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August 15, 2012

Filed Electronically

National Energy Board
444 Seventh Avenue S.W.
Calgary, Alberta T2P 0X8

Attention: Ms. Sheri Young, Secretary of the Board

Dear Ms. Young:

Re: NOVA Gas Transmission Ltd. (NGTL)
Northwest Mainline Expansion Project (Project)
Order XG-N081-003-2012 and GC-119
NEB File: OF-Fac-Gas-N081-2010-16 02

In accordance with Condition 7(a) of the captioned order, NGTL encloses for filing with the Board a copy of the preliminary Caribou Habitat Restoration Plan for those portions of the Project footprint that lie within the Chinchaga caribou range.

Should the Board require additional information with respect to this filing, please contact the undersigned at (403) 920-5364 or at adrienne_menzies@transcanada.com.

Yours truly,
NOVA Gas Transmission Ltd.

Original signed by

Adrienne Menzies
Senior Project Manager, Regulatory Services

Attachments

PRELIMINARY CARIBOU HABITAT RESTORATION PLAN FOR THE NOVA GAS TRANSMISSION LTD. NORTHWEST MAINLINE EXPANSION

August 2012
7212

TransCanada
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NOVA Gas Transmission Ltd.

A Wholly Owned Subsidiary of TransCanada PipeLines Limited
Calgary, Alberta

ACKNOWLEDGEMENTS

This document was prepared by TERA Environmental Consultants for TransCanada PipeLines Limited with contributions by:

- Golder Associates: prepared the literature review and reviewed the Preliminary CHRP
- Stantec: reviewed the Preliminary CHRP

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1.0 INTRODUCTION

NOVA Gas Transmission Ltd. (NGTL), a wholly owned subsidiary of TransCanada PipeLines Limited, received approval of Certificate GC-119 by Governor in Council on May 17, 2012 for the Northwest Mainline Expansion (the Project). The Project includes the construction of three separate pipeline loops to provide adequate capacity to transport natural gas supply from northeast British Columbia (BC) and northwest Alberta. The individual pipeline loops are referred to as the Horn River Mainline (Kyklo Creek Section), Northwest Mainline (Timberwolf Section) and the Tanghe Creek Lateral Loop No. 2 (Cranberry Section). Segments of the Timberwolf and Cranberry sections are located in the Chinchaga caribou range (Figure 1). The Timberwolf Section is located in the Chinchaga caribou range for approximately 27 km, and 100% is contiguous with an existing linear corridor. The Cranberry Section is located in the Chinchaga caribou range for approximately 5.8 km and 4.0 km (69%) is contiguous with existing linear corridors.

NGTL has prepared this Preliminary Caribou Habitat Restoration Plan (CHRP) in accordance with Certificate Condition 7a (Table 1). The Preliminary CHRP utilizes lessons learned from existing literature on habitat restoration to focus the strategies and actions that can be put in place to promote restoration of disturbed caribou habitat within the boundaries of the Project footprint (*i.e.*, the construction right-of-way and temporary workspace) in the Chinchaga caribou range. Based on the literature review, a suite of measures potentially suitable for implementation were identified, and a conceptual guide was developed to identify sites within the Project footprint where certain restoration measures would be appropriate.

This Preliminary CHRP will be followed by a Final CHRP, which will address Certificate Condition 7b. The Final CHRP will expand on the Preliminary CHRP to provide more specific information on the location of restoration sites and specific restoration measures selected, as well as an assessment of residual effects of the Project on caribou habitat. An Offset Measures Plan (Preliminary and Final as per Certificate Condition 23) and a Caribou Habitat Restoration and Offset Measures Monitoring Plan (as per Certificate Condition 24) will be prepared and filed separately in accordance with the timelines outlined in the Certificate Conditions.

TABLE 1

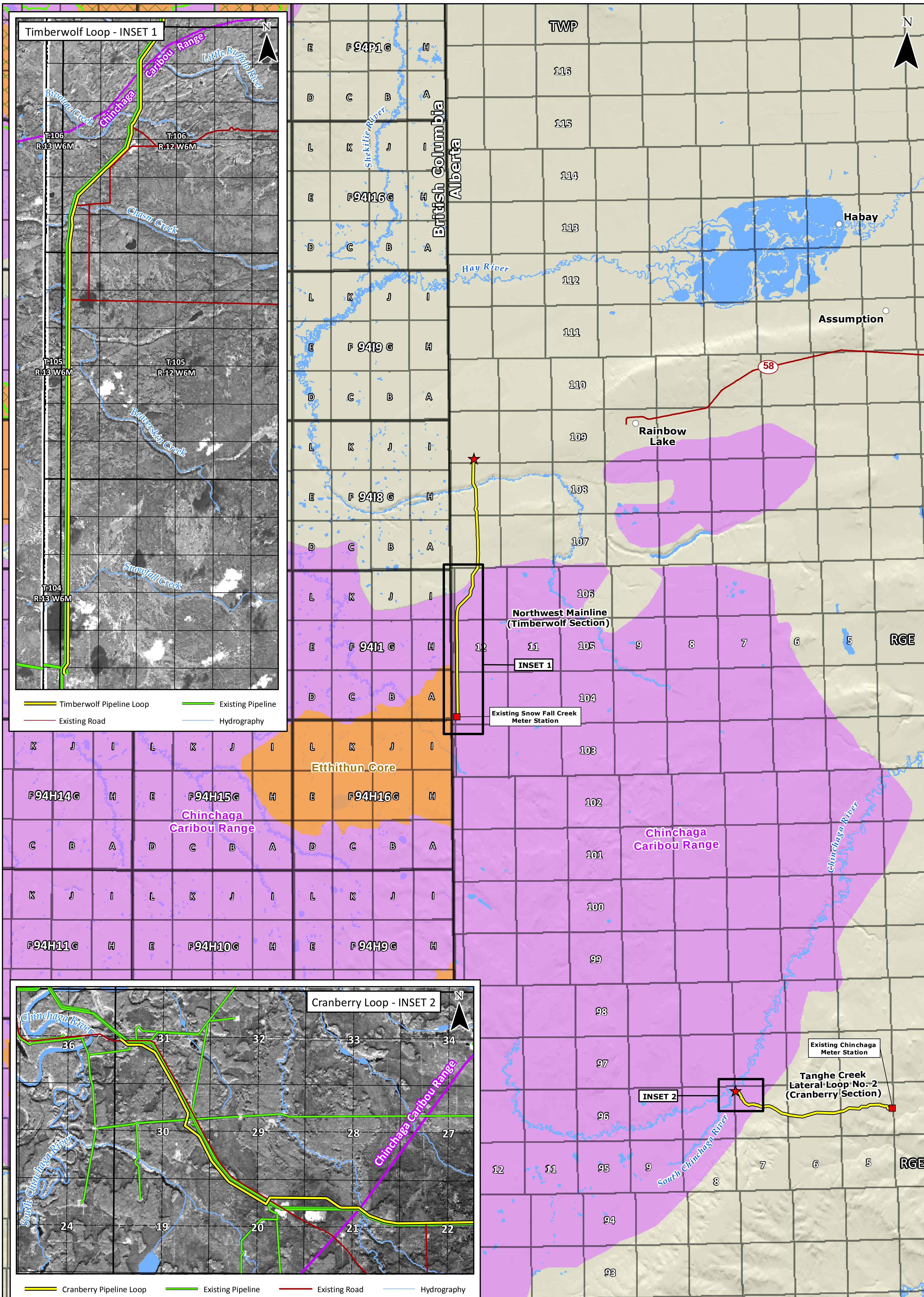
CERTIFICATE GC-119 CONDITION 7 – CARIBOU HABITAT RESTORATION PLAN

CARIBOU HABITAT RESTORATION PLAN CERTIFICATE CONDITION		
7. Caribou Habitat Restoration Plan NGTL shall file with the Board for approval, as per the timelines below, preliminary and final versions of a CHRP for those portions of the Project Footprint that lie within the Chinchaga caribou range.		
a)	Preliminary CHRP - at least 60 days prior to commencing construction. This version of the CHRP shall include, but not be limited to:	
	i)	the goals and measurable objectives of the CHRP
	ii)	identification of any suitable immediate, medium-term and long-term caribou habitat restoration methodologies, as well as a literature review and discussion of the effectiveness of the different potential methods;
	iii)	the framework that will be used to identify potential caribou habitat restoration sites and the decision-making criteria that will be used for final site selection;
	iv)	the criteria that will be used to evaluate the effectiveness of the CHRP and determine whether goals have been met;
	v)	evidence of consultation with Environment Canada and Alberta Sustainable Resource Development regarding the CHRP.
b)	Final CHRP – to be submitted on or before 1 November after the first complete growing season following the commencement of operation of the Project. This updated version of the CHRP shall include, but not be limited to:	
	i)	the contents of the preliminary CHRP, as well as any applicable updates;
	ii)	a complete list of the proposed caribou habitat restoration sites, including a description of the site-specific restoration activities and maps or Environmental Alignment Sheets showing the locations of the sites;
	iii)	confirmation of the rationale used to select the caribou habitat restoration sites;
	iv)	a discussion of the locations or conditions that may present specific challenges;
	v)	evidence of consultation with Environment Canada and Alberta Sustainable Resource Development regarding the final CHRP; and
	vi)	a quantitative and qualitative assessment of the area of caribou habitat within the Chinchaga caribou range that was directly and indirectly disturbed as a result of construction of the Project. The assessment shall identify and assess the caribou habitat to be mitigated for as a result of the implementation of the CPP and CHRP, as well as identify the remaining residual effects for which offset measures will be developed as part of Condition 23.

In addition to the Certificate Conditions issued by the NEB for the Project, the CHRP has been developed in consideration of the current regulatory policies specific to caribou. The Woodland Caribou Policy for

Alberta (Government of Alberta 2011) identifies recovery strategies that include maintenance and restoration of caribou habitat, establishment of range-specific habitat objectives, management of other wildlife populations (predators and primary prey), adaptive management, as well as legislative and social considerations. A key strategy adopted by the Woodland Caribou Policy for Alberta is the development of range-specific assessments and objectives, which builds on the work of previous recovery strategies, such as the Alberta Woodland Caribou Recovery Plan 2004/05 – 2013/14 (Alberta Woodland Caribou Recovery Team 2005). A range-specific assessment or recovery plan for the Chinchaga caribou range has not yet been developed.

Similar to the provincial policy, the draft Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada (Environment Canada 2011) stresses the importance of landscape level planning, such as planning development activities at appropriate temporal and spatial scales, incorporating caribou habitat requirements into fire management plans, establishing key protected areas and adaptive management. One of the management approaches suggested in the draft federal recovery strategy to address effects of habitat alteration on boreal caribou is to undertake coordinated actions to reclaim boreal caribou habitat through restoration efforts. This might include restoration of industrial features such as roads, seismic lines, pipelines, cut lines and clearings (Environment Canada 2011).



City/Town
Tie-In Location
Existing Meter Station
Timberwolf and Cranberry Pipeline Loops
58 Major Road
Hydrography
Boreal Caribou Range
Boreal Caribou Core (BC)

FIGURE 1

PROJECT LOCATION WITHIN THE CHINCHAGA CARIBOU RANGE

PRELIMINARY CARIBOU HABITAT RESTORATION PLAN FOR THE NGTL NORTHWEST MAINLINE EXPANSION

t7212_Wildlife_CHRP_Figure1_Overview_Rev0.mxd

TERA ENVIRONMENTAL CONSULTANTS

Date of Imagery: Oct 7, 2011 (Timberwolf) & Oct 15, 2011 (Cranberry):
2011 SPOT5 ©2012 CNES, Licensed by BlackBridge Geomatics Corp, www.blackbridge.com; City/Town: Natural Resources Canada 2003;
Pipeline Routing: Midwest Surveys Inc. 2011; Major Road: IHS Inc. 2012; Hydrography: IHS Inc. 2004, Natural Resources Canada 2007-2011;
Boreal Caribou Range, Boreal Caribou Core (BC): Alberta Environment and Sustainable Resource Development 2010, BC Ministry of Environment 2010;
Hillshade:TERA Environmental Consultants 2008.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

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SCALE: 1: 650,000

0 5 10 15 km

(All Locations Approximate)

7212

August 2012

2.0 GOALS AND MEASURABLE OBJECTIVES

The Project will potentially affect caribou in the Chinchaga caribou range as a result of direct loss of habitat, reduction in habitat effectiveness, and higher mortality risk due to increased access and travel efficiency by humans and predators. The intent of the Preliminary CHRP is to provide information on the potential restoration techniques available, their expected effectiveness and potential suitability for application to the Project footprint to reduce residual effects of the Project on caribou and caribou habitat.

To achieve the intent of the Preliminary CHRP, a literature review was conducted to focus the discussion of restoration techniques that would achieve the following goals.

1. Promote native vegetation re-establishment within the Project footprint in a manner that will achieve successional trajectories toward natural ecosystem types.
2. Implement access control to discourage human, and possibly predator, travel along the Project right-of-way.
3. Establish line-of-sight blocks to reduce caribou mortality risk.

The identified goals focus primarily on reclamation of habitat directly disturbed by the Project. By addressing direct habitat loss through reclamation, indirect effects on habitat effectiveness in surrounding habitats are also addressed.

Measurable objectives were developed to demonstrate whether the identified goals are achieved. Measurable objectives provide a means by which the effectiveness of the CHRP measures can be evaluated through monitoring. The following measurable objectives were identified for each of the three goals of the CHRP.

1. Habitat restoration: revegetation of the Project footprint that achieves establishment, survival and growth of target (*e.g.*, native woody) species in the short-term, such that natural ecosystems, consistent with adjacent forest stands, are expected to regenerate over the long-term.
2. Access control: achieve effective human access control over the short-term within segments of the Project footprint.
3. Line-of-sight blocking: reduce lines-of-sight along the Project footprint using a combination of long-term techniques (*e.g.*, vegetation screens), and measures that may be more effective in the short to medium-term (*e.g.*, constructed visual barriers such as berms or slash piles combined with vegetation plantings).

2.1 Preliminary Study Design

In order to evaluate the measurable objectives, a study design will be developed. The study design will include the following:

- coarse-scale monitoring of the Project footprint via aerial survey (*i.e.*, high level overview of revegetation performance for selected treatment categories); and
- fine-scale monitoring in sample plots within treatment categories (*i.e.*, evaluate revegetation performance).

Greater detail on the study design will be provided in the Final CHRP and the Caribou Habitat Restoration and Offset Measures Monitoring Plan.

3.0 LITERATURE REVIEW

Restoration of disturbed habitat has become one of the key components for caribou conservation identified through the draft federal recovery strategy (Environment Canada 2011) and through provincial boreal caribou recovery planning efforts (Government of Alberta 2011, BC Ministry of Environment 2011). This literature review is intended to provide an understanding of the current knowledge of the value and purpose of habitat restoration in caribou range, as well as previous and ongoing habitat restoration initiatives, techniques implemented and their reported successes and failures.

3.1 Current Information on Woodland Caribou, Habitat and Human Use

Boreal woodland caribou use a strategy of spatial separation from primary prey to limit predation risk (Bergerud *et al.* 1984, Bergerud 1988, Holt and Lawton 1994, Johnson *et al.* 2001, James *et al.* 2004, Environment Canada 2008). Evidence shows that caribou resource selection at the population and individual seasonal home range scale is affected by forestry cutblocks (DeCesare *et al.* 2012), which are linked to increased predator densities (Latham *et al.* 2011). Individual caribou resource selection at the location level, however, is shown to be affected by linear features (DeCesare *et al.* 2012). Linear features (*e.g.*, roads, pipeline and transmission rights-of-way, seismic and cut lines) have been associated with increased predator mobility and caribou are, therefore, potentially at greater risk of predation when near or on these features (James 1999, James and Stuart-Smith 2000, Whittington *et al.* 2011). However, McCutchen (2006) modelled dynamic use of the landscape by wolves, primary prey (moose) and caribou, and concluded that wolves experience no additional advantage accessing caribou from linear features, although they do benefit in accessing primary prey species (*i.e.*, moose). Latham *et al.* (2009) supports this by finding that kill sites were no closer to linear features than random. Reduced habitat effectiveness adjacent to linear features may occur as caribou may partially avoid habitats near access rights-of-way (Dyer 1999, Oberg 2001). DeCesare *et al.* (2012) reported a scale-dependent trade-off such that the ultimate costs to caribou habitat suitability appear relatively less for linear feature-induced changes to the predator functional response (predator kill rate) than forestry-induced changes to the predator numerical responses (predator density). This supports work by Latham (2009) where forest harvest leading to early seral stage regeneration was suggested as one factor leading to increased primary prey abundance (moose and deer), with numerical responses in wolf populations, increased forays into caribou range and subsequent higher predation risk to caribou.

Rehabilitation of existing anthropogenic disturbances not currently in use within caribou range is expected to reduce the degradation of functional habitat over the long-term, since caribou will no longer exhibit reduced use on or near (*i.e.*, within a zone of influence) a land-use feature (*e.g.*, Oberg 2001). Restoration of disturbances also assumes that caribou will return to being spatially separated from primary prey (moose, deer) and predators, and hence natural levels of mortality risk (Athabasca Landscape Team 2009).

Management of boreal caribou habitat to maintain viable populations over time will require both minimizing the impact of future development and recovery of the existing industrial footprint.

3.2 Recovery and Restoration of Habitat

Mitigating the effects of industrial development (*e.g.*, forestry, seismic, oil and gas, and mining) in the boreal forest has a common challenge: reclamation/restoration of a development footprint that is either a linear feature (*e.g.*, pipeline) or a polygon (*e.g.*, cutblock, mine). A common approach in reclamation of forested land is the application of provincial standards developed to achieve equivalent land capability to support target end land uses, often with a focus on merchantable forest stands. For example, the expected planting density is 2,000 stems/ha for sites planted with merchantable species on reclaimed well sites and associated facilities on forested lands in Alberta (AENV 2011). Criteria used to evaluate the reclamation success in wetland environments are not defined, although several variables are recommended for evaluating reclamation success (*e.g.*, positive water balance, and established wetland vegetation, processes, stability and function, etc.) (AENV 2008). In relation to oil sands mining in northeastern Alberta, Straker and Donald (2011) and Hawks (2011) have suggested that current reclamation standards may not be suitable where there is a broader set of management objectives such as maintenance of biodiversity, creating functional forest ecosystems, or restoration of species-specific wildlife habitat.

Although restoration ecology specific to caribou habitat is a relatively new science, some key initiatives have identified important learnings related to oil and gas development in caribou range. Initiatives have generally focused on revegetation and access control, as well as limiting growth and establishment of plant species favourable to primary prey (*e.g.*, Caribou Range Restoration Project [CRRP] 2007a,b, Golder 2010, Osko and Glasgow 2010). These included tree planting initiatives, coarse woody debris management best practices, habitat enhancement programs and habitat restoration trials in caribou range (CRRP 2007a,b, Enbridge 2010, Golder 2010, 2011, Oil Sands Leadership Initiative [OSLI] 2012). Blocking line-of-sight has been implemented through land use guidelines as a tool aimed at mitigating increased risk of predation in the short-term, while longer term goals of revegetation of lines are achieved. Common among many of these initiatives are learnings on: which plant species to use, and when and where to replant; development of effective techniques to promote natural revegetation; and a better understanding of methods to control access. Lessons learned from these initiatives have been incorporated into large scale habitat restoration projects near Grande Prairie, Cold Lake and Fort McMurray, Alberta.

Table 2 provides a summary of habitat restoration initiatives and the accomplishments and lesson learned.

TABLE 2

HISTORIC AND CURRENT HABITAT RESTORATION INITIATIVES

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
Consortium composed of oil/gas companies, Environment Canada, Alberta Conservation Association, the Alberta Caribou Committee, and Alberta Environment and Sustainable Resource Development [AESRD]) (previously referred to as Alberta Sustainable Resource Development[ASRD])	CRRP	• Program active from 2001 to the end of 2007 • Mandate was to use an adaptive management approach to restoring caribou habitat while testing methods to speed recovery of man-made linear disturbance • Involved trials to increase the recovery path of seismic and other linear corridors to treed cover, studying the effect of access management techniques on wildlife and humans, performing a cost/benefit analysis, and drafting recommended operating practices and planning strategies from the construction through to the reclamation phases of oil and gas developments • Field treatments included: transplanting trees and shrubs, seeding, tree seedling planting, using planting enhancements, soil decompaction, mounding, slash rollback, and installation of wooden fences for line-of-site breaks • Planning strategies included the use of aerial imagery for collecting vegetation inventories, and developing logistical best practices for tree seedling planting in wetland areas during the summer	• Tested site preparation techniques as they pertain to promoting revegetation and limiting human use of linear corridors, including excavator mounding, decompaction and slash rollback. • Planted different species of tree and alder seedlings on a number of ecosites on seismic lines and pipelines. Follow-up surveys have shown good survival of most species when planted on native site conditions. • Researched and tested the use of aerial imagery and LiDAR for collecting vegetation inventories on linear disturbances, of which aerial imagery was proven to be successful and adopted for other habitat restoration programs. • Managed the macro-scale Suncor/ConocoPhillips Caribou Habitat Restoration Pilot implemented within the Little Smoky caribou range in 2006: – over 100 km of linear corridors treated, encompassing several townships; – included site preparation techniques (excavator mounding and slash rollback); – included planting of tree seedlings on a variety of different ecosites, treatment types and disturbances. Effectively used helicopters and slings to plant seedlings in predominately wetlands sites and along seismic lines; – included the installation of wooden fences at the beginning of linear corridors to serve as line-of-sight breaks; – focused on access management by using excavator mounding at the beginning of linear corridors; and – installation of signs at treatment sites. • Produced an unpublished draft document on recommended practices for implementing a habitat restoration program, from the planning through to the treatment and monitoring phases. • Produced an unpublished monitoring manual for collecting revegetation data on linear corridors. • Successfully transplanted trees and shrubs during planting trials during winter and summer conditions, on a number of ecosites including treed wetlands. • Sponsored trials of frozen tree seedling planting. Note, since this showed promise, OSLI has sponsored further research and this technique is being implemented as part of the Algar Reclamation Program. • Sponsored trials for the use of encapsulated seed products for reclamation purposes. • Sponsored a line-blocking study, as part of L. Neufeld's Master's Thesis on wolf/caribou dynamics in the Little Smoky caribou range.	CRRP 2007a,b,c,d Neufeld 2006
Suncor Energy	Accelerated Seismic Line Restoration	Program initiated in 2000 • Objective was to promote revegetation of seismic lines through the use of tree seedling planting, bioengineering (willow staking) and transplanting existing vegetation • Techniques tried on upland, transitional wetlands and wetland ecosites • No follow-up monitoring beyond this program	Four years post-treatment: • upland black spruce transplants survived but showed signs of stress; • black spruce and willow plugs worked better than transplants; • poor results for lines with mulch on them; • transitional wetland black spruce transplanting showed high survival but low growth or vigour rate; and • wetland black spruce and willow transplants and plugs had poor survival, but slightly better survival when planted in elevated microsites.	Golder 2005

TABLE 2 Cont'd

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
Canadian Natural Resources Limited (CNRL), Diversified Environmental Services	Ladyfern Pipeline Re-vegetation Program (natural gas pipeline running from northeast BC into northwest Alberta)	Pipeline construction occurred in 2002 • Promoted revegetation on a pipeline development by: minimizing root disturbance during construction; mechanical seeding of the right-of-way on areas of erosion concern only; promoting the growth of native species from seed; planting of tree seedlings; and transplanting of existing trees • Goal was to create line-of-sight breaks as introduced trees grow over time • Upland habitat: tree seedlings were planted primarily with white spruce and lodgepole pine • Lowland habitat: planted larger, locally collected and transplanted black spruce	• Annual monitoring of species composition and percent vegetation ground cover was conducted for two growing seasons. • Survival rates were higher in upland sites than lowland sites (focus on lowland sites was black spruce transplants). • Poor survival of locally collected transplanted black spruce. • Coniferous tree seedling (nursery stock white spruce and lodgepole pine) survival and growth appeared to be more successful than using locally collected transplants. • Natural regeneration in both upland and lowland sites was noted in areas that had minimized root disturbance during construction of the pipeline and where there was no mechanical seeding of grass seed. • Re-colonization of coniferous species provided the best visual barrier; deciduous species effective more quickly. • Recommended that transplants should be conducted in the fall when trees are dormant, but still have sufficient time to establish roots. • Recommended that the most effective method for establishing a line-of-sight break is to concentrate efforts on productive uplands. • Recommended that smaller trees (20-30 cm) be selected for further transplants.	Diversified Environmental Services (DES) 2004
AXYS Environmental Consulting Ltd.	Recommended Peatland Restoration Techniques for Oil and Gas in Boreal Forest	• AXYS conducted a literature review of successfully used peatland reclamation techniques within wildlife habitats in the boreal forest	• A mean water table level higher than 40 cm and preferably within 20 cm promotes peatland growth[1]. • Removing drainage ditches following decommissioning will help restore peatlands[2]. • Water table management is essential to ensure successful re-vegetation of peatlands and to guide the direction of re-vegetation. Soil chemistry adjustment may be required for problem soils[3]. • To achieve improved black spruce seedling growth and environmental quality, use selected mycorrhizal fungi when reclaiming dense black spruce bogs[4]. • Re-establish site hydrology, site topography, and appropriate bog vegetation to reclaim raised bogs. • Patches of discontinuous permafrost (*e.g.*, in northeastern Alberta) are not yet possible to reclaim[5].	AXYS 2003 [1]Tedder and Turchenek 1996 [2]Girard *et al*. 2002 [3]Naeth *et al*. 1991 [4]Khasa *et al*. 2001 [5]Robinson and Moore 2000 [5]Turetksy *et al*. 2000 [5]Camill 1999
Enbridge Pipelines (Athabasca)	Waupisoo Pipeline Habitat Restoration	Pipeline construction occurred in the winter of 2007/08 • Promoted revegetation on a pipeline development within critical moose and caribou habitat by: mechanical seeding of the right-of-way on areas of erosion concern only; promoting the growth of native species from seed; planting tree and shrub seedlings; transplanting existing shrubs; and using slash rollback for access control and micro-site creation for seedling and seed establishment • Goal was to use growth of planted trees to create line-of-sight breaks, directly restore habitat and control access	• Approximately 250,000 seedlings were planted at strategic locations over 3 summers. Locations included: – intersections with other linear corridors; – upland sites to create line-of-sight breaks; and – riparian areas. • Slash rollback was applied on some steeper slopes and at some intersections with all-season and winter roads. • Shrub species (alder and willow) transplanted successfully on the banks of the Christina River during the winter. • Planting sites are currently subject to monitoring over a five year period. • Good survival of seedlings was observed on upland sites; lowland site seedling survival to be evaluated during monitoring in the fall of 2012. • Vegetation ingress of clover and native grasses has had a negative impact on seedling survival in some areas. • Where no access control measures were applied, human use of the right-of-way by ATV damaged many seedlings. • Seedlings planted in conjunction with slash rollback were not damaged.	Enbridge 2010 Golder 2011

TABLE 2 Cont'd

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
Canadian Natural Resources Limited, Wolf Lake	Interconnect Pipeline	Pipeline construction occurred during the winter of 2007/08 • Promoted revegetation on a pipeline development adjacent to the Cold Lake Air Weapons Range (CLAWR) by planting of tree and shrub seedlings • Goal was to use growth of planted tree species to create line-of-sight breaks, limit the overall width of the developed corridor that the pipeline parallels, directly restore habitat and control access	• Approximately 60,250 seedlings planted at strategic locations over 2 summers. Locations included: – intersections with other linear corridors; – upland sites to create line-of-sight breaks; and – riparian areas. • Planting sites are currently subject to monitoring over a five year period. • Good survival of seedlings where mechanical seeding of native grasses was avoided. • Areas mechanically seeded to native grass mixtures had lower survival and vigour of planted seedlings, possibly due to increased competition for sunlight, water and nutrients, and graminoid vegetation falling over and smothering the seedlings when snowfall occurs. • Damage to seedlings from ATV use in many monitoring plots. • Other environmental factors such as frost and wetland encroachment possibly contributing to seedling mortality.	Golder 2012a
University of Alberta led project, supported by a number of oil/gas companies, Canadian Association of Petroleum Producers (CAPP), Forest Resource Improvement Association (FRIA), and Alberta-Pacific Forest Industries Inc. (ALPAC)	Integrated Land Management	• Ongoing study began in 2004 and focused on contributing to best practices for wellsite construction and reclamation on forested lands in the Green Area of northeastern Alberta. Techniques to enable appropriate revegetation and accelerate recovery of ecological processes after disturbance were studied • Old wellsites component involved monitoring soils and vegetation • New wellsites component researched methods to use during well-site construction that will promote the prompt revegetation of the site during the reclamation phase	• Report produced in 2010, "Recommended Practices for Construction and Reclamation of Wellsites on Upland Forests in Boreal Alberta", that evaluated soil and vegetation responses to different winter construction and reclamation techniques. • Recommendations included: – maximizing low disturbance construction practices; – use of snow/water to level sites as opposed to stripping; – retain root zone when stripping and store soil layers in separate piles; – plant seedlings promptly after reclamation to lessen impact of native vegetation competition; – slash rollback is preferable to mulching; – mulch layers need to be less than 10 cm thick when present; – avoid planting tree and shrub species that may impact predator/prey dynamics and do not occur naturally in the area. For example, planting of species palatable to moose in caribou areas should be avoided; and – pre-disturbance assessments and prescription planning can pay dividends at the reclamation stage.	Osko and Glasgow 2010
OSLI	Faster Forests	• Ongoing since 2007, planting trees to increase the pace of reclamation	• Planting shrubs along with trees allows for trees to grow healthier, faster and with less competition for nutrients and water from fast-growing grasses. • Planted 143,850 seedlings on 113 sites in 2009. • Planted 238,632 seedlings on 120 sites in 2010. • Planted >600,000 seedlings in 2011 on 200 sites (included 4 tree species, 7 shrub species).	OSLI 2012
	Winter Wetland Planting Trial	• Wetlands re-vegetation trials consisting of winter planting of black spruce seedlings to address challenges involved with planting disturbed wetland sites during the summer months • Goal is to improve reclamation performance	• Planted 900 trees in winter 2011. • >90% survival rate in spring 2011. • Findings were used to help develop a larger scale frozen seedling program for the on-going Algar Reclamation Program.	

TABLE 2 Cont'd

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
OSLI (cont'd)	Algar Reclamation Program	• Program targeting the restoration of seismic lines through re-vegetation and access control to improve wildlife habitat in a caribou area with historic seismic disturbance • The Algar area of northeastern Alberta covers approximately six townships (each township is 6 miles by 6 miles)	• Inventory of linear disturbance completed using remote sensing methods. • Detailed restoration plan developed. • Stakeholder consultation led by AESRD on the closure of selected seismic lines to the general public (*i.e.*, to provide some level of protection to areas with restoration treatments). • Macro-scale restoration activities began in winter 2011/2012 and include: – excavator mounding; – slash rollback; and – frozen tree seedling planting.	
Alberta School of Forest Science and Management / OSLI	Coarse woody debris management - best practices	• Goal is to come up with consistent standards that industry users can implement when spreading woody debris on reclaimed sites	• Developed a guide for improved management of coarse woody debris materials as a reclamation resource. • Best practices manual was prepared through consultation with resource managers and operators, consideration of economic and ecologic requirements, and synthesis of the most relevant and current scientific knowledge. • Wood mulch depths exceeding 3-4 cm form an insulating layer over the soil surface limiting plant growth. • Use of whole logs enhances forest recovery by creating microsites, which creates improved conditions for vegetation to establish and grow. • Total rollback of material along the entire length of exploration and access features is the most effective way to discourage recreational use of linear features. • Well designed scientific monitoring of wildlife use is needed to provide managers with an understanding of treatment effectiveness.	OSLI 2012
CNRL	Habitat Enhancement Program	• Program is part of the Terms and Conditions of the *Environmental Protection and Enhancement Act* (*EPEA*) approval for the construction, operation and reclamation of the Canadian Natural Primrose and Wolf Lake (PAW) Project • Program targeted the restoration of seismic lines, old lease roads, and abandoned well and core hole sites through re-vegetation and access control to improve wildlife habitat on a caribou range within the CLAWR • Focused on restoration of historic (pre-oil sands development) features on the landscape that are recovering poorly, either due to environmental conditions (cold, wet soils), historical clearing and reclamation practices, or recent clearing for winter access • Focused on areas outside of 10 year development plan to avoid re-entry into areas where restoration treatments are placed	• Used aerial imagery to conduct linear corridor vegetation inventories on all of CNRL's CLAWR operations, encompassing approximately nine townships. • Detailed restoration plan developed. • Ground-truthed sites that appeared on aerial imagery as having little to no woody plant regeneration. • Focused on access control and micro-site creation for introduced tree seedlings, using the following three treatments: – mounding; – tree seedling planting; and – slash rollback. • Planting sites are subject to monitoring over a five year period. • To date, only monitored black spruce seedlings planted in the summer on sites treated in the winter with excavator mounding in treed bog and fen sites. • Excellent survival and vigour of seedlings after one growing season at all monitored sites. • Additional site preparation and seedling planting scheduled for 2013.	Golder 2010

TABLE 2 Cont'd

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
ConocoPhillips, Canadian Association of Petroleum Producers and Suncor Energy	Caribou Habitat Restoration Pilot Study	• Remote camera study (summer 2008) initiated within the Little Smoky caribou range in Alberta. Objectives included comparing wildlife (caribou, deer, moose, bear, wolf, coyote, cougar and lynx) presence and use between naturally restored seismic lines and open cutlines.	• Pooled prey species (caribou, deer, moose) preferentially select restored seismic lines (>1.5 m vegetation heights, average age of trees 23 years) over non-vegetated sites. • Deer had the strongest preference for restored sites, with the preference attributed to the increased forage within the restored sites, as well as reduced line-of-site and potentially predator avoidance. • Caribou were shown to have a slight preference for re-vegetated seismic line sites over non-vegetated sites, but with limited data there was no statistical difference. However, caribou on control sites were observed to be running much more frequently than on re-vegetated sites and engaged in standing related behaviours only while on re-vegetated sites. Data indicate that caribou are more likely to travel quickly through open seismic lines, which may be a response to the minimal vegetation cover.	Golder 2009

Note: Table modified from Golder 2012b.

3.2.1 Key Results

Recent research has shown positive results for establishing native vegetation on seismic lines and other linear features using techniques such as planting tree and shrub seedlings, and creating microsite conditions (*i.e.*, mounding) that are conducive to seedling growth and natural vegetation encroachment (CRRP 2007b, OSLI 2012). Measures such as slash rollback can address site condition issues including competition from non-target or undesired plant species, erosion, frost, and heat or moisture deficiencies (CRRP 2007b). Natural revegetation and successful planting initiatives have also benefited from construction practices that minimize disturbance during development of the footprint. Minimal disturbance pipeline construction techniques that avoid grubbing and grading are effective at facilitating rapid regeneration of native vegetation within the right-of-way, in particular in deciduous habitats (TERA Environmental Consultants [TERA], 2011a, 2012a). A trial natural revegetation response inventory program in west central Alberta reported that 85% of disturbed sites did not require artificial recovery, since a natural recovery projection was observed on previously disturbed sites (CRRP 2007c). Although regenerating conifers provide a better visual barrier, the faster growth rates of deciduous species provides for effective results more quickly (Diversified Environmental Services [DES] 2004). Recent research suggests that planting shrubs along with trees allows trees to grow healthier, faster and with less competition for nutrients and water from fast-growing grasses (OSLI 2012). It may also provide important habitat benefits for wildlife, compared to only planting tree seedlings, by providing hiding cover (Bayne *et al.* 2011).

Transplanting native vegetation appears to be difficult to implement on a large scale as part of a habitat restoration program for the following reasons (Golder 2012b):

- inconsistent availability of vegetation suitable for transplant;
- potential for degradation of neighbouring vegetation communities if transplants are sourced from adjacent stands;
- transplanting programs often result in the storage of plant materials under less-than-ideal conditions due to uncontrollable factors (*i.e.*, weather); and
- other treatments, such as seeding and seedling planting, have been shown to be more successful in comparison.

Seismic lines have been reported to have very slow reforestation rates (Revel *et al.* 1984, Osko and MacFarlane 2000), and recovery is strongly influenced by the characteristics of the adjacent forests (*e.g.*, site productivity, tree and shrub species and heights) (Bayne *et al.* 2011). Conventional seismic lines cleared by bulldozer may take as long as 112 years to reach 95% recovery to woody vegetation in the absence of restoration efforts (Lee and Boutin 2006). Slow tree regeneration has been attributed to root damage from the original disturbance, compaction of the soil in tire ruts, insufficient light reaching the forest floor, maintenance of apical dominance from surrounding stands, introduction of competitive species (*i.e.*, planted seed mixes), drainage of sites (*i.e.*, regeneration slowest on poorly-drained sites with low nutrient availability such as bogs) and repeated disturbances (*e.g.*, all-terrain vehicles [ATVs], animal browsing, repeated exploration) on seismic lines (Revel *et al.* 1984, MacFarlane 1999, 2003, Sherrington 2003, Lee and Boutin 2006). However, tree regeneration on seismic lines is a key determinant of recovery success (MacFarlane 2003) and, therefore, factors that hinder revegetation efforts should be mitigated.

The ability of linear features to recover to a natural forested state is affected considerably by human use. Oberg (2001) identified that recovery of conventional seismic lines to functioning mountain caribou habitat occurs within 20 years following disturbance in west-central Alberta. Golder (2009) reports that in the Little Smoky caribou range, seismic lines that were allowed to regenerate naturally achieved an average height of 2 m, across all ecosite types, within 20 to 25 years, when they had not been recently disturbed by human activity (*e.g.*, re-cleared to ground level for winter access or seismic program use). The average age of trees on the control lines was only 10 years, suggesting sites that are continually disturbed or re-cleared by human activity take longer to regenerate. Restoration efforts have also failed when ATVs destroyed seedlings after planting (Enbridge 2010, Golder 2011, 2012a).

Subjective expert ratings suggest that effectiveness of most physical access control measures (*e.g.*, gates, berms, excavations, rollback, visual screening) vary considerably between negligible and high effectiveness in controlling human access (Caribou Landscape Management Association [CLMA] and the Forest Products Association of Canada [FPAC] 2007). Effectiveness of access control measures are likely dependent on suitable placement (*e.g.*, placed to prevent detouring around access control point), enforcement, and public education of the intent of the access control, which facilitates respect of the control measures (AXYS 1995). Mounding has been found to discourage human access (*i.e.*, truck and ATV) during snow-free periods and also creates microsites that improve vegetation establishment (review in CLMA and FPAC 2007). Excavator mounding is a well researched and popular site preparation technique in the silviculture industry (Macadam and Bedford 1998, Roy *et al.* 1999, MacIsaac *et al.* 2004). Target density of mounding for access control and/or microsite creation purposes can vary from 1,400 to 2,000 mounds/ha (AENV 2011). Switalski and Nelson (2011) monitored human access on open and closed (*i.e.*, gated, barriered and recontoured) roads using remote cameras, and found that the frequency of detection of humans on closed roads was significantly lower than on open roads, but not significantly different among road closure types. Results of that study also indicated significantly higher levels of hiding cover and lower line-of-sight distances on barriered and recontoured roads compared to open roads (Switalski and Nelson 2011). Physical access control measures provide short-term solutions to manage access and allow for natural regeneration (Golder 2009). Once linear features have regenerated to a pole sapling or young forest structural stage, Sherrington (2003) suggested they no longer facilitate ATV access.

The above techniques to block human access also contribute to initiatives to block line–of–sight. Short-term management for access and line-of-sight blocking should ultimately lead to long-term access control by way of regeneration within disturbed areas (CLMA and FPAC 2007). Expediting growth of visual barriers along linear features can be achieved by concentrating reclamation efforts on productive upland habitats, since conifer and shrub (*e.g.*, alder) species grow more quickly on these sites compared to lowland sites. Although regeneration of conifer species provides the best year round visual barrier, their growth can be slow. Therefore, encouraging deciduous woody species growth is important to quickly establish visual barriers in the short-term.

While there has been some effort to assess wildlife use of regenerating seismic lines (*e.g.*, Bayne *et al.* 2011) and reclaimed areas in the Athabasca Oil Sands Region (*e.g.*, Hawkes 2011), few researchers have assessed natural habitat recovery and wildlife responses to recovery with respect to caribou. A pilot study was conducted in the Little Smoky caribou range to measure the effects of revegetating linear disturbances on wildlife use and mobility (Golder 2009). Data were collected for a group of predators (*i.e.*, cougar, wolf, coyote, lynx, grizzly and black bears) and prey (*i.e.*, moose, deer and caribou). Results of the pilot study indicated that revegetated seismic lines (*i.e.*, minimum 1.5 m vegetation regrowth) were preferred by both predator and prey species compared to control lines (*i.e.*, vegetation regrowth of 0.5 m or less), and in general, control lines were used primarily for travel (*i.e.*, both predators and prey species were constantly moving as opposed to standing, foraging, etc.). In addition, human use was almost exclusively limited to the control lines. The line-of-sight measured on the revegetating lines was typically less than 50 m. Golder (2009) suggested that moose and deer may have been attracted to the revegetated lines for forage availability and perceived cover protection. The preference for regenerating seismic lines by wolves may be explained as a response to increased prey use of these lines (Golder 2009). The study also showed that caribou travelled more quickly (running more frequently) and did not engage in standing-related behaviours on control lines, whereas on revegetating lines running was rare and standing-related behaviours occurred more often.

To date, vegetation recovery in the medium and long-term following the creation of pipeline rights-of-way or other industrial activity has been poorly documented. Lack of time sequence recording for regenerating seismic lines and other developments reduces the ability to estimate natural rates and types of vegetation recovery. The focus of most initiatives has been on establishing vegetation along pipelines or seismic lines, with the goals of creating line-of-sight breaks, directly restoring habitat with transplanted vegetation, planting shrub and tree seedlings, sowing native shrub and tree seed, and controlling human access to reclaimed areas to allow undisturbed vegetation growth. Due to the lack of monitoring and the time lag that exists to restore caribou habitat, there is currently no direct link to indicate that implemented restoration treatments are having a positive effect on caribou populations. However, based on modelling scenarios of management options for caribou, restoration of habitat should have benefits in the long-term by contributing to the restoration of large contiguous habitat patches that are preferred by caribou.

3.2.2 Best Suited Restoration Methods and Knowledge Gaps

Based on the review of industry initiatives in habitat restoration, a suite of habitat restoration measures that are considered best suited for caribou areas have been identified and are provided in Table 3. Transplanting of native vegetation has not been included since it has been shown to be a difficult technique to implement on a large scale with marginal results.

The literature review also provided the opportunity to identify knowledge gaps. These have been identified as:

- reclamation criteria (*e.g.,* defined guidelines or measurable objectives) for restoration of boreal ecosystems for wildlife habitat values, in particular habitats that do not support merchantable timber (*e.g.,* treed bogs and fens);
- functional responses of caribou, wolves and primary prey (*e.g.*, moose, deer) to reclaimed habitats in various stages of successional progression; and
- long-term monitoring of vegetation recovery on linear disturbances.

TABLE 3

HABITAT RESTORATION METHODS BEST SUITED FOR CARIBOU AREAS

Type of Mitigation Prescription	Objective(s)	Specifications	Comments	References
Minimum disturbance construction	• erosion control • reduce line-of-sight • facilitate rapid revegetation of native vegetation	Grubbing on the right-of-way is restricted to the trench width, allowing the integrity of the root layer to be maintained on the majority of the right-of-way, and allowing rapid recovery of herbaceous and deciduous woody vegetation species. Snow padding or matting on work areas of the right-of-way can be used to avoid the need for grubbing, and protect shrubs and small trees.	Construction during winter conditions reduces the need for soil salvage and grading, and the width of grubbing is limited to the trench area. Reduced disturbance to vegetation and root systems by cutting, mowing or walking down shrubs and small diameter trees at ground level facilitates rapid regeneration of vegetation. Use of snow padding or matting in select locations limits the need for cutting or mowing shrubs and small trees, and facilitates regeneration of native vegetation.	Results of preliminary field evaluation one growing season following construction on the Horn River Pipeline Project (TERA 2012a).
Excavator mounding	• create microsites in areas where it is deemed to be effective for enhanced survival and growth of planted seed and seedlings, and natural regrowth of woody species • access control	For access control purposes, mounds should be created using an excavator. Mounds should be approx. 0.75 m deep, if feasible. 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.	For the purposes 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 wetter, low-lying areas to create higher, better-drained microsites for seedlings. Mounding treed fen and bog areas 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 following implementation.	Macadam and Bedford 1998 Roy *et al.* 1999 MacIsaac *et al.* 2004 Golder 2010 OSLI 2012
Bio-engineering	• access control • erosion control • reduce line-of-sight • restore habitat	Species and densities utilized are site dependent.	Bio-engineering is the use of existing live vegetation to revegetate a site (*e.g.*, transplants; installing cuttings). Vegetation used is either found at the site to be treated, or collected nearby in the form of cuttings. Willows and poplar can be used as cuttings. Both species are fast growing, which establishes line-of-sight breaks quickly and works well for riparian restoration. Bio-engineering is considered a medium to long-term restoration treatment.	DES 2004 Golder 2005, 2011 Polster 2008
Tree/shrub seeding	• access control • erosion control • reduce line-of-sight • restore habitat	Species and application rates required are site dependent.	Seeding is considered a long-term restoration treatment. Application rates and preferred sites for seeding require further investigation.	CRRP 2007a Golder 2012a
Tree/shrub seedling planting	• access control • erosion control • reduce line-of-sight • restore habitat	Seedlings planted to approximately 2,000 stems/ha or greater meets current reclamation recommendations in forested areas, but may not be suited to treed lowland areas. Determination of which species to plant is determined at the planning stage of a restoration program. Species are determined based on the adjacent forest stand and restoration objectives (*e.g.*, low palatability for ungulates). Appendix A summarizes reclamation considerations specific to a selection of potentially suitable tree and shrub species. Shrub and tree seedlings are often planted together, depending on site conditions and anticipated natural revegetation of both species.	Seedling planting is considered a long-term restoration treatment due to the length of time it takes to establish effective line-of-sight breaks, hiding cover and access deterrents.	AENV 2010, 2011 CRRP 2007a DES 2004 Golder 2005, 2010, 2011, 2012a OSLI 2012

TABLE 3 Cont'd

Type of Mitigation Prescription	Objective(s)	Specifications	Comments	References
Berms	• access control • reduce line-of-sight • create microsites and protection for natural seed ingress and vegetation growth	Berms may be constructed of slash and timbers, or a combination of slash and earth. Supported berms are constructed using timber cleared from the right-of-way. Construct berms to an approximate height of 2 m. Promote rapid shrub/tree regeneration at ends of berms (*e.g.*, bio-engineering, seedling planting) to increase effectiveness as access control.	Feasibility of slash/timber berms is dependent on approval from provincial authorities to retain and pile slash onsite, and retention of sufficient quantities of slash onsite during construction. Availability of source material is unlikely sufficient for earth berm construction in areas where minimal disturbance construction techniques are employed. Earth berms should not be located in peatlands to avoid potential for settling and alteration of surface hydrology. Berms are effective immediately following implementation.	TERA 2011b Westland Resource Group 2011
Slash rollback	• control of human access during snow free 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	Spread slash evenly across the entire right-of-way width. Ensure woody debris is consistently dense enough on the ground to discourage ATV use along a right-of-way. Current slash rollback trials are implementing a coverage of 50 to 80 m^3/hectare, and are combining tree planting and seeding treatments with the slash rollback to take advantage of microsite creation. Osko and Glasgow (2010) recommend slash loads do not exceed 400 tonnes/ha. Locations where slash rollback are considered effective include the following: • on each side of an intersection with a linear feature that is not an all season road; • for 200 m or more on each side of roads and permanent watercourses crossed by the right-of-way; • on segments of the right-of-way that deviate from paralleling existing linear features (*i.e.*, new cut) to discourage new access trails from developing; • on slopes > 10%; and • on temporary access (*i.e.*, shoo-flies) and false rights-of-way created for vehicle crossings of watercourses Implement along segments left for natural recovery (*e.g.*, areas that are not graded, have low erosion potential, are located within wetlands), as well as segments that are seeded and/or planted with seedlings (*e.g.*, upland areas that are graded, upland and lowland areas where adjacent vegetation is characterized by a treed component).	The length of a slash rollback segment is dependent on the amount of available slash. Longer segments are a more effective treatment at controlling human access since ATV riders will be less inclined to try to ride through the slash or traverse around the slash in adjacent forest stands if slash continues for an extended distance. Slash rollback can also conserve soil moisture, moderate soil temperatures and provide nutrients as slash rollback 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. The use of slash rollback is only relevant when sufficient quantities of slash are left onsite during clearing of new disturbance. Slash rollback is effective immediately following implementation.	CRRP 2007b Enbridge 2010 Osko and Glasgow 2010 Golder 2010, 2011 Government of Alberta 2012 OSLI 2012

4.0 DEVELOPMENT OF THE FINAL CHRP

4.1 Habitat Restoration Treatment and Site Selection

A preliminary decision framework for implementation of habitat restoration measures has been developed in consultation with provincial and federal regulators (Figure 2). The framework identifies suitable habitat reclamation measures that may be implemented in various situations, based on the habitat type and construction factors. For example, natural regeneration, seeding and/or planting of riparian species, and implementation of site-specific watercourse restoration plans (where relevant) are suitable restoration techniques at riparian locations within the Project footprint that require grading.

Using the preliminary decision framework in conjunction with the Project-specific environmental alignment sheets and as-built construction information will allow for validation of site-specific restoration locations and techniques.

Site selection for the Final CHRP will require input from the NGTL construction and operation/maintenance staff, project biologists and reclamation specialists, as well as Alberta Environment and Sustainable Resource Development (AESRD) representatives. A thorough review of site characteristics will facilitate determination of the suitability of particular sites for restoration, and appropriate restoration treatments. Experience from implementing the CHRP for the NGTL Horn River Mainline Project will be incorporated in the decision process (TERA 2011a, 2012a).

Opportunities and constraints related to site-specific aspects of the Project will require consideration to ensure best value for restoration efforts. Site-specific factors that may influence restoration treatments and locations include the following:

- locations that NGTL will require maintenance of access for operation and maintenance;
- locations that are identified by other resource users for future developments (*i.e.*, publicly disclosed, applied for and/or approved but not yet completed projects) that would require habitat disturbance within or adjacent to the Project footprint;
- locations that are considered traditional access;
- intersections of the Project footprint with other linear features where access control, line-of-sight breaks and reclamation activities are expected to have high restoration value;
- locations adjacent to watercourse crossings with a Watercourse Crossing Reclamation Plan, where extending restoration efforts beyond the riparian area is feasible;
- higher suitability caribou habitat (*e.g.*, suitable forage, adequate cover/security, located away from human disturbance); and
- areas that are accessible by the restoration crews and equipment.

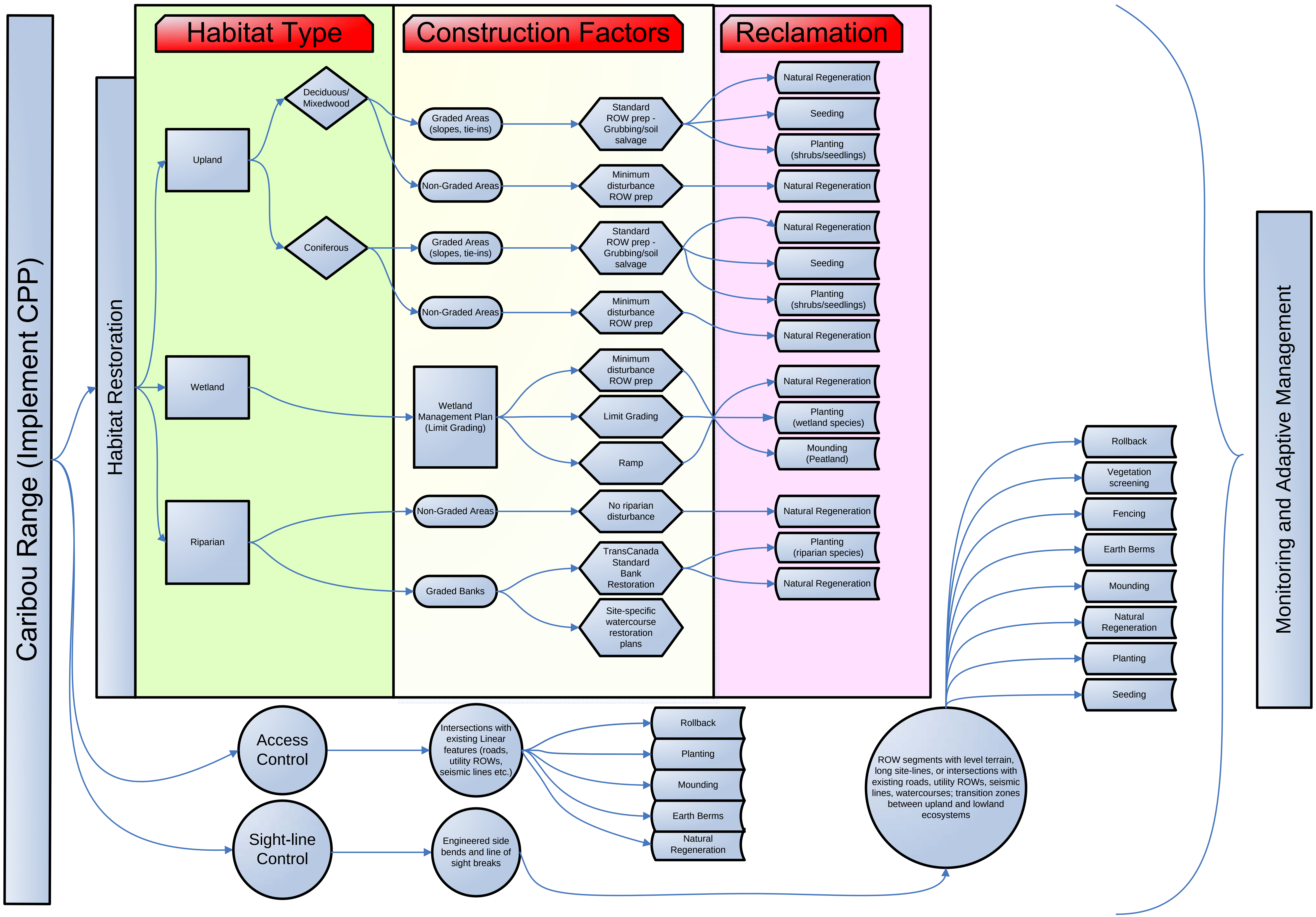

Figure 2 Conceptual Guide for Habitat Resortation Measures in Caribou Range

4.2 Access Control and Line-of-Sight Blocking

Techniques that reduce human access and reduce lines-of-sight also contribute to restoration. The Environmental Protection Plan (EPP)(TERA 2012b) and Caribou Protection Plan (CPP)(TERA 2011c) prepared for the Project provide measures that may be employed to reduce line-of-sight and control access, and are summarized below. The decision framework in Figure 2 addresses access control and line-of-sight measures. Additional information and maps detailing specific locations where access control and line-of-sight measures will be implemented and/or improved will be included in the Final CHRP, in accordance with Certificate Condition 7b(ii).

Access Control

An existing manned access check point (winter-only) located along the Chinchaga Forestry Road will assist in controlling access to the area of the Cranberry and Timberwolf sections of the Project. Additional access control measures may include rollback, vegetation planting, mounding or installation of berms (Figure 2). Locations for access management measures should focus on intersections with other linear features, such as roads, utility rights-of-way, seismic lines or watercourses. Where the Project is contiguous with another NGTL pipeline right-of-way, existing access control measures on the adjacent right-of-way should be extended to include the Project. Since public awareness of the reasons for access restrictions may influence the effectiveness of access control measures, signs may be installed in appropriate locations to facilitate understanding and respect for access closures.

Line-of-Sight

Measures to reduce sight-lines may discourage human use, and may also decrease predator efficiency and mobility. Appropriate locations for line-of-sight blocks include transition zones between upland forest and muskeg/black spruce forest, areas with level terrain that have long-sight-lines, and where the pipeline loop intersects an existing road or other pipeline right-of-way (Figure 2). Preliminary locations may be selected based on available mapping, however, the final locations for line-of-sight measures are most effectively determined post-construction when final site clearing and terrain contours can be evaluated. Bends in the right-of-way (*e.g.*, dog-legs) are an effective method of limiting line-of-sight distances. Line-of-sight can also be reduced through the use of short-term measures (*e.g.*, slash or earth berms constructed to an approximate height of 2 m; fences) and/or long-term measures (*e.g.*, vegetation screening). Although slash berms and fences can be an effective measure to create immediate breaks in lines-of-sight (TERA 2011b, Westland Resource Group 2011), the feasibility of their use is limited by increased fire hazard and pest outbreak risks. Berms and fencing may not be feasible in some situations such as lowland (*e.g.*, muskeg) areas where surface drainage may be affected and/or the peat substrate does not support fencing material. Earth berms may also be impractical if sufficient source material is not available, which is often the case in locations where minimal disturbance construction is employed (*i.e.*, reduced surface disturbance and grading). Spreading of weed seeds is also a concern associated with earth berms that are constructed using imported material. In consideration of these factors, the installation of earth berms is not a practical approach in many cases (*i.e.*, muskeg). Vegetation screening, combined with bends in the right-of-way, are better suited for reducing line-of-sight in caribou range. In addition to natural regeneration, vegetation screens that avoid forage species/legumes attractive to ungulates, can be planted across the right-of-way.

5.0 CRITERIA TO EVALUATE EFFECTIVENESS

Example criteria that can be used to evaluate the effectiveness of the CHRP measures are provided in Table 4. A post-construction monitoring program will be developed as outlined in Certificate Condition 24, which will provide further detail on the criteria by which the effectiveness of the CHRP will be evaluated. The monitoring program will be based on the measurable objectives identified for the CHRP in Section 2.0. The measurable objectives provide a means by which the effectiveness in achieving the identified goals can be measured. The adaptive management component of the monitoring program will facilitate identification of unsuccessful restoration techniques, microsite conditions that are either not conducive or highly suitable for establishment of vegetation, and measures that need to be adjusted or supplemented to achieve the goals of the CHRP.

TABLE 4

EXAMPLE EVALUATION CRITERIA

Goal	Measurable Objective	Evaluation Criteria Examples
Habitat Restoration	Revegetation of the Project footprint that achieves consistent establishment, survival and growth of target (*e.g.*, native woody) species in the short-term, such that natural ecosystems are expected to regenerate over the long-term.	• density (*e.g.*, stems/ha) of target species (*e.g.*, trees and shrubs) • growth measurements (height, percent cover) of target species • survival percentages of planted target species • percent cover of undesired species (*e.g.*, weeds, highly palatable species such as willow and dogwood)
Access Control	Achieve effective human access control over the short-term within segments of the Project footprint where restoration treatments are applied.	• evidence and level of vehicular (ATV, truck) use along the Project right-of-way at treatment sites compared to evidence and level of use at areas paralleling existing disturbance
Block Sight-Lines	Reduce lines-of-sight along the Project footprint using a combination of long-term techniques (*e.g.*, vegetation screens), and measures that may be more effective in the short to medium-term (*e.g.*, constructed visual barriers such as berms or slash piles combined with vegetation plantings).	• vegetation density and/or visibility distance

NGTL intends to conduct post-construction monitoring for the CHRP during years 1, 3 and 5 following completion of restoration. The frequency of monitoring will be re-evaluated after each monitoring program to determine the need for adjustment, and determine whether the goals were achieved and the need for ongoing monitoring.

6.0 SCHEDULE

Scheduling and logistical coordination prior to restoration field work will consider seasonal access constraints, sensitive periods for caribou and other wildlife, lead time needed for production of nursery seedlings, and appropriate timing for reclamation. Initial clean-up and reclamation activities are expected to begin immediately following construction (*i.e.*, winter 2012/2013). Final site selection for caribou habitat restoration treatments and seed collection, if required, will be completed during the first summer following construction (July/August 2013). Scheduling of caribou habitat restoration measures will be coordinated with final clean-up and reclamation of the Project footprint (summer 2013 and 2014).

7.0 CONSULTATION

Table 5 provides a summary of consultation related to the CPP, CHRP, offset measures and monitoring for the Project. Consultation for the Project will continue with Environment Canada and AESRD during the development and implementation of the CHRP and offset and monitoring plans.

TABLE 5

SUMMARY OF CONSULTATION WITH FEDERAL AND PROVINCIAL AUTHORITIES

Agency	Name and Title	Date and Method	Details
Federal Agencies			
Environment Canada	Paul Gregoire, Wildlife Biologist	October 18, 2011 Teleconference	TERA provided a summary of the Project. Environment Canada noted they had reviewed the CPP and the Supplemental Wildlife Report prepared for the Project. A summary of consultation with AESRD related to caribou and caribou habitat was provided. Environment Canada noted that they look to the province (AESRD) to identify any concerns related to caribou and caribou habitat. If AESRD has been actively engaged and have accepted the CPP, then Environment Canada has no specific concerns. The draft Recovery Strategy for Woodland Caribou was discussed. Environment Canada noted that they would rely on AESRD to provide input on the requirement for Project-specific habitat restoration. Environment Canada noted that habitat restoration was an expectation and it was not restricted to the immediate area of the Project and could be applied to abandoned sites elsewhere in the Chinchaga caribou range. Environment Canada noted that AESRD are better suited to comment on local habitat restoration requirements and locations.
Environment Canada	Paul Gregoire, Wildlife Biologist	May 14, 2012 Teleconference May 30, 2012 Follow-up Email	Conference call to discuss caribou-related Certificate Conditions 7, 23 and 24. The following is a summary of Environment Canada's comments. Environment Canada's position is to balance conservation and development, so that we might improve habitat while still allowing development. Restoration and offsets is a way to achieve that balance, and we are experimenting to see what will work. Environment Canada agreed that CHRP goals/measurable objectives might include: no net increase in access (NGTL can only be responsible for their own access activities); habitat restoration; and blocking line-of-sight. There are different approaches to restoration of linear features. Restoration with species similar to adjacent lands can be slow (*e.g.*, black spruce peatlands); planting quicker-growing tree/shrub species that may not be representative of the local vegetation can achieve suitable height for visual blocking faster. A combination of these approaches might be preferred. Location of measures is important. Involve AESRD in prioritizing locations and placement of different methods. Environment Canada advised that when direct disturbance is reclaimed, indirect habitat loss is addressed. Residual caribou habitat disturbance should be quantified as the area of new direct disturbance within the caribou range that is not reclaimed as part of the CHRP, assuming reclamation is successful. Short-term monitoring can provide information on whether plantings are successful. Predicting the effectiveness and value of restoration measures is challenging in practice. Goals may be achieved through monitoring and adaptive management. Implementing multiple measures may increase effectiveness and provide information to support adaptive measures. Environment Canada advised that an offset ratio >1:1 addresses uncertainty with restoration. Ratio of 4:1 is being used on other projects (*e.g.*, Northern Gateway). Since caribou populations are at a critical point, aggressive action is warranted and trying to achieve a 4:1 target offset ratio is recommended. Options for offset measures should focus on restoration of habitat in the affected caribou range as the priority. Offsets should apply within the affected herd's range, and preferably within the core areas of the range (*i.e.*, not on other ranges). Alternate measures such as funding research or regional monitoring are less preferable, and may be considered only after significant effort is made to identify on-the-ground habitat restoration locations and measures to make up the entire target offset. AESRD should be involved in selecting offset locations/measures. Environment Canada suggested that monitoring and adaptive management be incorporated in the assessment. Effectiveness of restoration measures will depend on the right microsite conditions to establish vegetation. Monitoring allows a feedback loop for adaptive measures on sites that are not successfully revegetating.

TABLE 5 Cont'd

Agency	Name and Title	Date and Method	Details
Environment Canada	Amy Wilker Environmental Assessment Coordinator	June 28, 2012 Letter	Environment Canada reviewed a draft version of the Preliminary Caribou Habitat Restoration Plan (Part I). Regarding provincial and federal responsibility for providing guidance related to caribou, Environment Canada clarified that although day to day management of caribou falls under the purview of the Province, the federal government has a responsibility under the *Species at Risk Act* to ensure that the species is being effectively protected; as such, Provincial approval may not necessarily address federal responsibilities. Environment Canada noted that the plan does not refer to offsets, and recommended the plan discuss habitat restoration ratios and logistics of how to achieve them.
Environment Canada	Amy Wilker Environmental Assessment Coordinator	June 29, 2012 Follow-up Email	A follow-up email was sent in response to voice mail from Environmental Canada on June 28, 2012 requesting information about the CPP. The NEB file number (A2A8S5) and AESRD approval reference numbers (NW3-NGTL-CHINCHAGA-2011/2012 and NW4-TCPL-Timberwolf-2012/13), as well as link to the CPP on NEB website were provided.
Environment Canada	Amy Wilker Environmental Assessment Coordinator	August 14, 2012 Email	Environment Canada was e-mailed a revised Preliminary CHRP for review.
Environment Canada	Amy Wilker Environmental Assessment Coordinator	August 15, 2012 Letter	Environment Canada reviewed the Preliminary CHRP and has no further feedback at this time and will await the Final CHRP.
Provincial Agencies			
AESRD	Dave Moyles, Wildlife Biologist	December 13, 2010 Telephone	NGTL should demonstrate how their planned activities adhere to the early in/early out philosophy as opposed to strictly abiding by the caribou timing dates of February 15 to July 15.
AESRD	Bill Johnson, Wildlife Biologist	July 15, 2011 Telephone	AESRD encourages industry to start work as early as possible in the fall so work can be completed early in the winter. Mitigation recommended by AESRD in caribou areas includes the following. - Line-of-sight: prefer line-of-sight measures to be installed at regular intervals along rights-of-way. AESRD encourages companies to implement line-of-sight measures on new linear corridors as well as where rights-of-way parallel existing corridors. Line-of-sight measures typically include vegetated visual screens made up of transplanted vegetation or nursery seedlings, or earth berms. - Access management: the purpose is to deter humans from driving on rights-of-way with trucks, ATVs or snowmobiles. AESRD noted that appropriate locations for rollback in the Project area are likely limited given the nature of the forest cover, and since it is not effective to deter access for very long. AESRD suggests earth berms (2 m high) be installed at intersections of the proposed pipeline rights-of-way with existing corridors. Vegetated screens can also be used.
AESRD	Dave Moyles, Wildlife Biologist	August 19, 2011 Email	AESRD was provided a copy of the CPP. TERA requested that AESRD provide comments on the CPP should they have any. No comments were provided by AESRD.
AESRD	Dave Moyles, Wildlife Biologist	October 26, 2011 Telephone	Discuss habitat restoration. AESRD noted this is a topic that will need to be addressed in detail. Discussed habitat restoration options in relation to the Northwest Mainline Expansion Project.
AESRD	Dave Moyles, Wildlife Biologist	April 16, 2012 Telephone	Review and discuss the comments related to caribou in the NEB Reasons for Decision (Certificate Conditions 7, 23 and 24).
AESRD	Dave Moyles, Wildlife Biologist	June 11, 2012 Meeting in Peace River	Discuss restoration techniques and possible locations for offset opportunities.
AESRD	Dave Moyles, Wildlife Biologist	August 14, 2012 Email	AESRD was e-mailed a revised Preliminary CHRP for review.

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APPENDIX A

RESTORATION CONSIDERATIONS FOR SELECT RECLAMATION SPECIES

Species	Restoration Considerations
Black Spruce	Black spruce appears to grow well when there is sufficient sunlight and on well-drained upland sites, particularly in mixedwood forests, and on wider corridors where greater exposure to the sun may warm soils, and where enhanced microsites are created by mounding or slash rollback (CRRP 2007b). Black spruce seedling growth may be limited by nutrient deficiency common in treed muskegs. The OSLI has reported positive results with planting frozen nursery-grown black spruce seedlings during winter in wetland areas of northeastern Alberta (OSLI 2012), although longer term monitoring is required to attain conclusive results.
White Spruce	White spruce requires well-drained and nutrient rich soils to grow, such as some upland mixedwood forests. Disturbance or reduction of surface organic soils as a result of construction affects success of restoration using white spruce on disturbed areas (CRRP 2007b).
Lodgepole Pine	Pine grows well in a variety of site types, despite limitations such as low light and lack of nutrient rich soils (CRRP 2007b). Soils must be relatively well drained.
Alder	Many shrub species (*e.g.*, willow) are not considered suitable for planting to restore caribou habitat due to their high palatability for primary prey (CRRP 2007b). Alder generally has low browse value for ungulates such as moose and deer. Sites that are difficult to treat using mechanical site preparation methods (*e.g.*, mounding) can benefit from inter-planting alder with conifers. When alder is interspersed with conifer plantings, human access on linear features can be reduced over the medium-term (*i.e.*, alder's faster growth compared to conifers helps to reduce visibility and make travel difficult), and the nitrogen-fixing characteristics of alder will provide soil enhancement (Sanborn *et al*. 2001, Sweeney 2001), potentially promoting improved conifer growth over the long-term (Simard and Heineman 1996, BC Forest Service 2001). Additional benefits of planting alder include: its ability to increase soil porosity by reducing soil compaction; quick growth (relative to conifers), which can assist with soil stabilization where erosion may be a problem; and leaf litter, which helps re-establish the forest floor where extensive disturbance to surface soils is a problem (Robb 2001, CRRP 2007b). However, the fast growth of alder may reduce growth rates of conifer plantings due to competition when alder densities are high (Simard and Heineman 1996, CRRP 2007b).
Hardwood Trees (*e.g.*, aspen, poplar, cottonwood)	Similar to shrubs, hardwood trees have relatively fast growth rates. Since their growth is less dense than shrubs such as alder, hardwood trees are less likely to out-compete conifers. The fast root growth of hardwood trees can effectively reduce soil compaction, which provides a natural alternative to costly and highly disruptive mechanical site preparation. They are also better adapted to unfavourable site conditions (*e.g.*, wet or compacted areas) than conifers. Deciduous trees provide leaf litter to enhance surface soil properties. They may also improve conifer growth in mixed plantings by deflecting browse and moderating temperatures, although their fast growth can out-compete or slow conifer growth. Seed and nursery stock for hardwood trees is not as readily available as for conifers, and less information on site characteristics, propagation and planting requirements are available for some hardwood species compared to conifers (CRRP 2007b).