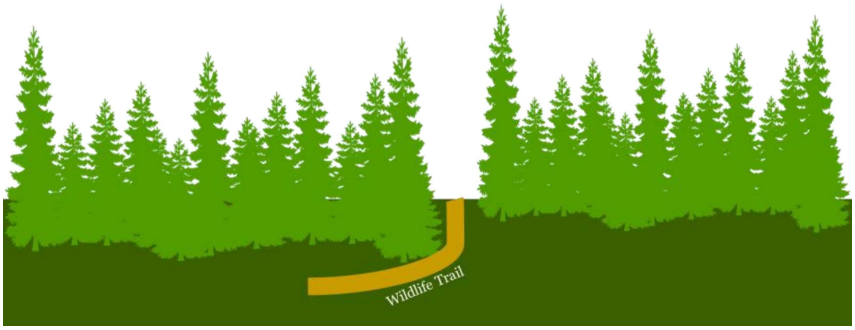


Figure 6-2: Monitoring Treatment Types where Predator (Treatments A, B and C) and Human (Treatments A and B) Use will be Measured

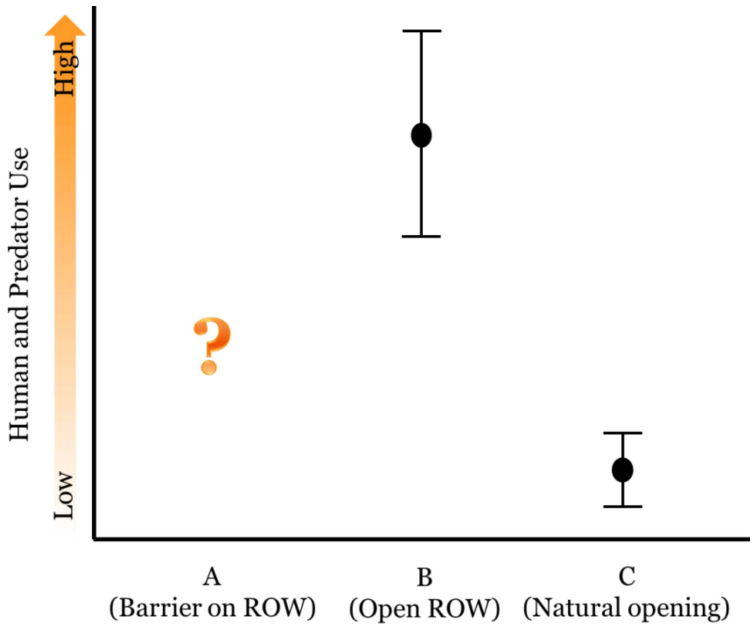


Figure 6-3: Predicted Relative Predator (Treatments A, B and C) and Human (Treatments A and B) Use of Monitoring Treatment Types

Monitoring Access Control Measures Using Aerial Surveys

Aerial surveys will be used in part to assess access control and line-of-sight effectiveness. The surveys will occur three times each year, for the first five years of post-construction monitoring. The surveys will include two flights during winter (during snow-covered conditions) and one flight during fall (snow-free, and ideally leaf-free period). These survey times will provide an indication of seasonal differences in use that will be complementary to the remote camera monitoring program (see Monitoring Access Control Measures Using Remote Cameras below). For example, data may indicate if mitigation is bypassed in snow but not snow-free periods. The identification of predator, prey and human tracks during winter is easier than in snow-free periods. However, surveys in late fall would likely show any vehicle tracks laid down over the course of the summer. In addition, if the fall survey coincides with the fall hunting season, there may be a greater likelihood of observing hunters on the ROW.

Surveys will consist of flying over top of each access control and line-of-sight mitigation to assess its effectiveness at deterring predator, prey and human use along the ROW, and flying up to a 1-km section of the ROW on each side of the mitigation (less if mitigation is less than 1 km apart). For example, surveyors will look for evidence of whether access control and line-of-sight mitigation has been breached or degraded, or if it is being bypassed, and for evidence of use on either side of the mitigation. This will help Coastal GasLink maintain access control and line-of-sight

mitigation, but will also provide additional support for whether mitigation is effective.

Observers will make detailed notes and take pictures of access control and line-of-sight mitigation and for each 1-km section of the ROW on each side of the mitigation. Data collected will include whether there is evidence of a breach or bypass of mitigation by people (yes or no) and evidence of use on either side of the mitigation (yes or no). When practical to make reasonable estimates, the relative amount of breach or bypass (i.e., number of tracks or trails) will be recorded. In addition, incidental data on wildlife use of the area in and around mitigation (i.e., along the ROW) will be recorded, including direct observations and signs (i.e., tracks).

Data from the aerial surveys will be summarized as part of annual effectiveness monitoring and adaptive management considerations. Summaries will include the proportion of mitigation breached or bypassed by predators, prey and humans, by mitigation type (if appropriate to include; e.g., coarse woody debris, soil berm), to provide an overall assessment of which mitigation types are or are not being breached or bypassed. In addition, data on predator, prey and human use of the ROW on either side of the mitigation will provide information on whether the mitigation is deterring use for the length of the ROW, or just for the portion where the mitigation occurs. If there are certain locations or types of mitigation that have high rates of being breached or bypassed, or if use along unmitigated sections of the ROW is higher than at mitigated sections, then Coastal GasLink will implement the adaptive management framework in a timely manner (refer to Section 6.7.4).

Monitoring Access Control Measures Using Remote Cameras

Coastal GasLink will monitor predator, prey and human use of each treatment type using remote cameras, which will be complementary to the aerial monitoring. Remote cameras are an emerging and non-invasive method to monitor wildlife (O'Connell et al. 2010) that consist of a digital camera, external flash and infrared motion sensor. They take a digital photograph of any human or wildlife that passes in front of and triggers the sensor. The digital photograph provides a date and time-stamped image of the animal that triggered it, thus providing a permanent record of human or wildlife occurrence at a site. Remote cameras have been used successfully to monitor predator, prey and human use of roads and trails to test how humans influence predator and prey use of linear features (Muhly et al. 2011), the response of predators and humans to road removal (Switalski and Nelson 2011), and black bear use of seismic lines (Tigner et al. 2014).

Coastal GasLink will deploy remote cameras at a random sample of each treatment type in the Project area. Monitoring of each site for an entire year will measure seasonal variation in linear feature use by predators and humans, which may be important for evaluating mitigation effectiveness. For example, predator and human

use of the Project area may vary across seasons and some mitigation may be more effective in the summer than winter, when barriers may be buried under snow.

It is expected that a linear feature will be used by predators and humans with relatively similar frequency across years (i.e., high use trails will remain high use from one year to the next), but different linear features will be used differently depending on their location (e.g., location in predator home ranges, distance from nearest town). Therefore, cameras will be moved after each year, which will increase the number of linear features and access control sites sampled, and more effectively capture variability in predator and human use of linear features.

Sampling Effort for Remote Cameras

Remote cameras will be deployed for five years, commencing after access control management mitigation is implemented during final cleanup. A total of 60 randomly selected sites each year (20 in each treatment) and 10 fixed sites (five in each of the Hart Ranges (KP 137.2 to KP 189.3) and Telkwa caribou ranges (KP 527.7 to KP 578.0)) will be monitored. Of the 70 cameras, 40 (30 random and 10 fixed) cameras will be allocated to caribou range in the first year to test whether human and predator use of linear features differs in caribou range compared to outside of caribou range (refer to Remote Camera Data Analysis below). The fixed cameras will remain for the duration of the five-year monitoring program, and the proportion of cameras randomly allocated to caribou range may be adjusted in subsequent years (up or down), depending on interpretation of annual results.

Cameras will be deployed at a site for an entire year, which will likely provide an adequate sampling period to determine wildlife species use of a site. Typically, deploying cameras at a location for 60 to 100 days is sufficient to maximize detection of all species at that location (Fisher and Burton 2012; Burton 2014; Steenweg et al. 2015). In addition, it is anticipated that monitoring 20 sites per treatment type per year will provide adequate sample size to detect an effect of the mitigation on wildlife use of a linear feature. For example, Switalski and Nelson (2011) detected a statistically significant 4-fold decrease of black bear and 150-fold decrease in human use of closed (i.e., gated, barriered and recontoured) versus open roads with a sample of 36 cameras (18 on open roads and 18 on closed roads, including six on gated roads, five on barriered roads and seven on recontoured roads) in north-central Idaho. In addition, Steenweg et al. (2015) found that approximately 60 cameras were needed to detect a 10% difference in probability of occupancy between two treatment types with 80% statistical power.

Remote camera data collected as part of Coastal GasLink's EAC Application was analyzed to assess the precision (i.e., coefficient of variation) of estimated average wildlife and human detection rates (i.e., count/100 days) with different remote camera sample sizes. This analysis indicates how precise the average wildlife and human

detection rate estimate is for various remote camera sampling efforts. The remote camera data consisted of detection rates of humans and wildlife species (i.e., wolf, black bear, grizzly bear, moose, deer and elk) and wildlife species groups, including caribou predators (wolverine (*Gulo gulo*), wolf, black bear and grizzly bear) and other ungulates (i.e., prey, including moose, deer and elk). Detection rates for each species and species group at each of the 20 cameras placed along the length of the ROW were calculated over a six-month period (April 1, 2013 to October 1, 2013). Cameras were deployed in a variety of different habitats.

Detection rates of humans, wildlife species and species groups from the 20 cameras were used to calculate the precision of the mean detection rate estimate from different levels of sampling effort, including 10, 20, 30, 40, 50 and 60 cameras. Camera detection rates were randomly drawn from the sample, with replacement (i.e., each camera could be drawn repeatedly), and the mean detection rate estimate was calculated for each level of sampling effort. This assumes that the 20 cameras sampled were representative of variability in human and wildlife use across the Project route. This process was iterated 1,000 times to calculate a stable estimate of the mean (Yoe 2011) and the standard deviation of the means to calculate the coefficient of variation of mean detection rates for each sampling effort.

Results of the precision analysis indicate that the coefficient of variation for the predator species group reached an asymptote at approximately 30 to 40 cameras, with a value of 27% at 30 cameras and 20% at 60 cameras (Figure 6-4). Coefficient of variation for individual predator species was highest for wolves and lowest for black bear and generally reached an asymptote at 40 cameras. The coefficient of variation for prey species also reached an asymptote at approximately 30 to 40 cameras. However, the coefficients of variation were typically lower for prey than predator species. For example, the prey species group had coefficient of variation values of 17% at 30 cameras and 12% at 60 cameras. The coefficients of variation for individual prey species were highest for elk and smallest for moose. Humans had a coefficient of variation that reached an asymptote at approximately 30 cameras, with a value of 30% at 30 cameras and 22% at 60 cameras

Results of the literature review and precision analysis suggest a sample of 60 cameras per year is robust to estimate a precise mean detection rate for wildlife species and will likely be a sufficient sample to detect the effect of access control measures on wildlife use of linear features. One consideration of this analysis is that the remote camera program used to collect baseline data was not set up to address the objectives of the mitigation effectiveness monitoring program. Therefore, there may be greater variability in the baseline data because those cameras were not targeted at specific linear feature treatments as will be done in the mitigation effectiveness monitoring design.

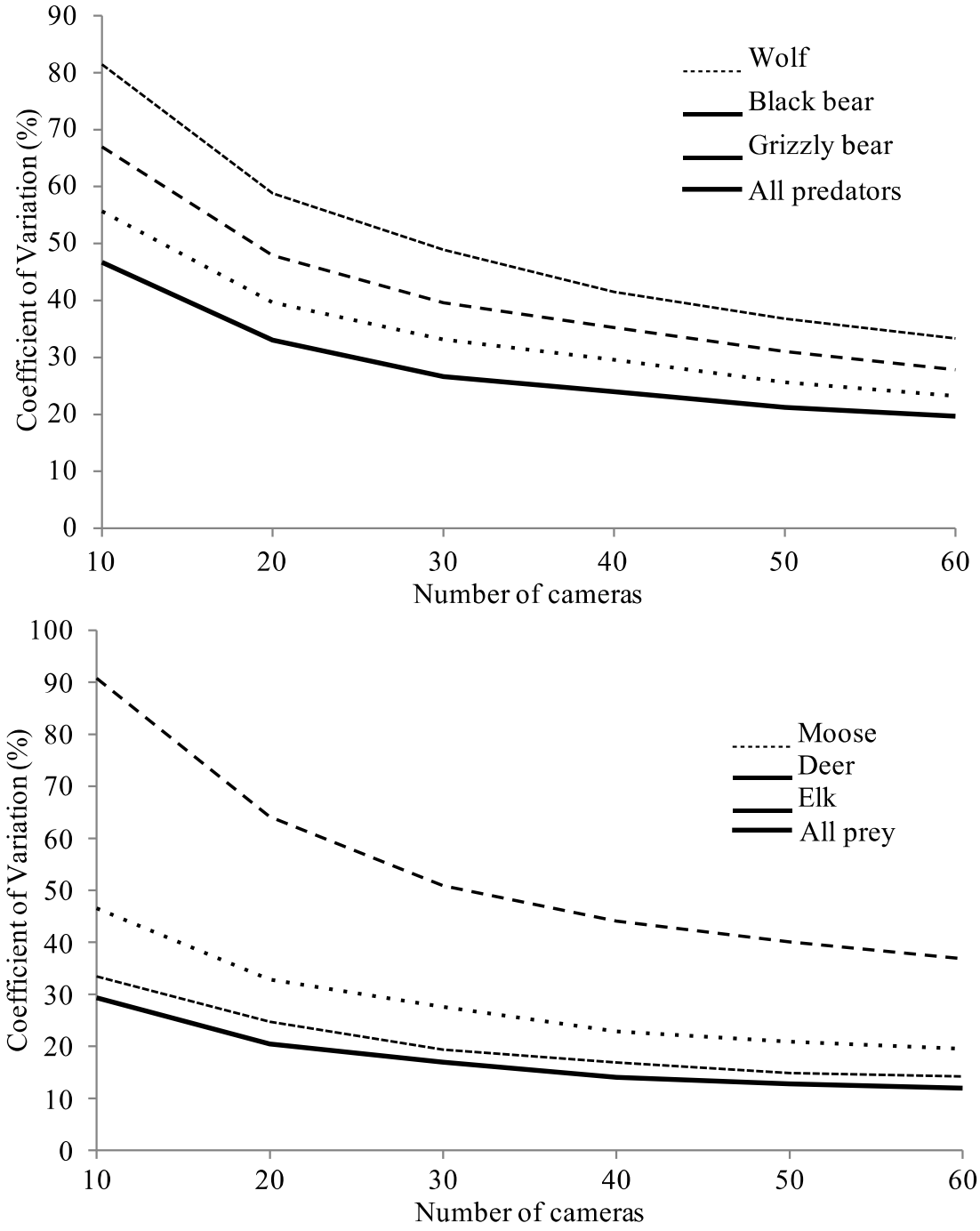


Figure 6-4: Coefficient of Variation in Predator (top), Prey (middle) and Humans (bottom) Mean Detection Rate as a Function of the Number of Remote Cameras in the Sample

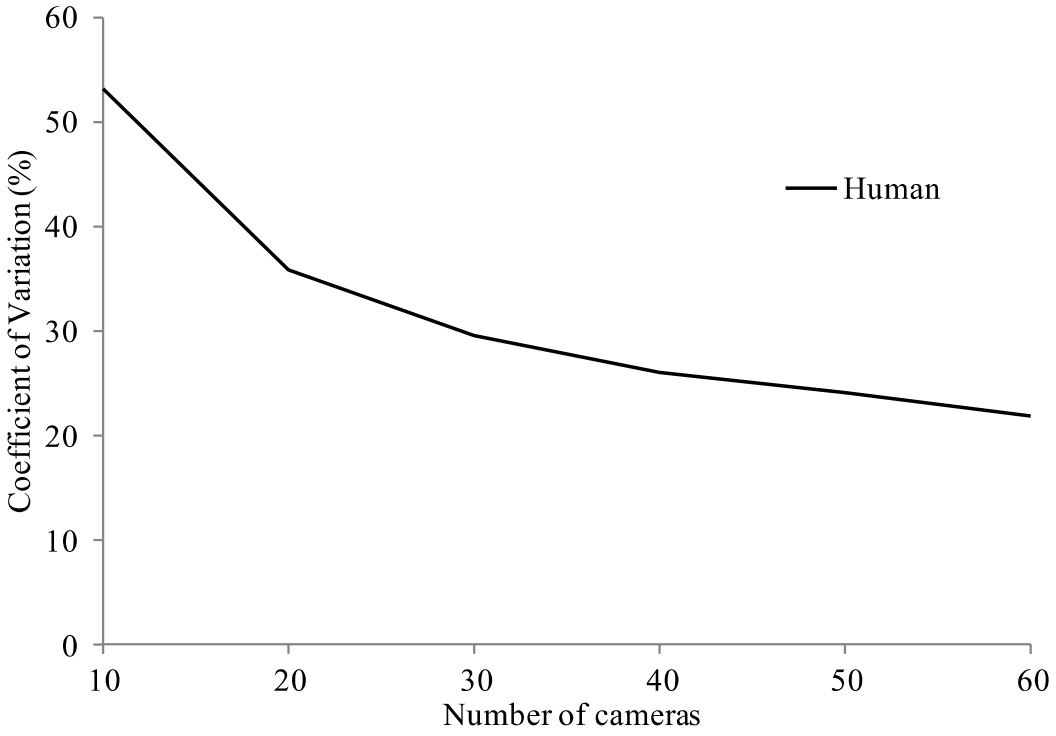


Figure 6-4: Coefficient of Variation in Predator (top), Prey (middle) and Humans (bottom) Mean Detection Rate as a Function of the Number of Remote Cameras in the Sample (cont'd)

Remote Camera Data Analysis

Data from the 60 remote cameras will be analyzed together at the scale of the Project, and from the fixed cameras at the scale of those sites, to test for the effectiveness of mitigation. It is predicted that human and wildlife response to mitigation will generally be consistent across the length of the Project, including inside and outside of caribou range. For example, predators are expected to respond in a similar way to mitigation treatments inside and outside of caribou range. Nevertheless, after the first year of monitoring, a test for the effect of caribou range on human and wildlife use at camera sites will be completed. This will be done by including a covariate for caribou range in the analytical approaches described below to test if the location of the camera (i.e., inside or outside of caribou range) has a significant effect on human and wildlife use. If it is significant, then it suggests that humans and wildlife are uniquely responding to the ROW and mitigation in caribou range. In that case, a review of whether or not additional sampling effort (i.e., additional remote cameras) in caribou range is necessary to assess the effect of mitigation exclusively within caribou range will be determined.

Data analysis will consider the effect of time and mitigation type (if appropriate to include) on human and predator counts, as human and predator use of the pipeline or the effectiveness of mitigation may change over time. For example, humans may take some time to learn to use new access. In addition, mitigation features such as rollback will decay, potentially becoming less effective, while vegetation screens will grow and potentially become more effective. The effects of time and mitigation type (if appropriate to include) will be considered annually in data exploration and analysis to test whether there is a stable, decreasing or increasing trend in human and predator use. These trends will be evaluated in the context of trends in predator and human use of unmitigated linear features and wildlife trails.

Data from remote cameras can be analyzed in a variety of different ways, but to best understand differences in human and wildlife use among the three treatments, standardized data collection methods are important. One way to standardize methods is to set up the remote cameras so that the effects of camera placement on detecting humans and wildlife (i.e., probability of detection) are minimized. For example, the remote cameras will be consistently set up to point at a 45 degree angle across the ROW/trails, at similar heights on trees and with no vegetation blocking the viewing angle. This approach will reduce the number of missed detections (i.e., false absences).

An Analysis of Variance (ANOVA) will be completed to test if there are significant differences in photographic rates (e.g., number of photographs per 100 days) of humans, predators and prey across the treatment types, and to test for the strength and type of effect of the mitigation on photographic rates. In addition, occupancy models will be used to test for differences in human and wildlife occupancy among the treatment types, and specifically between ROWs that have access control measures compared to those that do not. Occupancy modelling is a statistical model of species occupancy of a location that accounts for imperfect detection of the species in the survey protocol (MacKenzie et al. 2002; MacKenzie 2006). It explicitly addresses the concern with most wildlife surveys that some unknown proportion of the population was missed by the survey by calculating probability of detection. Occupancy models consist of two logistic regressions that model probability of occupancy and probability of detection.

Occupancy models provide a great deal of flexibility by allowing for the inclusion of covariates. Covariates are measurable variables that are suspected to influence occupancy or detectability. Probability of detection can be modelled as a function of site measurements, such as camera height, snow depth and vegetation cover, to account for their potential effects on wildlife detection. Probability of occupancy can be modelled as a function of habitat covariates in proximity to each camera (e.g., within a 500 m radius) and may include attributes, such as linear feature density (e.g., roads, ROWs), vegetation cover types, stream density, and distance to nearest

town or major highway, to account for their effects on human or wildlife occupancy of a site. Most importantly, a covariate for mitigation treatment type will be included to test for the strength and type of effect of the mitigation on human and wildlife occupancy.

Monitoring Targets and Schedule

Monitoring includes targets to measure the effectiveness of physical and line-of-sight barriers at controlling access of predators, prey and humans along the Project ROW. For physical barriers, targets are measured relative to their use by predators and prey among the three monitoring treatments, with the goal of having less use on mitigated sections of the ROW compared to unmitigated sections of the ROW, and similar use as on wildlife trails. Similarly, for humans, the target is to have less use on mitigated sections of the ROW compared to unmitigated sections of the ROW. Targets for line-of-sight include intactness (i.e., not destroyed) and achieving an effective height of 1.5 m so that line-of-sight does not exceed 500 m. Monitoring the effectiveness of physical barriers and line-of-sight relative to specified targets will be completed using the remote camera and aerial survey methods. In addition, some monitoring for line-of-sight barriers will also be completed as part of vegetation monitoring surveys.

Coastal GasLink will monitor the effectiveness of access control measures annually through years 1 to 5 (beginning the first complete growing season after mitigation is implemented), and report on the results annually (refer to Section 6.8). The first year of monitoring the effectiveness of access control measures will provide data to complete a preliminary descriptive analysis of patterns of predator and human use of the different treatments (controlled ROW, open ROW and natural opening). Results will primarily be used to assess whether changes to the monitoring design are needed (i.e., determine whether adequate data is being collected to identify patterns in predator and human use of treatments) and, secondarily, if data are sufficient, as a preliminary test of whether predicted patterns of predator and human use of treatments are observed. If data is insufficient to identify patterns in predator and human use of treatments, then adjustments to the monitoring design will be made. If predator and human use patterns are clear, then a preliminary assessment of the effect of treatments on predator and human use will be completed and will include recommendations for adjusting treatments, if necessary.

At the end of Year 5, if mitigation targets are met at each monitoring interval (i.e., they are effective at reducing predator and human use of the Project ROW), no further action will be taken. However, if it is uncertain whether mitigation targets and objectives are being met, then the need for additional or alternative mitigation will be reviewed by Coastal GasLink in consultation with a Qualified Professional, and through ongoing engagement with relevant regulatory agencies, Indigenous groups that have traditional territories affected by the Project that overlap caribou ranges and

stakeholders. Any additional mitigation implemented will be monitored and reported on.

6.7.2 Mitigating External Factors that may Influence Mitigation Success

Coastal GasLink recognizes that its efforts to implement effective access control and vegetation recovery could be at risk of disturbance from other industrial activity in the Project footprint. Coastal GasLink will make efforts to engage with third parties to mitigate potential third-party effects on mitigation efforts, to the extent practical. Where regulatory approval (provincial or federal) is given for other projects or land use activities that destroy mitigation implemented by Coastal GasLink, that area is to be excluded from the final determination of Coastal GasLink's mitigation effectiveness on completion of the monitoring program.

6.7.3 Direct Caribou and Predator Monitoring

To satisfy Condition 11 of Schedule B to the EAC, Coastal GasLink will enter into an agreement with BC MFLNRORD to contribute financially to BC MFLNRORD's Caribou Program.

It is expected that this monitoring program will include looking at how the Project influences caribou movement and habitat use in caribou range. For example, the program could contribute to the deployment of Global Positioning System (GPS) collars on caribou and predators in the Project area to collect high-resolution data on their locations. This data may be used to test whether caribou and predator movement and habitat selection are influenced by the Project (i.e., to test whether the Project ROW is providing a movement corridor for predators, or to test if the Project ROW is causing avoidance by caribou).

Funding for the project might also be used for caribou population management, such as supporting maternal penning of pregnant female caribou to protect caribou calves when they are most vulnerable to predation. Coastal GasLink will communicate with BC MFLNRORD to support effective linkages between Project mitigation and caribou population conservation and management.

6.7.4 Adaptive Management

Data collected through the implementation of the CMMP will be analyzed to determine the effectiveness of mitigation. Specifically, these data will be used to assess if the measurable targets for vegetation re-establishment and access control (human and predator use of the ROW, and line-of-sight) are being met (refer to Section 6.7.1). Coastal GasLink will utilize available and applicable information (e.g., data, trends, results) from the Caribou Program referenced in Condition 11 of Schedule B to the EAC during implementation of the CMMP.

Figure 6-5 illustrates Coastal GasLink's adaptive management framework for effectiveness monitoring. If measures are effective, then under the adaptive management framework no change to mitigation would be required. However, if an analysis of monitoring data indicates that mitigation is ineffective at limiting predator, prey and human use of the ROW, then adjustments to mitigation will be necessary.

Effectiveness of access control measures will be assessed at the Project scale and at the site scale using data from remote cameras and aerial surveys. At the Project scale, if mitigation is not reducing predator, prey and human use of the ROW overall, or for example, if mitigation is consistently bypassed or destroyed, then mitigation will be modified across the entire Project. At the site scale, if a particular mitigation location is determined to have been bypassed or destroyed on inspection, or predator, prey or human use is unusually high at that site, but generally the mitigation is effective across the entire Project route, then only the mitigation at that site will be modified. If there is evidence that a particular site has a high rate of access breach, Coastal GasLink will consider using additional cameras for longer term placement at these sites and to treat them as fixed, rather than random, sites.

The type of adjustment to be implemented will be informed through a review of why the original mitigation was ineffective. This will include consultation with a Qualified Professional and a discussion, as necessary, with BC MFLNRORD and Indigenous groups that have traditional territories affected by the Project that overlap caribou ranges. Coastal GasLink will also include in its review a response to the monitoring and assessment results, as available, from the Caribou Program (Section 6.7.3). The review is expected to result in identifying remedial actions to be implemented, which may include adjusting existing, or developing new, mitigation. The timing of implementing remedial actions will take into consideration sensitive periods for wildlife (e.g., critical and cautionary periods for ungulates, migratory bird primary nesting period), reduced risk instream work windows for fish species, and also of resource users (e.g., guided outfitting).

If breaches in access control measures are observed during any of the three annual aerial surveys, or if Coastal GasLink is alerted to a breach through some other means, Coastal GasLink will conduct a ground-based assessment of the site to determine the nature and cause of the breach to develop a remedial plan to return access control to the site. The remedial plan may include steps to determine type and availability of materials, equipment needs for implementation and a mobilization schedule. Coastal GasLink will implement the remedial plan as soon as practical, pending suitable weather and ground conditions.

Consideration of mitigation to offset residual adverse effects is part of the adaptive management framework, and is specifically related to evaluating several measurable targets and criteria related to mitigation and restoration effectiveness (i.e., primary mitigation), and to achieving the no net loss of caribou habitat objective in accordance with Condition 10 of Schedule B to the EAC.

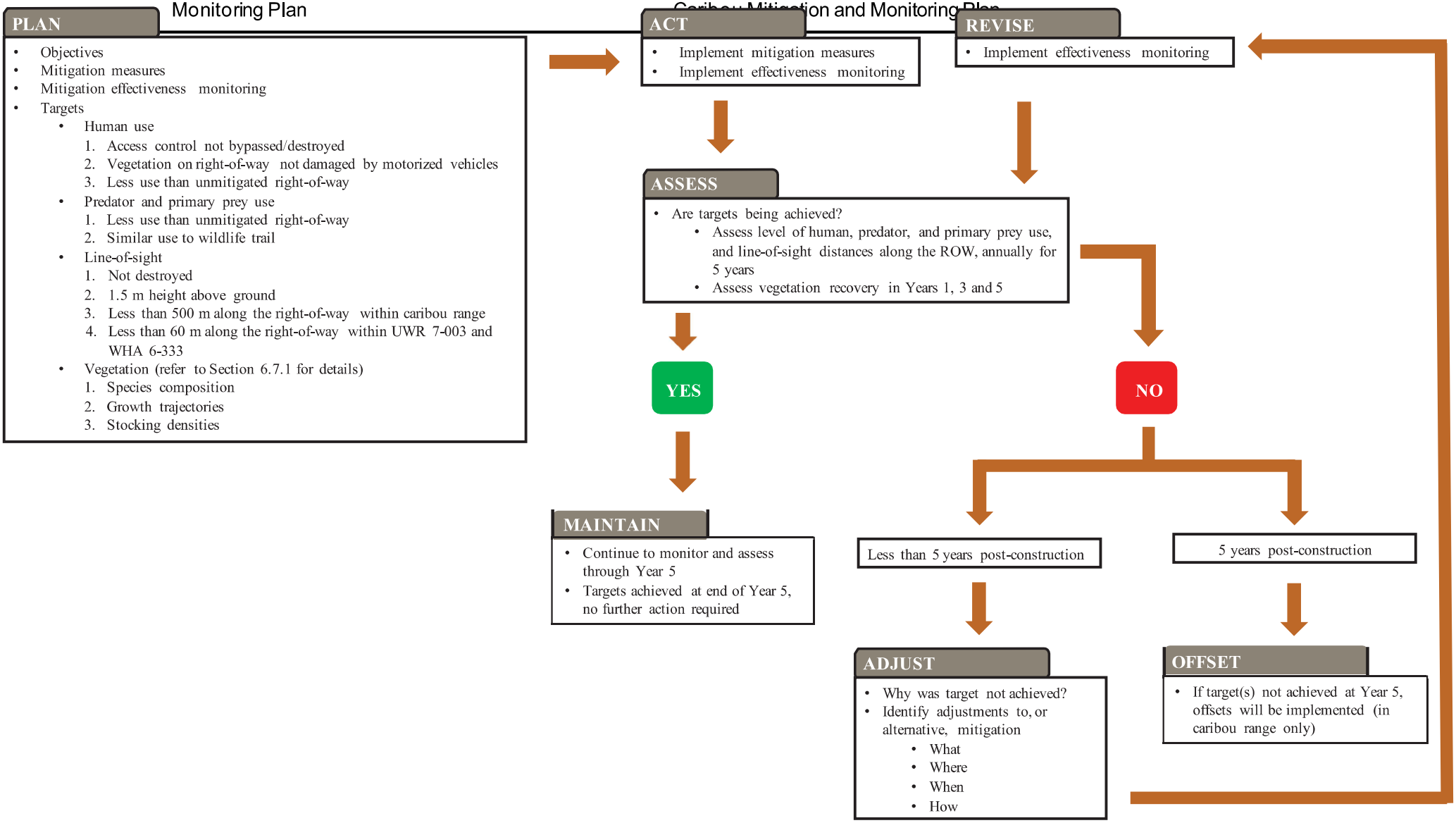


Figure 6-5: Adaptive Management Framework for Effectiveness Monitoring

6.8 REPORTING FRAMEWORK

Coastal GasLink will report annually on the CMMP during the construction phase by providing a summary of mitigation implemented and an evaluation of its effectiveness. Monitoring will be reported by herd range, with consideration of the different habitat designations that are intersected by the Project (e.g., UWR, WHA, and critical habitat).

During the post-construction (operations) phase, Coastal GasLink will report annually for five years the monitoring results obtained from the remote cameras and aerial monitoring; vegetation monitoring will be included in reports for Years 1, 3 and 5. Each report will include, as applicable, a description of any mitigation that did not result in the intended outcome. This will be accompanied either by suggested remedies for improving the effectiveness of that mitigation or proposed new mitigation. The Year 5 report in particular will be a comprehensive effectiveness monitoring report that will include a more thorough test of whether all mitigation implemented was effective at achieving the objectives. Coastal GasLink will submit annual effectiveness monitoring reports to BC EAO, BC MFLNRORD, ECCC, BC OGC and Indigenous groups that have traditional territories affected by the Project, and that overlap caribou range and have been requested through Coastal GasLink's ongoing engagement.

As part of the CMMP strategy, Coastal GasLink will prepare a CMOP to describe the strategy for mitigation to offset residual adverse effects, as per Condition 10 of Schedule B to the EAC. The CMOP will be developed by a Qualified Professional with input from BC MFLNRORD, ECCC, and BC OGC. The preliminary CMOP will be developed following construction, and will be provided as an appendix to the Year 1 effectiveness monitoring report. The final CMOP will be provided as an appendix to the Year 5 comprehensive effectiveness monitoring report.

Coastal GasLink will continue communication with BC MFLNRORD, ECCC, BC OGC and Indigenous groups that have traditional territories affected by the Project that overlap caribou ranges about:

- construction progress within caribou herd ranges
- status of implementing mitigation
- caribou sightings on the ROW
- adaptive management framework for issues identified during construction and for five years post-construction

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