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May 1, 2015

Filed Electronically

National Energy Board
517 Tenth Avenue SW
Calgary, Alberta T2R 0A8

Attention: Ms. Sheri Young, Secretary of the Board

Dear Ms. Young:

Re: NOVA Gas Transmission Ltd. (NGTL)
Chinchaga Lateral Loop No. 3
Condition 10, Certificate GC-121
Revised Final Caribou Habitat Restoration Plan
NEB File: OF-Fac-Gas-N081-2011-05 02

In accordance with Condition 10 of Certificate GC-121, NGTL encloses for filing with the Board its revised Final Caribou Habitat Restoration Plan (CHRP) for the Chinchaga Lateral Loop No. 3 (Project). The Final CHRP for the Project was originally filed on November 7, 2014 (NEB Filing ID: A64196). However, based on feedback received from the National Energy Board (NEB), NGTL has updated the Final CHRP for the Project as follows:

- Additional information regarding line-of-sight mitigation, including how topography and bends in the right-of-way were considered, has been added to Section 2.5. Details on the location of line-of-sight breaks were also added to Table 5.
- Section 2.1 has been updated to provide clarification regarding the number of vegetation species expected to re-vegetate naturally, without planting.
- Effectiveness monitoring of access control and line-of-sight blocking measures using remote, motion-triggered cameras have been incorporated into Section 6.1.2.
- Further detail on monitoring targets and measures and how they link to the Caribou Habitat Restoration and Offset Measures and Monitoring Plan (CHROMMP) is provided throughout Section 6.0.
- The monitoring period of the revised Final CHRP has been increased from five years to fifteen years.
- The consultation tables in Section 7 have been updated to include the updated record of correspondence specific to the Final CHRP.

For ease of reference, both a clean and blacklined versions of the revised Final CHRP have been included with this filing.

If the Board requires additional information with respect to this filing, please contact me by phone at (403) 920-7732 or by email at steph_brown@transcanada.com.

Yours truly,
NOVA Gas Transmission Ltd.

Original signed by

Stephanie Brown
Regulatory Project Manager

Attachment

cc: Mr. Dan Barghshoon, NEB Operations Manager

Revised Final Caribou Habitat Restoration Plan for the Chinchaga Lateral Loop No. 3 (Chinchaga Section) May 2015

Prepared for:
NOVA Gas Transmission Ltd.
A Wholly Owned Subsidiary of
TransCanada PipeLines Limited
Calgary, Alberta

Prepared by:
Stantec Consulting Ltd.
Sidney, British Columbia
and
TransCanada PipeLines Limited
Calgary, Alberta

May 1, 2015

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Abbreviations

AESRD	Alberta Environment and Sustainable Resource Development
CHRP	Caribou Habitat Restoration Plan
CHROMMP	Caribou Habitat Restoration and Offset Measures Monitoring Plan
CPP	Caribou Protection Plan
CSA	Canadian Standards Association
EAS	Environmental Alignment Sheets
EC	Environment Canada
GoA	Government of Alberta
Ha	hectare
M	metre
NEB	National Energy Board
NGTL	NOVA Gas Transmission Ltd.
OMP	Offset Measures Plan
ROW	right-of-way

1 INTRODUCTION

This report describes the revised Final Caribou Habitat Restoration Plan (CHRP) for the NOVA Gas Transmission Limited (NGTL) Chinchaga Lateral Loop No. 3 project (the Project). The Final CHRP for the Project was originally filed on November 7, 2014 (NEB Filing ID: A64196). However, based on feedback received from the National Energy Board (NEB) in March 2015, NGTL has revised the Final CHRP for the Project and made the following modifications:

- Additional text about how line-of-sight will be mitigated, including how topography and bends in the right-of-way were considered, has been added to Section 2.5. In addition, details on the location of line-of-sight breaks were added to Table 5.
- Clarification was added to Section 2.1 that greater than one vegetation species is expected to re-vegetate naturally, without planting.
- Effectiveness monitoring of access control and line-of-sight blocking measures using remote, motion-triggered cameras has been incorporated into Section 6.1.2 of the revised Final CHRP.
- Further detail on monitoring targets and measures and how they link to the Caribou Habitat Restoration and Offset Measures and Monitoring Plan (CHROMMP) is provided throughout Section 6.0.
- The monitoring period of the revised Final CHRP has been increased from five years to fifteen years.
- The consultation tables in Section 7 contain an updated record of correspondence specific to the Final CHRP.

NGTL, a wholly owned subsidiary of TransCanada PipeLines Limited, applied to the NEB under section 52 of the National Energy Board Act (NEB Act) for authorization to construct and operate the Project. The Project is a 33 km long pipeline that parallels an existing right-of-way (ROW) for 31 km, 94% of the route (Figure 1). The NEB requires that NGTL meet several conditions of Certificate GC-121. NGTL prepared this revised Final CHRP in accordance with Certificate GC 121, Condition 10b. The Preliminary CHRP (NEB Filing ID: A54279) focused on lessons learned from existing literature on habitat restoration to identify the strategies and actions that can be feasibly implemented to promote restoration of disturbed caribou habitat within the Project footprint (i.e., the construction ROW and temporary workspace) located in the Chinchaga caribou range. Based on the literature review, measures suitable for implementation were identified, and a guide developed to identify sites within the Project footprint where certain restoration measures would be appropriate. This revised Final CHRP provides site-specific information on the implementation of restoration measures and an assessment of residual effects of the Project on caribou habitat.

1.1 ORGANIZATION OF THE FINAL CHRP

The revised Final CHRP is organized to address each requirement of Certificate Condition 10b (Table 1). The requirements of Certificate Condition 10b state that the Final CHRP must include:

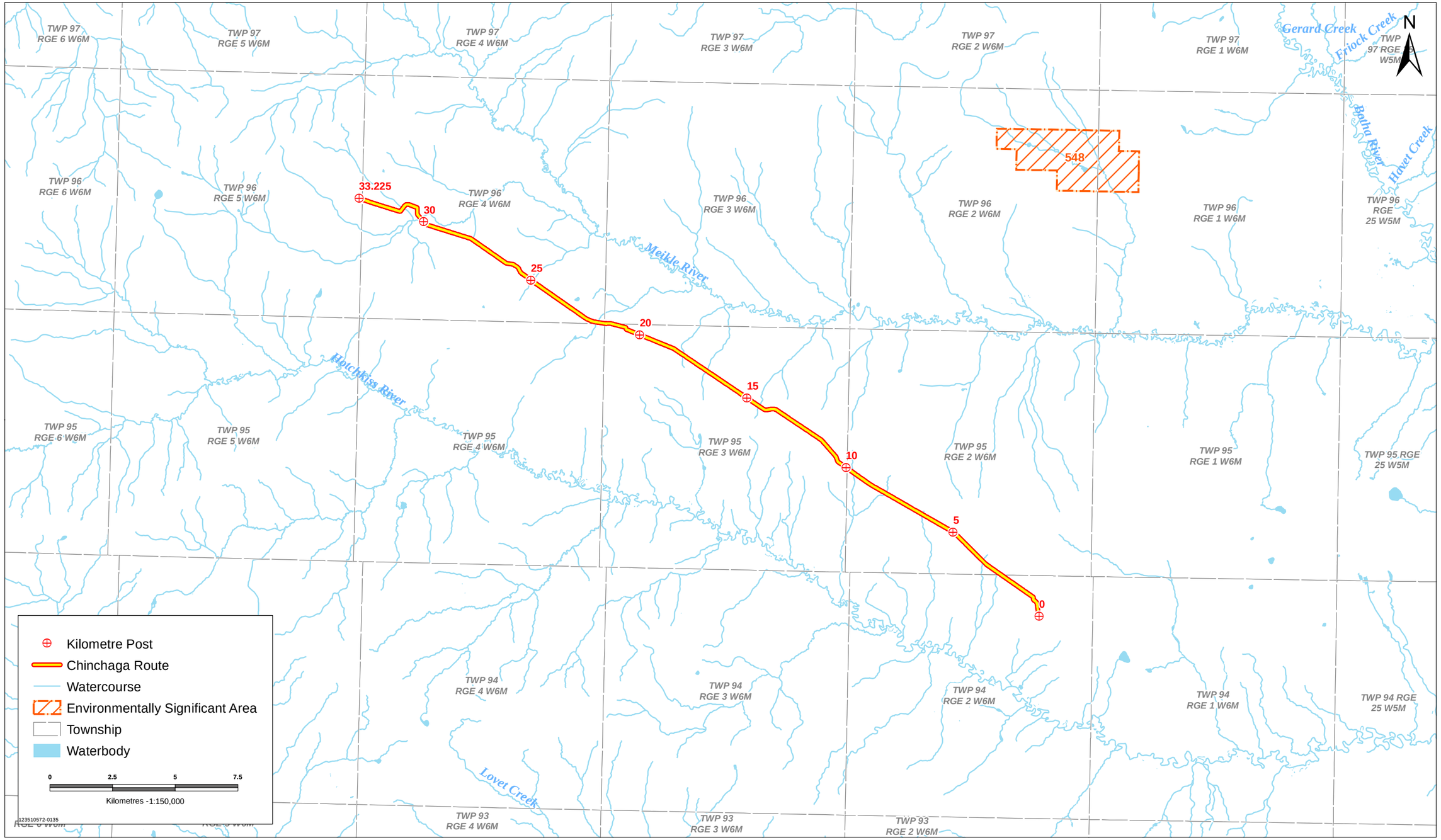
- The Preliminary CHRP, with any updates identified in a revision log that includes the rationale for any changes to decision making criteria
- A complete table of caribou habitat restoration sites, including but not limited to location, spatial area, description of habitat, site-specific restoration activities and challenges
- Maps or Environmental Alignment Sheets showing the locations of the sites
- Evidence and summary of consultation with Environment Canada and provincial authorities regarding the Final CHRP
- A quantitative and qualitative assessment of the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the areal extent of the resulting residual effects to be offset, which also includes indirect disturbance

The restoration goals and objectives of the revised Final CHRP are described in Section 2.0. Specifically, Section 2.0 builds on the Preliminary CHRP and describes how habitat will be restored for boreal woodland caribou (*Rangifer tarandus caribou*). Section 3.0 describes information from the Preliminary CHRP (Appendix A) that was updated in the Final CHRP. This includes results of an updated literature review (completed June 2014 and revised throughout preparation of the Final CHRP). Section 4.0 describes the specific restoration sites. This section includes a table describing the location, habitat, timing and restoration activities and challenges along the entire Project ROW. This information is supplemented by Environmental Alignment Sheets that are provided in Appendix B. Section 5.0 describes the predicted direct and indirect residual effects of the Project on caribou habitat. Section 6.0 describes the monitoring and adaptive restoration framework for the Project. Finally, Section 7.0 provides a summary of consultation with Environment Canada (EC) and Alberta Environment and Sustainable Resource Development (AESRD). The revised Final CHRP expands on the Preliminary CHRP to provide more specific information on the location of restoration sites and specific restoration measures, as well as an assessment of residual effects of the Project on caribou habitat. A Final Offset Management Plan (OMP) in 2016 (Certificate Condition 20) and a Final CHROMMP (Certificate Condition 21), which describes the monitoring program for restoration measures applied to the Project footprint and the offset locations, will be filed in 2015.

Table 1 Certificate Condition 10: Caribou Habitat Restoration Plan

Certificate Condition	Details and Location in Report
10. Caribou Habitat Restoration Plan NGTL shall file with the Board for approval, in accordance with the timelines below, preliminary and final versions of a CHRP for the Chinchaga Section. NGTL shall provide a copy of the filings to Environment Canada and the appropriate provincial authorities.	
a. Preliminary CHRP –to be submitted at least 180 days prior to commencement of construction for the Chinchaga Section. This version of the CHRP shall include, but not be limited to: i. The objectives of the CHRP.	• The Preliminary CHRP is provided in Appendix A. • The goals and objectives of the revised Final CHRP (Section 2.0) have been modified from the Preliminary CHRP to provide more detail and clarity on measurable targets and evaluation criteria.
ii. A decision tree(s) that will be used to (1) prioritize potential caribou habitat restoration sites and (2) prioritize mitigation to be used at different types of sites. The decision tree(s) should be based on a literature review identifying temporal and spatial caribou habitat restoration methodologies and their relative effectiveness, as well as based on typical site factors that may constrain implementation.	• Appendix A(Preliminary CHRP) and Figure 2a, 2b and 2c in the revised Final CHRP
iii. The quantifiable targets and performance measures that will be used to evaluate: (1) the extent of predicted, residual effects, (2) the extent to which the objectives have been met and the need for consequent compensation offsets.	• Appendix A (Preliminary CHRP) • The evaluation criteria and measurable targets are provided in the Section 6.1 of the revised Final CHRP.
iv. A schedule indicating when mitigation measures will start and the estimated completion date.	• Appendix A (Preliminary CHRP) • Updated and revised schedule is in Section 4.1 of the revised Final CHRP.
v. Evidence and a summary of consultation with Environment Canada and provincial authorities regarding the CHRP.	• Appendix A (Preliminary CHRP) • Section 7.0 of the revised Final CHRP

Certificate Condition	Details and Location in Report
b. Final CHRP – was submitted on 7 November . This updated version of the CHRP included, but was not be limited to: i. Preliminary CHRP, with any updates identified in a revision log that includes the rationale for any changes to decision making criteria. 1. Note that this version of the CHRP has been revised to address additional comments provided by the NEB (see Section 1.0 of the revised Final CHRP) and submitted 1 May 2015	• Deadline extended to May 2015 to align with CHROMMP • Appendix A (Preliminary CHRP) • Updates to the Preliminary CHRP are outlined in Section 3.0 and the revision log (Table 3), including: – Updates to objectives in Section 2.0 of the revised Final CHRP. – Updates and further detail on criteria to evaluate effectiveness in Section 6.1 of the revised Final CHRP. – Updates and further detail on the Schedule in Section 4.1 of the Final CHRP.
ii. A complete table of caribou restoration sites, including but not limited to location, spatial area, description of habitat quality, site-specific restoration activities and challenges.	• Section 4.0 (Table 5) of the revised Final CHRP
iii. Maps or Environmental Alignment Sheets showing the locations of the sites.	• Appendix B: Environmental Alignment Sheets
iv. Evidence and summary of consultation with Environment Canada and provincial authorities regarding the Final CHRP.	• Appendix A (Preliminary CHRP) • Section 7.0 of the Final CHRP (Table 7)
v. A quantitative and qualitative assessment of the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the areal extent of the resulting residual effects to be offset, which also includes indirect disturbance.	• Section 5.0 of the Final CHRP



NOVA Gas Transmission Ltd. (NGTL) - Northwest Mainline Komie North Extension - Chinchaga Section

Project Location within the Chinchaga Caribou Range

Acknowledgements: Base data supplied by the Government of Alberta. Route information provided by TransCanada Pipelines Ltd. and MidWest Surveys Inc. Imagery provided by MidWest Surveys Inc.

PREPARED BY: Stantec

PREPARED FOR: NGTL

FIGURE NO.: 1

Last Modified: 20141028 By: bcurry

1.2 GUIDELINES FOR BOREAL CARIBOU

This CHRP was developed in considering current regulatory policies specific to boreal woodland caribou. This includes the *Woodland Caribou Policy for Alberta* (Government of Alberta [GoA] 2011), which 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, and legislative and social considerations. A key strategy in this policy is the development of range-specific assessments and objectives (i.e., Action Plans), 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 specific Action Plan for the Chinchaga Caribou Herd range has not yet been completed, but strategies in the *Woodland Caribou Policy for Alberta* were followed in the CHRP.

Similar to the provincial policy, the recovery strategy for the woodland caribou, boreal population, in Canada (Environment Canada 2012) stresses the importance of landscape level planning, incorporating caribou habitat requirements into fire management plans, establishing key protected areas and incorporating adaptive management. One of the management approaches suggested in the federal recovery strategy to address the effects of habitat alteration on caribou is to undertake coordinated actions to reclaim boreal caribou habitat through restoration efforts. This includes restoration of industrial features such as roads, seismic lines, pipelines, cut lines and clearings (Environment Canada 2012). The revised Final CHRP defines caribou habitat in the same terms as the recovery strategy, i.e., any habitat within defined caribou herd ranges. Therefore, all habitat affected by the Project is considered caribou habitat, as the Project is entirely within the Chinchaga Caribou Herd range. NGTL continues to engage with AESRD to align all of their caribou habitat restoration, offsetting and monitoring plans with emerging provincial caribou policies, plans and priorities (see Section 7.0).

2 GOAL AND OBJECTIVES OF THE FINAL CARIBOU HABITAT RESTORATION PLAN

The goal of the revised Final CHRP is to minimize "residual effects" of the Project on caribou habitat. Residual effects are environmental effects predicted to remain after mitigation is applied. The Final CHRP supplements the Preliminary CHRP by detailing the location and type of restoration that is planned along the Project ROW, and by predicting residual effects requiring caribou habitat offsetting measures. The approach to validate residual effects predictions and restoration success is described in the revised Final CHRP, with the detailed adaptive management plan to be described in the CHROMMP. The CHROMMP also describes adaptive management action that will be implemented on the Project footprint if CHRP measures don't achieve their targets.

The revised Final CHRP will achieve the goal of minimizing residual effects of the Project by implementing three mitigation objectives:

1. Habitat restoration through native re-vegetation that achieves establishment, survival and growth of target vegetation species in the short term, such that ecosystems on the ROW regenerate over the long term to similar ecosystems as those adjacent to the ROW
2. Effective access control over the short term within segments of the Project footprint
3. Line-of-sight reduction along the ROW using barriers, such as screens and vegetation

The rationale for applying these mitigations measures was first described in detail in the Preliminary CHRP (Stantec 2013) and has been included in the revised Final CHRP. This rationale includes 'decision trees' that describe how each of the mitigation measures was applied to the Project based on habitat type and site characteristics (Figure 2a, 2b and 2c).

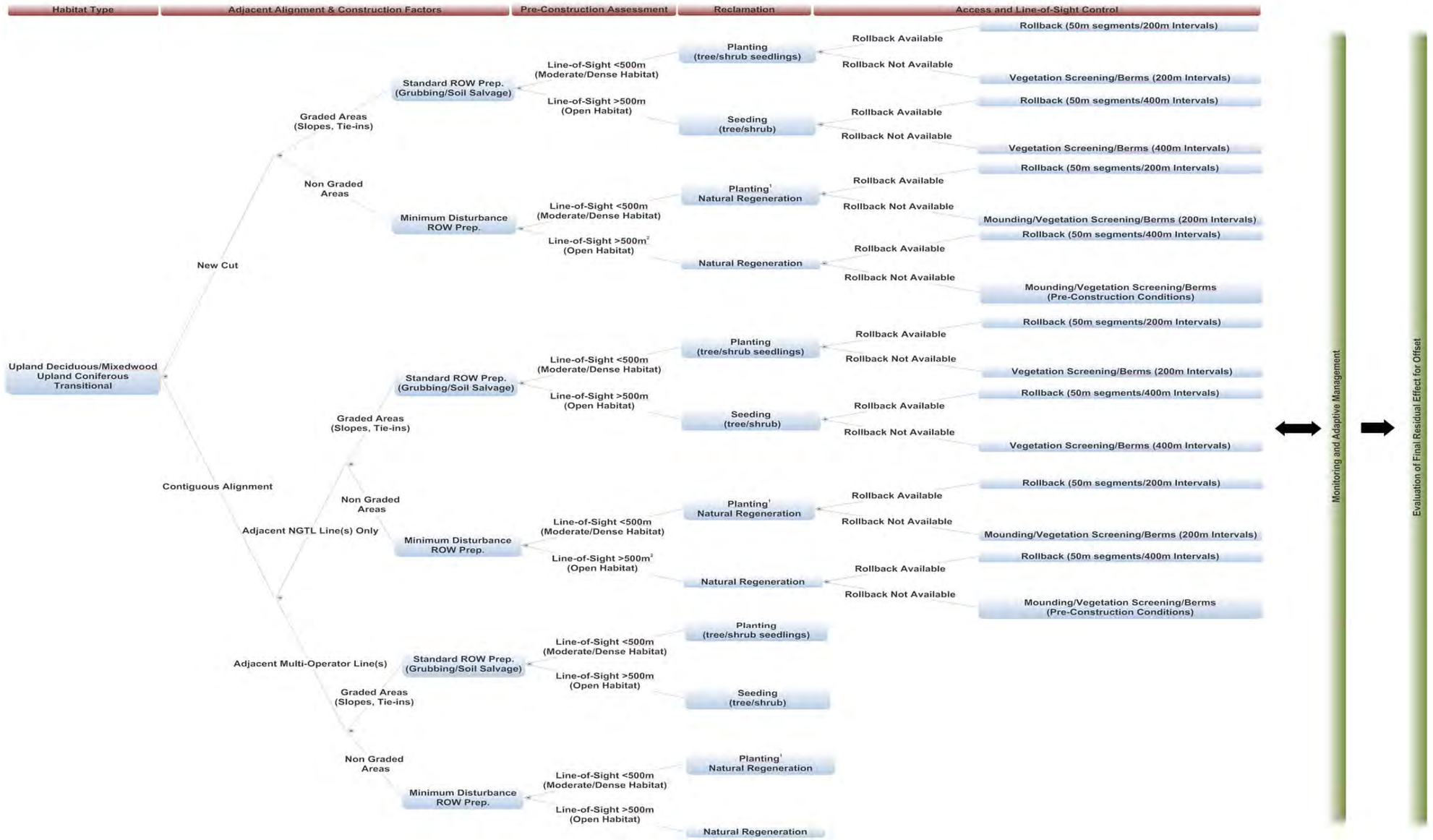
2.1 EVALUATION CRITERIA AND MEASURABLE TARGETS

Evaluation criteria are the quantifiable restoration parameters that will be measured during monitoring to evaluate restoration effectiveness. Measurable targets are the criteria that will be used to determine whether the CHRP objectives have been achieved. Overall, the site conditions specific to the Project were a key factor in the development of the measurable targets (see Figures 2a, 2b and 2c), including the natural site characteristics, existing disturbance features and activities, regulatory requirements, and construction methods.

The need to maintain operational access, site conditions specific to the Project and natural variation (using Alberta Environment [AENV] 2001 as a guideline) are considered in the measurable targets provided in Table 2. The Reclamation Assessment Criteria for Pipelines (AENV 2001) recommends that equivalent land capability should take into account natural variability, which is the range of biophysical landscape conditions in an area, for example, slope, drainage, vegetation composition, and organic matter. This guideline specifies that equivalent

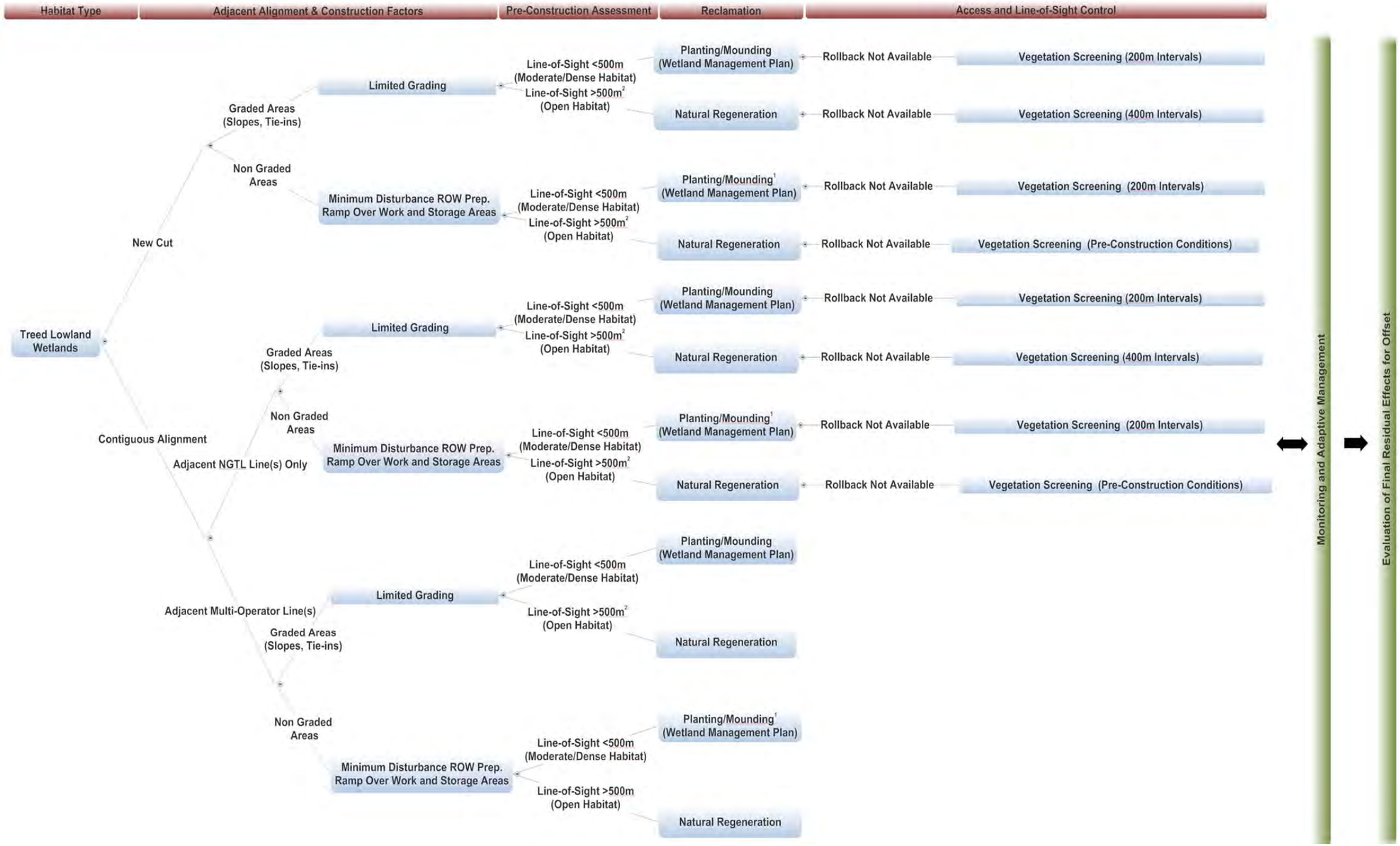
land capability is achieved when the reclaimed ROW restoration targets (i.e., evaluation criteria) fall within 20% of natural variability in the surrounding environment (AENV 2001). This implies that when natural variation is considered, habitat restoration may be considered successful when a minimum of 80% of the restored area is re-vegetated (e.g., 100% survival minus 20% due to natural variability). Similarly, reforestation standards in Alberta require a minimum of 80% stocking of regeneration sites (AESRD 2013a). Therefore, the equivalent land capability criterion was incorporated into the measurable targets for upland forest restoration units for the Project.

Goal and Objectives of the Final Caribou Habitat Restoration Plan
April 30, 2015



Note: (1) Habitat-specific planting to accelerate natural regeneration in areas of minimal disturbance ROW preparation with line-of-sight < 500 m will be considered from detailed habitat information as part of Condition 7. (2) In areas of new cut or contiguous alignment with NGTL lines only, where minimum disturbance ROW preparation and pre-construction line-of-sight extends > 500 m on-easement (i.e., open habitat), line-of-sight blocking will be placed at intervals that achieve pre-construction conditions as determined by Condition 7.

Figure 2a Chinchaga Lateral Loop No.3 – Caribou Habitat Restoration Site Selection and Mitigation Prioritization Decision Tree (Upland Mixedwood/Upland Coniferous/Transitional Habitat)



Note: (1) Habitat-specific planting to accelerate natural regeneration in areas of minimal disturbance ROW preparation with line-of-sight < 500 m will be considered from detailed habitat information as part of Condition 7. (2) In areas of new cut or contiguous alignment with NGTL lines only, where minimum disturbance ROW preparation and pre-construction line-of-sight extends > 500 m on-easement (i.e., open habitat), line-of-sight blocking will be placed at intervals that achieve pre-construction conditions as determined by Condition 7.

Figure 2b Chinchaga Lateral Loop No.3 – Caribou Habitat Restoration Site Selection and Mitigation Prioritization Decision Tree (Treed Lowlands and Wetlands)

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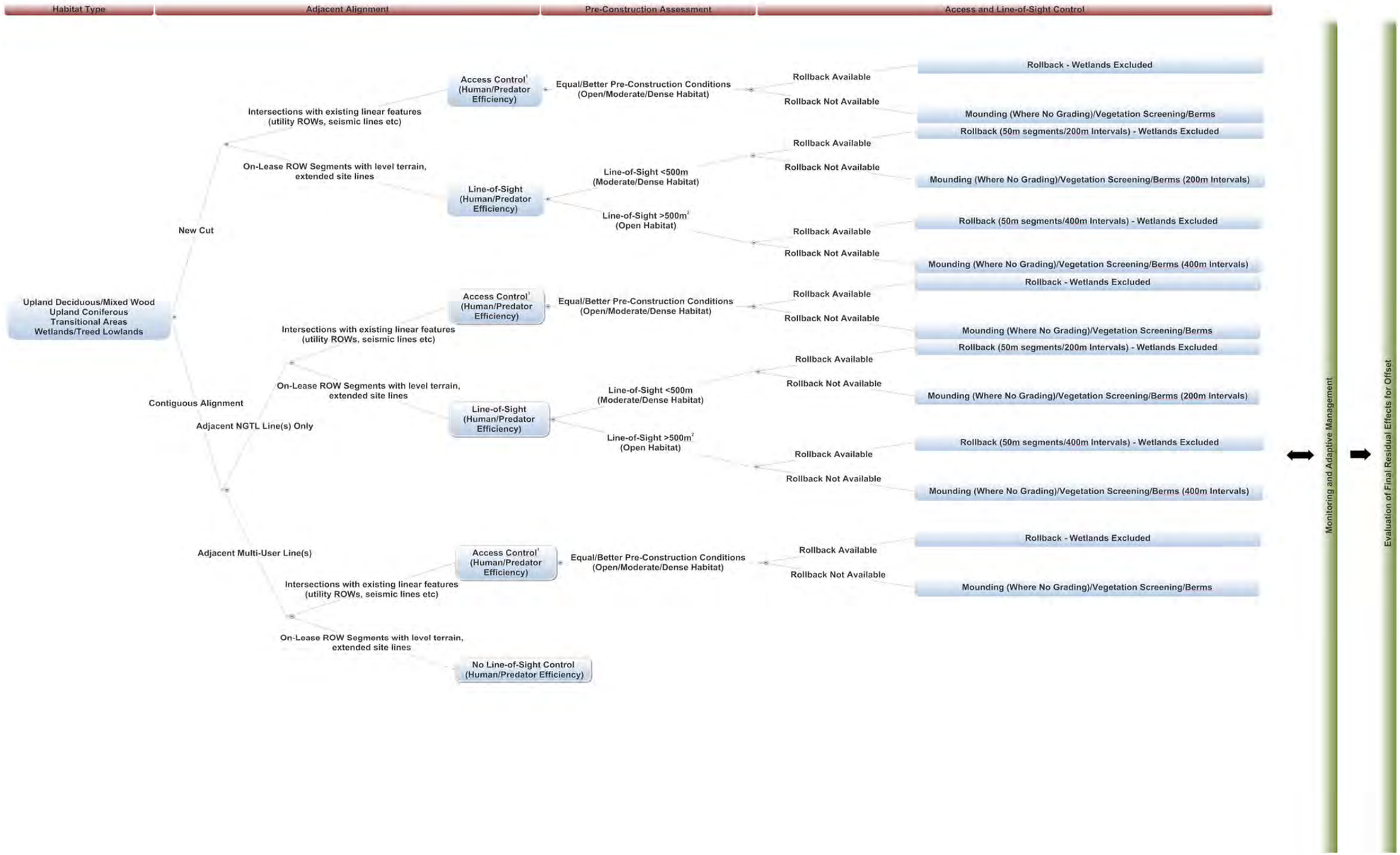

Note: (1) Access control at intersecting existing linear features (i.e., utility ROW, seismic lines etc.) will not be implemented or inhibit traditional use.

Figure 2c Chinchaga Lateral Loop No.3 – Caribou Habitat Restoration Site Selection and Mitigation Prioritization Decision Tree (Line-of-Sight and Access Control)

Goal and Objectives of the Final Caribou Habitat Restoration Plan
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Table 2 CHRP Objectives, Evaluation Criteria and Measurable Targets

Objective	Monitoring Method	Evaluation Criteria	Measureable Targets	Adaptive Management
Habitat Restoration	Aerial Monitoring LiDAR Imagery 360 Photography Ground-Based Monitoring Establishment Surveys Performance Surveys	Total density of planted seedlings and naturally regenerating seedlings (i.e., from seed ingress or suckering) Height and percent cover of seedlings Vigour of seedlings (evidence of chlorosis, pests/disease, browse, other damage) Vegetation community composition (percent cover, species present, abundance): conifer tree deciduous tree palatable shrub non-palatable shrub herb/graminoid nonvascular (mosses and lichens) introduced (non-native, weed, invasive)	Habitat restoration measurable targets are designed to demonstrate restoration success in terms of survival and sustained growth trends following completion of restoration. **Upland Conifer, Deciduous, Mixedwood and Transitional**: Seedling density will vary by species with target range from 1600 to 2000 stems/ha (combined planted seedlings and/or natural regeneration) on sites that are not mounded. Seedling density will vary by species with target range from 800 to 1400 stems/ha (combined planted seedlings and/or natural regeneration) on mounded sites, dependent on mound density. Spatial distribution of seedlings (combined planted seedlings and/or natural regeneration) ≥80% of the restoration unit (footprint available for restoration). ≥80% of the tree seedlings (planted and/or natural regeneration) demonstrate sustained growth trends since time of planting (i.e., increasing values for height and percent cover). **Treed Lowlands**: Natural vegetation is regenerating, including at least two characteristic species (vascular and/or nonvascular; e.g., Carex sp. and Sphagnum moss sp.) (classified as per Halsey et al. 2004). As indicators of healthy vegetation community, no restricted weeds or invasive species such as cattails or reed grass. ≥80% cover of native vegetation species in the project footprint. Where tree seedlings are planted (e.g., mounded sites): seedling density of 400 to 1000 stems/ha (combined planted seedlings and/or natural regeneration), dependent on mound density continuous spatial distribution of seedlings (combined planted seedlings and/or natural regeneration) ≥80% of the restoration unit ≥70% of the tree seedlings (planted and/or natural regeneration) demonstrate sustained growth trends since time of planting (i.e., increasing values for height and percent cover). **Shrub/Graminoid Lowlands**: Natural vegetation is regenerating, including at least two characteristic species (as per Halsey et al. 2004). No restricted weeds. ≥80% cover of native vegetation species in the project footprint.	Adaptive management actions for habitat restoration are implemented at sites where the measurable targets have not been met and take into consideration site conditions and other ecological factors that may affect successful restoration. **Upland Conifer, Deciduous, Mixedwood and Transitional**: If seedlings (planted or natural regeneration) are damaged due to human access, assess and modify access control measures and plant seedlings to maintain desired seedling density targets. If seedlings (planted or natural regeneration) are damaged due to disease, plant seedlings to replace those that have died to maintain desired seedling density targets. If seedling growth/vigour (planted or natural regeneration) is impeded by competition from surrounding vegetation, such as grasses, implement spot spraying or manual vegetation control to reduce competition pressure and plant seedlings to maintain desired seedling density targets. **Treed Lowlands**: If establishment and growth of planted seedlings is impeded by wet site conditions (e.g., flooding and ingress of invasive species such as cattails), modification of surface drainage patterns may be implemented to facilitate near-surface water flow. If natural regeneration of vegetation is impeded, plant alder seedlings to facilitate natural regeneration of shrubs. If noxious weed species occur on the Project ROW or on offset locations, implement spot spraying or manual control measures to manage weed populations. **Shrub/Graminoid Lowlands**: If natural regeneration is impeded by wet site conditions (e.g., flooding and ingress of invasive species such as cattails), modification of surface drainage patterns) may be implemented to facilitate near-surface water flow. If natural regeneration of vegetation is impeded, plant alder seedlings to facilitate natural regeneration of shrubs. If noxious weed species occur on the Project ROW or on offset locations. implement spot spraying or manual control measures, as required to manage weed populations.

Goal and Objectives of the Final Caribou Habitat Restoration Plan
April 30, 2015

Objective	Monitoring Method	Evaluation Criteria	Measureable Targets	Adaptive Management
Access Control	Aerial Monitoring LiDAR Imagery 360 Photography Ground-Based Monitoring Establishment Surveys Performance Surveys Remote Camera Monitoring	Evidence and level of vehicular use along the Project ROW and at offset locations will be measured using subjective criteria ratings, as follows: Evidence of access: Yes/No Evidence of U-turns at access barriers: Yes/No Motorized access type: all-terrain vehicle truck other Access level metrics: absent low (tracks/trail evident but difficult to discern or appear to be infrequently used) high (tracks/trails appear to be well-used; vegetation is trampled down; bare ground might be visible from frequent use)	Access control targets are designed to demonstrate human access is prevented and/or limited to low levels within five years following completion of restoration activities in caribou range: No evidence of motorized access via entry points where access control measures are installed on the Project ROW or in offset locations. Success of habitat restoration targets, specifically sustained growth trends, is a good indicator that human access is not inhibiting habitat restoration.	Adaptive management actions for access control will enhance or alter current access control measures to improve the effectiveness of these measures for limiting human use of areas undergoing restoration. The location, and source and type of access will be investigated, with enhanced access controls added where evidence of access is identified. This will be in the form of physical access barriers such as enhanced use of coarse woody debris, tree felling/tree bending (Cody 2013; Golder 2014), large rocks or fencing.
Line-of-Sight Breaks	Aerial Monitoring LiDAR Imagery 360 Photography Ground-Based Monitoring Establishment Surveys Performance Surveys Remote Camera Monitoring	Woody debris (log)/earth berms: footprint width length of berm (perpendicular to ROW) length of berm with height ≥1.5 m sight-line model results Vegetation screens: spatial distribution (distance between live woody stems) height of live woody stems percent cover of live woody stems	Line-of-sight breaks are designed to block sight lines along sections of new alignment of the Project ROW and at offset locations within five years following completion of restoration in caribou range. Line-of-sight is limited to ≤500 m along the linear feature in upland forested areas. Where log/earth berms are installed to break the line-of-sight, berms are in good condition and functional (in terms of blocking line-of-sight). Where vegetation screening is used to break the line-of-sight: seedling densities and growth trends meet the targets for habitat restoration line-of-sight breaks are in good condition and functional (in terms of blocking line-of-sight)	Adaptive management actions for line-of-sight breaks will enhance the effectiveness of line-of–site measures and include: Where log/earth berms are installed, repairing berms to maintain height and length requirements (i.e., revegetating berm to prevent erosion). Implementing adaptive management actions associated with habitat restoration to create effective vegetation screens as line-of-sight breaks. For example, adding alder seedlings to a site to enhance rate of shrub growth for establishment of a line of site or use of tree-felling or tree-bending (Cody 2013, Golder 2014), across the ROW where there is suitable thick, adjacent forest cover of either non-merchantable or merchantable coniferous trees.

Additional guidelines were consulted when developing the measurable targets for the CHRP. Reclamation criteria and guidelines for forested areas in Alberta and reforestation standards in Alberta specific to the Project area (AENV 2010, 2011; AESRD 2013a) were used to set measurable targets for tree seedling densities in upland forested and transitional restoration units. Target seedling densities in areas with mounding were adjusted to reflect the limited number of suitable planting sites that results from mounding.

The CHRP measurable targets applied to upland forest restoration units are not suitable for treed and shrubby lowland restoration units encountered within the Project footprint. The lowland restoration units typically have relatively slow rates of vegetation establishment and growth (i.e., wet sites can take longer than 50 years to recover; van Rensen et al. 2015), making tree seedling establishment and growth less certain. Rather, guidelines for wetland reclamation associated with oil sands mining (AENV 2008) may be used, but they focus on disturbance types that are not applicable to pipeline construction and operation. In addition, current research on reclamation of bogs and fens (i.e., the treed and shrubby lowland restoration units addressed in this CHRP) is in experimental stages and is not addressed in the current guidelines. The *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (AENV 2010) includes specifications for various indicators using an "end land use" approach that targets reclamation of commercial forests, which conceptually provide other ecosystem functions, including wildlife habitat. However, the application of these guidelines to the CHRP needs to be approached with caution, since they relate to a very different disturbance type (i.e., bitumen mining versus pipeline ROW) and are developed for different natural subregions and objectives. With these limitations in mind, it is recognized that the AENV guidelines for oil sands reclamation are developed for boreal forests with similar attributes to those on the Project and, therefore, the thresholds and indicators were used to guide the development of measurable targets for the CHRP. In particular, the measurable targets associated with treed and shrubby lowland restoration units incorporated the concept of plant community composition as an appropriate indicator to assess reclamation status and progress (AENV 2010).

Plant community composition as described in the *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (AENV 2010) and characteristics of healthy plant communities within lowlands (i.e., the number and abundance of characteristic species found in undisturbed native wetland plant communities and the number of restricted weeds; Cibrowski et al. 2012) were used to develop measurable targets for the lowland restoration units in this CHRP. AENV 2010 suggests a threshold of two characteristic species in wet poor sites, which was derived to be conservative (low) with respect to realistic reclamation success. Given the much lower disturbance level associated with pipeline construction and operation compared with oil sands mining, two characteristic species within a 15 year monitoring period is likely a reasonable measurable target and therefore has been adopted for restoration of the lowland restoration units (Table 2). Characteristic species may include vascular and non-vascular plants, provided they are species found in the adjacent undisturbed native plant community. They are not limited to the two tree species that will be planted (i.e., white spruce and black spruce), but also other native vegetation species that will naturally re-vegetate the ROW (see Section 6.1.1). The other

measurable targets are the absence of restricted weeds to indicate vegetation community health and 80% vegetation cover by characteristic species.

The evaluation criteria and measurable targets are summarized in Section 2.1. As noted above, the site conditions specific to the Project were a key factor in the development of the measurable targets, including the natural site characteristics, existing disturbance features and activities, regulatory requirements, and construction methods.

The ability to achieve the CHRP measurable targets will be dependent, in part, on future development activities. NGTL recognizes that habitat restoration implemented to reduce the Project's residual effects may be at risk of disturbance due to ongoing industrial activity in proximity to the project footprint.

NGTL will include terms and conditions in new and existing crossing agreements with third parties specifying that avoidance of NGTL's CHRP and OMP measures is preferred. If disturbance does occur, the third party will be responsible and accountable for restoring measures to as close as practical to pre-disturbance conditions. The third party will be required to comply with all reasonable instructions of a NGTL Representative to complete the work.

Where regulatory (provincial or federal) approval is granted for other projects/land use activities that destroy measures implemented by NGTL for the CHRP, the area of influence within the Project footprint will be excluded from the final determination of restoration success upon completion of the monitoring program. These locations will be tracked in monitoring reports filed after each monitoring year (see CHROMMP).

A repeated measures monitoring study design using the evaluation criteria will be developed to test whether the restored footprint meets the measurable targets. A summary of the monitoring and adaptive management plan is provided in Section 6.0. The approach to validate effects predictions and restoration success is described in the revised Final CHRP and the detailed monitoring and adaptive management plan will be described in the CHROMMP.

2.2 RESTORATION UNITS AND MEASURES

Restoration units were developed in the Preliminary CHRP (Appendix A) to describe the habitat characteristics within the Project footprint, which affect the habitat restoration measures that can be applied to each site. The restoration units are based on ecosite phases mapped along the Project footprint. However, the ecosite phases were derived from a vegetation community model based on Alberta Vegetation Inventory (AVI) data and there is a margin of error associated with ecosite phase mapping.

The restoration units identified in Table 2 and on the alignment sheets in Appendix B were derived from a combination of ecosite phase mapping, field data, aerial imagery, satellite imagery and notes documented by Environmental Inspectors during construction. The rationale for selection of restoration measures is closely tied to the restoration units.

2.3 HABITAT RESTORATION/NATIVE VEGETATION RE-ESTABLISHMENT

The objective of native vegetation re-establishment for the revised Final CHRP is to restore equivalent land capability of habitat along the ROW. Under this paradigm, the objective is to support and promote native vegetation establishment so that it has similar characteristics (e.g., composition) to native vegetation that existed before pipeline construction. This will be completed through natural re-vegetation (i.e., minimum disturbance areas) and tree planting along the ROW. Minimum disturbance construction is a promising approach for promoting native vegetation re-establishment (see Section 3.2.4) and was conducted along the ROW where it was safe to do so. Specifically, minimum disturbance construction was done where the terrain was flat. Soil stripping and grading is necessary on sidehills and steep slopes to ensure a safe work environment. Established reclamation and forestry reforestation practices will be applied to promote native vegetation re-establishment where tree planting is required (see Section 4.2.2).

2.4 ACCESS CONTROL

The creation of new access is a relatively minor issue for the Project because it parallels existing ROWs for much of its length. Thus, little or no new access will be created as a result of the Project. Nevertheless, there is an opportunity for the Project to positively contribute to caribou habitat in the area by implementing access control along the Project ROW. Access control measures were implemented with the primary intention of blocking human use of the ROW. There is evidence that linear features enhance predator movement across landscapes (see Section 3 of Preliminary CHRP, Appendix A). However, control of predator access and movement along wide linear features may require intensive rollback treatments to be effective, which can increase fire risk and may impede operational access for maintenance. Predator access control was not prescribed as part of the revised Final CHRP.

Access control measures were recommended at intersections of the Project ROW with existing perpendicular linear features (*e.g.*, roads, utility corridors, seismic lines, etc.) to reduce access between the ROW and existing linear features. Specifically, access control will be implemented during operation where existing seasonal or all-weather roads intersect the ROW at 19 separate sites (see Table 5 and Appendix B for locations). Access control measures include use of rollback (i.e., large logs) (Figure 3), site preparation such as mounding (Figure 4), fabricated line-of-sight screens, and minimum-disturbance hand-cutting of vegetation (Figure 5). In addition, willow staking of riparian areas traversed by the ROW will create vegetation barriers.

Measures to evaluate human use include ground-based monitoring criteria such as evidence of vehicular access and/or U-turns, the type of vehicle access (e.g., ATV, truck) and the intensity of use (see Table 2). For example, an access controlled site may be considered successful where vehicular tracks or trails are evident but difficult to discern or infrequently used, or requiring adaptive management where tracks or trails appear to be highly used, vegetation is trampled, and bare ground is visible. Adaptive management measures will consider the location, source, and type of access to inform corrective action strategies.

Figure 3 **Example of Rollback Spread at a Road Intersection with a Pipeline ROW from the Air (left) and Ground (right)**

Figure 4 **Example of Mounding along a Pipeline ROW from the Air (left) and Ground (right)**

Figure 5 Example of Minimum Disturbance Construction, Hand-Cutting of Vegetation along a Pipeline ROW, at a Road Intersection

2.5 LINE-OF-SIGHT BLOCKING

Linear features create open habitats that are easier for humans and wildlife to see along and travel through than forest. Line-of-sight blocks along linear features are intended to reduce human use and possibly wildlife predator travel and visibility of their prey. This may mitigate increased predator hunting efficiency due to linear feature development, which might ultimately mitigate caribou mortality risk (see Section 3 of Preliminary CHRP).

Similar to access control, line-of-sight blocking is a challenge to implement because the Project parallels an existing ROW, which does not have line-of-sight blocks. To reduce Project residual effects line-of-sight blocks will be implemented along the Project ROW at locations where they are most likely to be successful.

Line-of-sight blocks will be established at a minimum of 500 m intervals within 15 years along the Project ROW where no topographic or route features (e.g., dog-legs in the ROW) occur.

There are no provincial guidelines in Alberta for line-of-sight management for linear features. Reclamation programs for previous developments in Alberta have targeted maximum sight lines of 400 m (Golder 2007, DES 2004). Operating practices for energy development in sensitive caribou range in BC (BC Ministry of Environment 2011) suggest implementing line-of-sight management every 500 m on linear features that do not share a ROW boundary with a road (see Section 3.2.1).

Line-of-sight blocks include planting vegetation (e.g., tree planting or willow staking), fabricated site screens and minimal disturbance construction to preserve vegetation (Figure 3). Line-of-sight blocks will be implemented at locations with sight lines >500m, particularly where they intersected with existing road access. Trees will be planted in an alternating pattern across the pipeline centreline along portions of the ROW (Figure 6). Specifically, trees will be planted across the centreline with open vegetation left at alternating sides of the ROW along some sections. This alternating vegetation pattern will create a line-of-sight break (Figure 6). Details on exact configuration of seedling planting to achieve line-of-sight breaks depend on as-built location of the pipe centreline and adjacent linear disturbances. Figure 6a illustrates the potential planting configuration at locations where there is no disturbance parallel to an NGTL ROW. Figure 6b illustrates the potential planting configuration where the adjacent disturbance is an existing NGTL ROW. Figure 6c illustrates the potential planting configuration where the adjacent disturbance is an existing third-party ROW.

Topography, bends in the ROW, minimum disturbance construction to preserve vegetation and willow staking create immediate line-of-sight blocks (i.e., create visual barriers after restoration activities are implemented). However, short-term barriers were not necessarily implemented every 500 m along the ROW, as the objective is to create line-of-sight blocks at least every 500 m along the ROW in the long term, after 15 years. Vegetation planting, including at staggered intervals across the pipeline centreline, will establish these blocks. Therefore, vegetation planting will create long-term line-of-sight blocks <500 m apart.

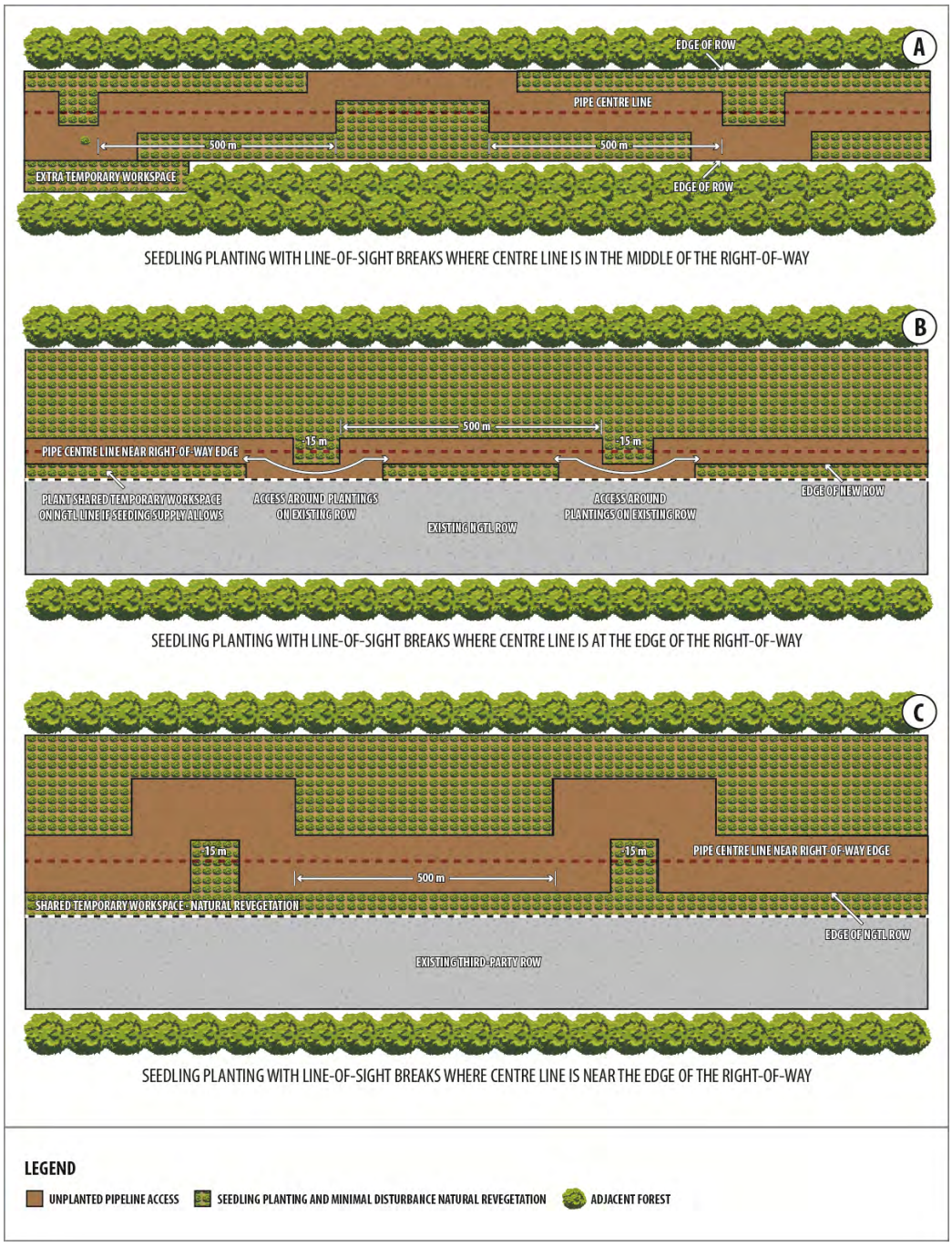

Figure 6 Seedling Planting with Line-of-Sight Breaks

2.6 ASSUMPTIONS AND LIMITATIONS

Habitat restoration assumes that caribou will be able to maintain adequate spatial separation from predators, i.e., pre-disturbance levels of mortality risk (Athabasca Landscape Team 2009). Restoration of the ROW is also expected to mitigate caribou avoidance of the ROW (i.e., within a zone of influence) (Oberg 2001). As such, habitat restoration is expected to mitigate the residual effects of the Project on caribou over the long-term (i.e., longer than 15 years). Although there is uncertainty in the effectiveness of some measures prescribed to restore habitat, the assumption is made that habitat restoration will be effective in the long-term. In addition, monitoring and adaptive management will be completed to systematically evaluate program outcomes and address unsuccessful restoration measures by adjusting or supplementing how these measures are implemented.

Restoration of habitat within the ROW through implementation of the CHRP will not completely eliminate the residual effects of the Project on caribou habitat. Maintenance of low vegetation heights over the pipeline centreline is required to comply with operational standards and regulations for monitoring and safe operation. NGTL has updated its operational standards to allow for alternating plantings of woody vegetation over the pipeline centreline, allowing for a narrow, meandering access line over the centreline (Figure 6). The result is that the CHRP treatments applied within segments of the project footprint that are planted with tree seedlings are expected to achieve the targets set out for the CHRP and effectively eliminate Project residual effects along those segments in the long-term. For quantification of residual habitat loss, it is assumed that there are no residual effects on the segments of the Project footprint that are planted with trees.

Where the CHRP prescribes natural regeneration as the primary treatment for re-vegetation of the project footprint, NGTL conservatively assumes that the 10 m wide area over the pipeline centreline will be periodically maintained to provide access for operational purposes. This area will not achieve the measurable targets for the CHRP and is quantified as residual caribou habitat loss.

The lag time required to achieve habitat value equivalent to pre-construction conditions is an important consideration and discussed further in the OMP. Residual effects within restored segments of the project footprint will extend over the long-term, until vegetation community composition and structure has matured to a seral stage that is presumed to provide functional caribou habitat and restore pre-disturbance predator-prey dynamics.

2.7 SUMMARY

The three objectives of the revised Final CHRP are complementary. Native vegetation re-establishment ultimately provides access control and line-of-sight blocking, which might support vegetation re-establishment by reducing vegetation trampling along the ROW. Nevertheless, an important consideration of caribou habitat restoration is that the scientific understanding of the relationship between linear access, native vegetation, access control, line-of-sight blocking and caribou mortality is correlative. Measuring the mechanistic relationship between habitat

restoration and caribou mortality is outside of the scope of the revised Final CHRP. The evaluation criteria described here focuses on measuring the direct effects of restoration to infer any indirect effect on caribou mortality risk. That is, if restoration is successful, than it is inferred that there will be few or no negative residual effects of the Project on caribou mortality risk. The three restoration objectives are complementary to promote successful and rapid restoration of caribou habitat.

3 UPDATES FROM THE PRELIMINARY CHRP

This section discusses specific updates or modifications to the Preliminary CHRP that were incorporated into the Final CHRP (submitted November 2014). This included an updated literature review (Section 3.1) and documentation of how NEB comments on the Preliminary CHRP were incorporated into the Final CHRP, including if and how they influenced decision making criteria (Section 3.2). Further comments were received from the NEB on the Final CHRP, and revisions were made to the Final CHRP and are provided in the revised Final CHRP (i.e., this document). Details of the NEB comments on the Final CHRP and how they are addressed in revised Final CHRP are provided in Section 1.0.

3.1 UPDATED LITERATURE REVIEW

A literature review was conducted in June 2014 an additional literature has since been incorporated to ensure that NGTL considered the most recent published knowledge of caribou habitat restoration in the Final CHRP and revised Final CHRP. Restoration of disturbed habitat has become one of the key components for caribou conservation, and has been identified in the federal boreal caribou recovery strategy (Environment Canada 2012) and in Alberta boreal caribou recovery planning efforts (GoA2011). The literature review was conducted using a systematic approach and standard research techniques including the use of in-house reference material and querying online scholarly databases using keywords and phrases. The literature review for the Final CHRP included a search of the following databases:

- Google
- Google Scholar
- BioOne
- Web of Science
- Cumulative Environmental Management Association (CEMA) database
- Oil Sands Research and Information Network (OSRIN) database

The following combinations of search terms were included in the literature review:

- Caribou habitat restoration
- Boreal forest restoration
- Linear feature restoration in boreal forest

In addition to the literature search, Stantec attended the 15th North American Caribou Workshop, where seven papers related to habitat restoration for caribou were presented (Reid 2014; Bentham and Coupal 2014; Keim et al. 2014; Saxena et al. 2014; Dickie et al. 2014; Finnegan et al. 2014; Cody et al. 2014). Key messages from those presentations that are relevant to the revised Final CHRP are summarized here.

Most of the new information obtained in the recent literature review is related to use of rollback and monitoring wildlife use of restored linear features. Key references related to use of rollback include the updated GoA Enhanced Approval Process (GoA 2013), specifically related to industrial operation in caribou range and the rollback management guides provided by Pyper and Vinge (2012) and Vinge and Pyper (2012). Vinge and Pyper (2012) highlight the advantages of using rollback to enhance re-vegetation of disturbed area. Specifically, they summarize the benefits of using whole logs to create microsites and use of rollback along as much of the ROW as possible to control access, both of which can enhance the speed and success of vegetation re-establishment. They recommend using rollback volumes of 60 to 100m^3/ha in upland areas and 30 to 50m^3/ha in lowland areas. They also provide a visual guide (Pyper and Vinge 2012) to help operators achieve these targets. The advantages of rollback are reflected by the GoA, as they recommend using rollback at least 40% of the ROW length, as long as sections of rollback do not exceed 250 m lomg and are separated by 25 m to minimize fire risk (GoA 2013).

Results of research on wildlife species using linear features, including pipelines, and response to restoration treatments is emerging. Black bears (*Ursus americanus*) have recently been found to use seismic lines more than 2 m wide more than forest interior, suggesting they may use linear features to increase their ability to capture prey, including caribou (Tigner et al. 2014). Wolves have been found to use linear features 1.25 to 2 times more than expected and move 1.3 to 3.3 times faster on linear features than non-linear habitats in the oil sands region of Alberta (Dickie et al. 2014). Similarly, wolves in northeastern BC were found to be 1.5 times more likely to move to seismic lines and 3 times more likely to move to roads than other habitats, and travelled 4.2 times faster on roads than other habitats (DeMars et al. 2014). 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 to these species. Some very preliminary results of intensive linear feature blockages suggest that this type of mitigation can be effective at reducing wildlife use of linear features. Application of high densities of salvage logs (i.e., rollback) at linear feature intersections reduces human use of linear features by 100%, wolf use of linear features by 90%, and deer use of linear features by 50% (Keim et al. 2014). However, a limitation of this recommendation is that it requires very large amounts of woody debris, which may not be available, may pose a fire risk and may impede natural vegetation growth (see consultation with AESRD in Section 7.0). Therefore, it is not recommended in the revised Final CHRP.

Winter tree planting and mechanically bending live trees into the ROW are emerging mitigation options currently being implemented in the oil sands region of Alberta (Reid 2014; Cody et al. 2014). Tree bending may be particularly promising as it promotes natural re-vegetation by increasing cone deposition onto the ROW and creating microsites through shading and dropped dead woody debris. However, these mitigation measures are only initially being evaluated and their utility remains unknown. Furthermore, they were applied on narrower seismic lines rather than pipeline ROWs. Therefore, they are not proposed in the revised Final

CHRP, but may be considered in the future as part of adaptive management if the restoration plans proposed in the revised Final CHRP are unsuccessful.

Caribou habitat restoration is receiving increasing research attention and it is anticipated that methods to restore habitat will continue to tested and modified in the near future. NGTL will continue to incorporate this new information as part of post-construction monitoring and adaptive management, and in development of the CHROMMP, as well as subsequent CHRPs to be completed for other projects.

3.2 RESPONSE TO NEB COMMENTS ON THE PRELIMINARY CHRP

Feedback obtained from the NEB on the Preliminary CHRP was filed and was incorporated in the Final CHRP. The updates are summarized in a revision log (Table 3). Additional feedback was obtained from the NEB on the Final CHRP and has been incorporated into the revised Final CHRP (this document). Details of this revision are described in Section 1.0.

Table 3 Revision Log of Changes to Restoration Measures from the Preliminary CHRP

Issue/Comment	Amendment/Action	Reference – revised Final CHRP
NEB comment to reconcile 50 m line-of-site in literature with 500 m line-of-site used in the decision tree.	Provided explanation for 500 m line-of-sight threshold in decision trees (Section 2.3): "There are no provincial guidelines in Alberta for line-of-sight management for linear features. Reclamation programs for previous developments in Alberta have targeted maximum sight lines of 400 m (Golder 2007, DES 2004). Operating practices for energy development in sensitive caribou range in BC (BC Ministry of Environment 2011) suggest implementing line-of-sight management every 500 m on linear features that do not share a ROW boundary with a road."	Section 3.2.1
NEB comment: Clarify whether the proposed 5 year monitoring period is just a preliminary minimum period that would feed into a CHROMMP.	Section 3.2.2 now provides details that 15 years is a preliminary monitoring period and that during the 15 years adaptive management will be implemented to determine whether additional restoration treatments will be implemented, or whether the residual effects will be offset. If restoration treatments are on trajectory to achieve targets after 15 years they will be deemed successful (i.e., no residual effects).	Section 3.2.2
NEB comment: Where do the quantifiable targets come from (e.g., 70% survival rate)?	Target has been increased to 80% success rate (see Section 3.2.3) for the following reasons: Consistent with NWML and Leismer to Kettle River plans. These plans provide rationale that equivalent land capability is achieved when the reclaimed fall within 20% of 'control values' (AENV 2001), where 'control' is considered 100% survival in surrounding landscape. They indicate reforestation standards in Alberta require a minimum of 80% stocking of regeneration sites (AESRD 2013a). Provides a consistent target for evaluating success across projects.	Section 3.2.3

Updates from the Preliminary CHRP
April 30, 2015

Issue/Comment	Amendment/Action	Reference – revised Final CHRP
NEB comment: "Are uncertainties already calculated in the quantifiable targets? Or how will time lags and uncertainties be carried forward to the OMP?"	Section 3.2.3 provides a description of how restoration targets will be used. Specifically, it states that post-construction monitoring will be used to evaluate if the restoration treatments are on a trajectory to achieving the targets, and if not, further restoration treatments or offsets will be implemented. These will be described in detail in the OMP and CHROMMP.	Section 3.2.3
NEB question: "How do restoration units compare to habitat types?	"Restoration units" were identified from "habitat types" that were determined using ecosite phase data.	All sections
NEB question: "Will any ongoing management/planned succession practices be used in those areas that will undergo natural regeneration? Or would natural regeneration be an entirely hands off approach?"	Section 3.2.4 addresses this section by describing that natural regeneration will essentially be hands off.	Section 3.2.4
NEB comment: "Further clarification around how opportunities and constraints determine the choice of restoration method…" is needed.	Sections 2.1 to 2.5 describe the opportunities and constraints for the restoration methods.	Sections 2.1 to 2.5
NEB question whether any new literature sources were viewed since one year ago. NEB comment to provide a discussion of how NGTL will continue to incorporate new research ideas into the CHRP over time, the date of the last literature search and to have a clear reproducible methodology for future literature reviews.	Section 3.0 summarizes all updates to the Preliminary CHRP. Section 3.1 describes results of the updated literature review, how and when it was completed and how new information was incorporated.	Section 3.0 and 3.1.
NEB comment: How do restoration targets link to OMP, for example if 70% restoration target is met will 30% be offset?	We now clarify in Section 2.1 that measures ≤ 20% of targets will not be offset, but targets > 20% and that can't be mitigated in adaptive management will be offset.	Section 2.1
NEB comment: Evaluation criteria, performance measures and targets do not always match-up and often use different measures entirely.	This refers to Table 4 in the Preliminary CHRP. The Table (now Table 2) has been re-organized so that each CHRP objective is aligned with its restoration targets and measures. Objectives align with the appropriate mitigation type, by habitat type.	Section 2.1, Table 2

Updates from the Preliminary CHRP
April 30, 2015

Issue/Comment	Amendment/Action	Reference – revised Final CHRP
NEB comment: The link between caribou habitat, caribou mortality risk, restoration targets and evaluation and performance criteria are unclear.	Section 3.1 now explains that the linkage between caribou mortality and restoration is correlative; therefore the focus is on measuring the direct effects of restoration measures on habitat to infer a reduced effect on caribou mortality risk.	Section 3.1
NEB comment: A concordance table is needed in the Final CHRP to track how NGTL addressed the NEB comments on the Preliminary CHRP. NEB certificate Condition 10 requirement to document "any updates" to the Preliminary CHRP "that includes the rationale for any changes to decision making criteria."	Section 3.0 summarizes all updates to the Preliminary CHRP and provides a concordance table (Table 3) where each NEB comment is a separate row and a description of where and how the comment was addressed is provided.	Section 3.0, Table 3
NEB certificate condition 10 requirement to provide "a complete table of caribou habitat restoration sites, including but not limited to location, spatial area, description of habitat quality, site-specific restoration activities and challenges;	Table 5 in Section 4.3 provides this information.	Section 4.3, Table 5
NEB certificate condition 10 requirement to provide "maps or Environmental Alignment Sheets showing the locations of the sites."	Appendix B includes the restoration sites alignment sheet.	Appendix B
NEB certificate condition 10 requirement to "a quantitative and qualitative assessment of the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the areal extent of the resulting residual effects to be offset, which also includes indirect disturbance."	Sections 5.0 and 5.2.1. and Table 6 quantify the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the areal extent of the resulting residual effects to be offset, including indirect disturbance.	Section 5.0, 5.2.1 Table 6.
NEB certificate Condition 10 requirement to provide "Evidence and summary of consultation with Environment Canada and provincial authorities regarding the Final CHRP."	Section 5.0 and Table 7 summarizes consultation with Environment Canada and provincial authorities.	Section 5.0, Table 7

3.2.1 Line-of-sight Blocks

Clarification was requested regarding the use of a 500 m line-of-sight break in the Preliminary CHRP when in the literature review it was stated that "line-of-sight measured on the re-vegetating seismic lines was typically less than 50 m after 20 years" (Stantec 2013). An important clarification about this statement is needed, as it refers to line-of-sight measured 20 years after restoration, when vegetation was already established. The Preliminary CHRP recommended a 500 m line-of-sight break as an initial mitigation until vegetation became established. A 500 m line-of-sight break is consistent with linear feature restoration guidelines in Alberta and BC (see Section 2.3). Native vegetation re-establishment is a higher mitigation priority than line-of-sight breaks because vegetation will ultimately create visual and access barriers along the entire ROW. Once vegetation is re-established it is anticipated that line-of-sight breaks in the Project ROW will be shorter and more typical of re-vegetated seismic lines (i.e., less than 50 m). The 500 m line-of-sight break decision tree from the Preliminary CHRP was therefore applied to the revised Final CHRP.

3.2.2 Monitoring Period

A five year post-restoration monitoring period was recommended in the Preliminary CHRP, but later changed to a 15 year monitoring period. Additional monitoring was recommended in the CHRP (See Section 6.0).

3.2.3 Restoration Targets

Restoration targets have been revised based on the recent literature review (2014). The rationale for some of the targets discussed in the Preliminary CHRP is clarified and specific targets have been developed as part of the revised Final CHRP (Section 2.1) that was not discussed in the Preliminary CHRP.

Sustained vegetation growth in 70% of restoration sites was proposed in the Preliminary CHRP. However, this target was not consistent with AESRD recommendations, which proposed that 80% of restoration sites should be re-vegetated to be considered successful restoration. AESRD provided detailed rationale for this target, including Alberta reforestation standards (AESRD 2013a) and the Alberta Reclamation Assessment Criteria for Pipelines (AENV 2001) and therefore this target was adopted in the revised Final CHRP. Using a consistent target across NGTL projects allows for a 'meta-analysis' of restoration success (i.e., analysis of results from multiple projects). This approach enhances adaptive management by providing similar data across projects to evaluate restoration treatments within the context of local environmental conditions.

More specific restoration targets have been provided in Table 2. These include a specific planting density target for seedlings, levels of human use and line-of-sight distances. A planting density of 1,600 to 2,400 stems/ha has been proposed as a restoration target in upland areas, and 800 to 2,000 stems/ha in lowland and mounded areas. Again, this provides a target consistent with forestry standards across Canada (Golder 2014; TERA 2014).

Maintaining a 'low' level or no human use along the ROW is another target. This will be measured qualitatively by looking for evidence of human use at restoration sites.

The restoration targets identified here are supported by regulatory restoration guidelines. The purpose of monitoring is to determine if habitat restoration locations achieve their respective targets in the short term (less than 15 years) and long term (more than 15 years) term. If yes, restoration would be considered successful. If no, additional mitigation and adaptive management actions will be implemented, which is discussed in the CHROMMP.

3.2.4 Natural Re-vegetation

Natural re-vegetation will occur at some locations along the ROW (see Table 5 and Appendix B), particularly where minimum disturbance practices were implemented or in wet lowland areas with little soil, as indicated by poor tree growth in neighboring sites. Based on the literature review in the Preliminary CHRP (Stantec 2013), because restoration treatments are not well evaluated, the success of natural re-vegetation versus other treatment types is unknown. It is predicted here that natural re-vegetation of minimally disturbed sites should be successful, as long as human use is kept to a minimum. Monitoring for 15 years post-construction is a key aspect of the revised Final CHRP and will be used to evaluate if this prediction is correct.

Natural re-vegetation is a "hands-off" approach to restoration where the primary objective is to avoid disturbing vegetation and soil. Surface disturbance (e.g., compaction or removal of soil) can slow or prevent the recovery of native vegetation on industrial developments. For example, Osko and Glasgow (2010) measured a few hundred stems per hectare (stems/ha) of aspen on highly disturbed (i.e., stripped-soil) wellsites compared with 10,000 to 15,000 stems/ha of aspen on minimum disturbance construction wellsites, indicating minimum disturbance resulted in two orders of magnitude higher vegetation biomass recovery. Similarly, seismic lines cleared by a bulldozer and left to restore on their own may take as long as 112 years to reach 95% recovery to woody vegetation (Lee and Boutin 2006).

Minimum disturbance was conducted as part of the CHRP where it was safe for equipment to operate without soil stripping and grading (i.e., flat terrain) by minimizing surface disturbance and soil stripping during construction. Surface disturbance will also be minimized post-construction through limiting all-terrain vehicle (ATV) travel on the site (i.e., access control).

4 CARIBOU HABITAT RESTORATION SITE PRESCRIPTIONS

This section includes a detailed table of proposed habitat restoration sites, including the location, habitat, and site-specific restoration activities for each site, as well as a restoration schedule. This is supplemented by alignment sheets with the location of each of these proposed habitat restoration sites (Appendix B). Together these provide a detailed restoration plan along the Project route.

4.1 SCHEDULE

Restoration measures implemented during the construction and rough clean-up phase (winter 2013/2014) included the following:

- Minimum disturbance construction that will facilitate natural regeneration
- Bio-engineering (e.g., geotextile soil wraps or "coir lifts") of watercourse banks and riparian areas
- Retention and spreading of woody debris for erosion control, improved microsite conditions (i.e., to enhance seedling survival) and access control (note: woody debris was retained on-site in some locations and will be spread during final clean-up)
- Retention of vegetation across portions of the project footprint at select road crossings to break line-of-sight (i.e., visual screens)

The locations of these measures are shown on the Environmental Alignment Sheets (Appendix B). Going forward, the proposed habitat restoration schedule is listed below and in Table 4. The schedule includes the following:

- Fall 2014: nursery seedling procurement
- Winter 2015: final clean-up and restoration measures, including recontouring surface soils, installing drainage and erosion control measures, additional bio-engineering at watercourse banks and riparian areas (e.g., geotextile erosion control), spreading mulch in areas where depth is too thick, spreading woody debris and mounding for access control and creation of microsites
- Summer/fall 2015: seedling planting; willow cutting collection and staking
- Summer/fall 2016: contingency plan for additional planting/staking and/or mounding at select locations, in the event that unforeseen circumstances prevent completion of CHRP measures during 2015

The scheduling of the habitat restoration work considered that seasonal access constraints (i.e., frozen conditions and adequate snow) are required to accommodate vehicle and machinery travel along the ROW, as well as to protect areas of minimum disturbance during clean-up activities, comply with sensitive and/or restricted activity periods for caribou and other wildlife, and provide adequate lead time for the production of nursery seedlings. An "early-in/early-out" approach was taken for final clean-up work in winter 2015 and final clean-up

was completed before the February 15 recommended timing restriction within caribou ranges in Alberta (GOA 2013).

Scheduling of monitoring will be detailed in the CHROMMP. The implementation of CHRP measures will be documented and sample plots will be established to form the basis of monitoring. Monitoring will commence in the first growing season following completion of habitat restoration measures (i.e., Q3 2015) and will continue for 15 years (i.e., 2030). Implementation of adaptive management protocols, if warranted, will depend on the monitoring schedule as well as the seasonal, wildlife sensitivity and logistical considerations described above.

Table 4 Schedule of Habitat Restoration Measures 2014-2015

Activity	2014		2015			
	Q3	Q4	Q1	Q2	Q3	Q4
			February 15 ↓		July 15 ↓	
Field Assessments and Planning						
Seedling Procurement						
Nursery Seedlings Grown						
Final Clean-up and Winter Restoration						
Collect Willow Cuttings						
Bio-Engineering (Willow Staking)						
Plant Seedlings						

4.2 STANDARDS AND SPECIFICATIONS

There are no existing specifications for the design and implementation of caribou habitat restoration. As a result, relevant standards and guidelines for forestry (AESRD 2013a), reclamation of pipelines, wellsites and associated facilities (AENV 2001, 2011), reclamation of oil sands development (AENV 2008, 2010; AESRD 2013b) and results of caribou habitat restoration research were used to develop specifications for the CHRP. In addition, information obtained from the literature review provided in the Preliminary CHRP and updated in the revised Final CHRP was considered.

Given the limited quantitative information available regarding monitoring and success of restoration, and the uncertainty associated with the effectiveness of various restoration measures for different ecosites in different parts of Alberta, the specifications identify

acceptable ranges for the implementation of restoration measures. The following specifications will be applied to the restoration measures.

4.2.1 Minimum Disturbance Construction

NGTL implemented minimum surface disturbance construction techniques to facilitate natural re-vegetation (Appendix B; Table 5). Minimum disturbance construction techniques included limiting grading and soil salvage on flat terrain, hand-cutting or mowing of vegetation (Figure 5), and snow padding over vegetation. Hand-cutting/snow padding was implemented at intersections with other linear features to facilitate rapid vegetation recovery to create access and line-of-sight barriers.

4.2.2 Conifer Tree Planting

Tree planting densities are based on western Canadian forestry recommendations, which typically range from 1,500- 2,500 stems/ha (MacDonald et al. 2012). Specific to oil and gas developments, the GoA *Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands* (AENV 2011) recommends that upland sites should be planted with merchantable species at 2,000 stems/ha. Similarly, the guidelines for forest reclamation in the oil sands region (AENV 2010) specify planting densities of conifer (pine and white spruce) seedlings in dry, moist poor or moist rich site types of 1,400-2,000 stems/ha and planting densities of black spruce at 1,400-2,800 stems/ha in wet poor sites.

The objective of the revised Final CHRP is to plant 1,600-2,400 stems/ha with the goal of establishing 2,000 stems/ha in upland sites. Upland sites will be planted with either white spruce or lodgepole pine (Appendix B; Table 5). Lowland and mounded sites will be planted with black spruce (Appendix B; Table 5).

4.2.3 Alternating Tree Planting Across the ROW

To comply with Canadian Standards Association (CSA) CSA-Z662-11, the pipeline must be accessible for emergency and operational purposes. However, to create line-of-sight breaks, tree planting will cross the centre of the ROW at alternating sections along the ROW (Figure 6). Alternating tree planting sections of the ROW will occur at least every 500 m along the ROW where tree planting is recommended to maintain line-of-sight breaks.

4.2.4 Mounding

Mounding (excavations approximately 0.3 m to 0.75 m deep) will be implemented at applicable lowland sites and transition sites between upland and lowland sites. It will be targeted in wet to moderately wet areas with sufficient mineral soil to support tree growth, particularly at intersections with other linear features with these conditions for access control (Appendix B; Table 5). Mounding will not be done anywhere on the ROW within 5 m of the pipeline to comply with the CSA *Oil and Gas Pipeline Systems Standard Z662-11*, which restricts ground disturbance

by heavy machinery within 5 m of the pipeline (CSA 2011). Black spruce will be planted two per mound to achieve tree planting densities of at 800-2,000 stems stems/ha with the goal of establishing 1,400 stems/ha.

4.2.5 Willow Staking

Native willow from nearby locations with high densities of willow will be cut into stakes and planted along restored riparian areas. Willow staking will contribute to stabilization of the banks of waterbodies traversed by the pipeline, as well as to creating line-of-sight and access barriers along the ROW (Appendix B; Table 5).

4.2.6 Rollback

Rollback (i.e., logs) will be used primarily to control access, and secondarily to provide microsites for re-vegetation along the ROW. Availability of large woody debris is limited. Furthermore, forestry companies and AESRD are concerned with the additional risk of fire due to placing concentrated amounts of woody debris on the ROW. Therefore, rollback will be targeted to sites where the ROW intersects other linear features (Appendix B; Table 5). Rollback will be placed in > 50 m long sections to a maximum of 250 m, if sufficient material is available and will be placed where the ROW narrows to maximize the length of rollback. Rollback will be placed by stacking layers of logs spaced a few metres apart on top of each other at a perpendicular angle (Figure 2). Thus, it will create a barrier approximately 1 m high with spacing that allows for trees to be planted among the logs. Trees planted among rollback will be planted at a density of 1,600-2,400 stems/ha with the goal of establishing 2,000 stems/ha.

4.3 RATIONALE FOR SITE SELECTION AND RESTORATION MEASURES

Restoration sites were selected based on local site conditions and using the decision trees developed in the Preliminary CHRP (Figure 2a, 2b and 2c). Local site conditions were determined based on a post-construction site visit completed in September 2014. The decision tree was developed based on a literature review completed in the Preliminary CHRP that was updated in Section 3.0. Final clean-up and restoration of the Project ROW will be completed in spring/summer of 2015. Monitoring will commence the following year in fall 2016.

Table 5 List of Caribou Habitat Restoration Sites along the Chinchaga Lateral Loop No. 3

Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
0.000 to 0.004	NE 26-094-02	Upland Deciduous/Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
0.004 to 0.079	NE 26-094-02 to SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
0.079 to 0.212	SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1112 seedlings).	-	-	✓	In progress
0.212 to 0.221	SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier from the existing road and promote rapid vegetation recovery.	✓	-	-	Complete
0.221 to 0.251	SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
0.251 to 0.259	SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier from the existing road and promote rapid vegetation recovery.	✓	-	-	Complete
0.259 to 0.331	SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (606 seedlings).	-	-	✓	In progress
0.331 to 0.688	SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,728 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
0.688 to 0.753	SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (376 seedlings).	-	-	✓	In progress
0.753 to 0.828	SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
0.828 to 0.846	SE 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (606 seedlings).	-	-	✓	In progress
0.846 to 0.913	SE 35-094-02 to NW 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (578 seedlings).	-	✓	✓	In progress
0.913 to 0.973	NW 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (540 seedlings).	-	-	✓	In progress
0.973 to 1.028	NW 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
1.028 to 1.090	NW 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (460 seedlings).	-	-	✓	In progress
1.090 to 1.169	NW 35-094-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (346 seedlings).	-	✓	✓	In progress
1.169 to 1.514	NW 35-094-02	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,728 seedlings).	-	-	✓	In progress
1.514 to 1.682	NW 35-094-02	Upland Deciduous/Mixedwood Transitional Treed Lowland Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (732 seedlings). Terrain creates line-of-sight barrier.	-	-	✓	In progress
1.682 to 2.164	NW 35-094-02 to NE 34-094-02	Upland Deciduous/Mixedwood Transitional Treed Lowland Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,316 seedlings).	-	-	✓	In progress
2.164 to 2.554	NE 34-094-02 to SE 03-095-02	Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
2.554 to 2.852	SE 03-095-02	Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,308 seedlings).	-	-	✓	In progress
2.852 to 3.093	SE 03-095-02	Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
3.093 to 3.346	SE 03-095-02 to SW 03-095-02	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,594 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
3.346 to 3.382	SW 03-095-02	Upland Deciduous/Mixedwood Disturbed Land Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
3.382 to 5.006	SW 03-095-02 to SE 09-095-02	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (7,490 seedlings).	-	-	✓	In progress
5.006 to 5.015	SE 09-095-02	Disturbed Land	Line-of-Sight Barrier	Fabricated visual screen.	A visual screen will be fabricated across the width of the ROW. The screen will be ≥ 2 m high and consist of biodegradable materials. Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
5.015 to 5.089	SE 09-095-02	Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (652 seedlings).	-	-	✓	In progress
5.089 to 5.110	SE 09-095-02	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
5.110 to 5.165	SE 09-095-02	Disturbed Land Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (436 seedlings).	-	-	✓	In progress
5.165 to 5.173	SE 09-095-02	Disturbed Land	Line-of-Sight Barrier	Fabricated visual screen.	Intersection with existing road. A visual screen will be fabricated across the width of the ROW. The screen will be ≥ 2 m high and consist of biodegradable materials.	-	-	✓	In progress
5.173 to 5.367	SE 09-095-02 to SW 09-095-02	Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (850 seedlings).	-	-	✓	In progress
5.367 to 5.465	SW 09-095-02	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (432 seedlings).	-	✓	✓	In progress
5.465 to 6.300	SW 09-095-02 to SE 08-095-02	Upland Deciduous/Mixedwood Transitional Wetland – Treed Swamp Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (4,264 seedlings). Terrain creates line-of-sight barrier.	-	-	✓	In progress
6.300 to 6.714	SE 08-095-02 to NE 08-095-02	Transitional Wetland – Treed Swamp	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
6.714 to 8.015	NE 08-095-02 to NW 08-095-02	Upland Deciduous/Mixedwood Transitional Wetland – Treed Swamp Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (6,404 seedlings).	-	-	✓	In progress
8.015 to 8.072	NW 08-095-02	Upland Deciduous/Mixedwood Transitional	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
8.072 to 8.212	NW 08-095-02 to NE 07-095-02	Upland Deciduous/Mixedwood Transitional	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (620 seedlings). Terrain creates line-of-sight barrier.	-	-	✓	In progress
8.212 to 8.311	NE 07-095-02	Upland Deciduous/Mixedwood Transitional	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
8.311 to 8.388	NE 07-095-02 to SE 18-095-02	Upland Deciduous/Mixedwood Transitional	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (334 seedlings). Terrain creates line-of-sight barrier.	-	-	✓	In progress
8.388 to 8.792	SE 18-095-02	Upland Deciduous/Mixedwood Transitional	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,996 seedlings).	-	-	✓	In progress
8.792 to 8.913	SE 18-095-02	Upland Deciduous/Mixedwood	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (690 seedlings).	-	-	✓	In progress

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
8.913 to 9.062	SE 18-095-02 to SW 18-095-02	Upland Deciduous/Mixedwood	Habitat restoration/ native vegetation Line-of-Sight Barrier	Minimal Disturbance	Flat terrain. Limited grading and soil salvage. Bend in ROW creates line-of-sight barrier.	✓	-	-	Complete
9.062 to 9.601	SW 18-095-02	Upland Deciduous/Mixedwood	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,792 seedlings).	-	-	✓	In progress
9.601 to 9.660	SW 18-095-02	Transitional Wetland – Treed Bog Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
9.660 to 9.795	SW 18-095-02	Upland Deciduous/Mixedwood Transitional Wetland – Treed Bog	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (636 seedlings).	-	-	✓	In progress
9.795 to 9.908	SW 18-095-02 to NW 18-095-02	Upland Deciduous/Mixedwood Transitional Wetland – Shrubby Bog	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
9.908 to 10.218	NW 18-095-02 to NE 13-095-03	Upland Deciduous/Mixedwood	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,520 seedlings).	-	-	✓	In progress
10.218 to 10.343	NE 13-095-03	Upland Deciduous/Mixedwood	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (550 seedlings).	-	✓	✓	In progress
10.343 to 10.461	NE 13-095-03	Upland Deciduous/Mixedwood	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (928 seedlings).	-	-	✓	In progress
10.461 to 10.471	NE 13-095-03	Upland Deciduous/Mixedwood	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier from the existing road and promote rapid vegetation recovery.	✓	-	-	Complete
10.471 to 10.496	NE 13-095-03	Upland Deciduous/Mixedwood	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
10.496 to 10.506	NE 13-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier from the existing road and promote rapid vegetation recovery.	✓	-	-	Complete
10.506 to 10.564	NE 13-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (802 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
10.564 to 10.594	NE 13-095-03	Upland Deciduous/Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
10.594 to 10.660	NE 13-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (516 seedlings).	-	-	✓	In progress

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
10.660 to 10.792	NE 13-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600 -2,400 trees/ha (578 seedlings).	-	✓	✓	In progress
10.792 to 11.028	NE 13-095-03 to SE 24-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,360 seedlings).	-	-	✓	In progress
11.028 to 11.154	SE 24-095-03	Wetland – Treed Bog	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
11.154 to 11.220	SE 24-095-03 to SW 24-095-03	Upland Deciduous/Mixedwood Wetland – Treed Bog	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (310 seedlings).	-	-	✓	In progress
11.220 to 11.341	SW 24-095-03	Upland Deciduous/Mixedwood Wetland – Treed Bog	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
11.341 to 12.290	SW 24-095-03 to SE 23-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (4,842 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
12.290 to 12.396	SE 23-095-03 to NE 23-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
12.396 to 12.536	NE 23-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (614 seedlings).	-	-	✓	In progress
12.536 to 13.534	NE 23-095-03 to NW 23-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (5,008 seedlings).	-	-	✓	In progress
13.534 to 13.621	NW 23-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (5,384 seedlings).	-	✓	✓	In progress
13.621 to 13.948	NW 23-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,332 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
13.948 to 13.977	NW 23-095-03	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
13.977 to 14.046	NW 23-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (682 seedlings).	-	-	✓	In progress

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
14.046 to 14.215	NW 23-095-03 to NE 22-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,064 seedlings).	-	✓	✓	In progress
14.215 to 14.394	NE 22-095-03 to SE 27-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (966 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
14.394 to 14.425	SE 27-095-03	Upland Deciduous/Mixedwood Riparian Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
14.425 to 15.036	SE 27-095-03 to SW 27-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,666 seedlings).	-	-	✓	In progress
15.036 to 15.608	SW 27-095-03	Upland Deciduous/Mixedwood Wetland – Shrubby Bog Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,734 seedlings).	-	-	✓	In progress
15.608 to 15.889	SW 27-095-03 to NW 27-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,542 seedlings).	-	-	✓	In progress
15.889 to 15.971	NW 27-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (360 seedlings).	-	✓	✓	In progress
15.971 to 16.046	NW 27-095-03 to NE 28-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (654 seedlings).	-	-	✓	In progress
16.046 to 16.054	NE 28-095-03	Upland Deciduous/Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
16.054 to 16.153	NE 28-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (620 seedlings).	-	-	✓	In progress
16.153 to 16.234	NE 28-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (366 seedlings).	-	✓	✓	In progress
16.234 to 16.864	NE 28-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (3,346 seedlings).	-	-	✓	In progress

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16.864 to 16.876	NE 28-095-03	Wetland – Shrubby Fen Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
16.876 to 17.003	NE 28-095-03 to NW 28-095-03	Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
17.003 to 17.013	NW 28-095-03	Wetland – Shrubby Fen Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
17.013 to 17.034	NW 28-095-03	Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Minimal Disturbance	This is a rare plant location, therefore limited grading and soil salvage was completed and the area will be avoided to ensure the plant is not impacted.	✓	-	-	Complete
17.034 to 17.230	NW 28-095-03	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,144 seedlings).	-	-	✓	In progress
17.230 to 17.317	NW 28-095-03 to SW 33-095-03	Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
17.317 to 17.435	SW 33-095-03	Transitional Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (520 seedlings).	-	-	✓	In progress
17.435 to 17.621	SW 33-095-03	Transitional Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
17.621 to 18.106	SW 33-095-03 to SE 32-095-03	Upland Deciduous/Mixedwood Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,396 seedlings).	-	-	✓	In progress
18.106 to 18.143	SE 32-095-03	Riparian Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
18.143 to 18.870	SE 32-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (3,706 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
18.870 to 18.995	SE 32-095-03 to NW 32-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
18.995 to 19.269	NW 32-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,204 seedlings).	-	-	✓	In progress
19.269 to 19.321	NW 32-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Next to open wellsite. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier between the wellsite and the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (548 seedlings).	-	✓	✓	In progress

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19.321 to 19.645	NW 32-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,408 seedlings).	-	-	✓	In progress
19.645 to 19.674	NW 32-095-03	Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
19.674 to 19.888	NW 32-095-03 to NE 31-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,160 seedlings).	-	-	✓	In progress
19.888 to 19.972	NE 31-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (366 seedlings).	-	✓	✓	In progress
19.972 to 20.051	NE 31-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (670 seedlings).	-	-	✓	In progress
20.051 to 20.077	NE 31-095-03	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
20.077 to 20.169	NE 31-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (802 seedlings).	-	-	✓	In progress
20.169 to 20.399	NE 31-095-03	Upland Deciduous/Mixedwood Transitional Wetland – Treed Fen Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,016 seedlings).	-	✓	✓	In progress
20.399 to 20.631	NE 31-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,466 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
20.631 to 20.650	NE 31-095-03	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
20.650 to 20.817	NE 31-095-03 to NW 31-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,184 seedlings).	-	-	✓	In progress
20.817 to 20.900	NW 31-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
20.900 to 21.075	NW 31-095-03	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (788 seedlings).	-	-	✓	In progress

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21.075 to 21.603	NW 31-095-03 to SE 01-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (4,158 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
21.603 to 21.620	SE 01-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
21.620 to 21.788	SE 01-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,520 seedlings).	-	-	✓	In progress
21.788 to 21.817	SE 01-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
21.817 to 22.144	SE 01-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,196 seedlings).	-	-	✓	In progress
22.144 to 22.225	SE 01-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant lodgepole pine.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (352 seedlings).	-	✓	✓	In progress
22.225 to 22.342	SE 01-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (796 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
22.342 to 22.927	SE 01-096-04 to SW 01-096-04	Upland Deciduous/Mixedwood Transitional Wetland – Treed Fen Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
22.927 to 23.004	SW 01-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (346 seedlings).	-	-	✓	In progress
23.004 to 23.421	SW 01-096-04 to SE 02-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
23.421 to 24.109	SE 02-096-04 to NE 02-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (3,310 seedlings).	-	-	✓	In progress
24.109 to 24.418	NE 02-096-04 to NW 02-096-04	Upland Deciduous/Mixedwood Transitional Wetland – Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete

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						C	FC	R-NF	
24.418 to 24.820	NW 02-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,762 seedlings).	-	-	✓	In progress
24.820 to 24.918	NW 02-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant lodgepole pine.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (432 seedlings).	-	✓	✓	In progress
24.918 to 24.980	NW 02-096-04 to SW 11-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (516 seedlings).	-	-	✓	In progress
24.980 to 25.013	SW 11-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
25.013 to 25.177	SW 11-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,182 seedlings).	-	-	✓	In progress
25.177 to 25.208	SW 11-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
25.208 to 25.244	SW 11-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (312 seedlings).	-	-	✓	In progress
25.244 to 25.291	SW 11-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
25.291 to 25.330	SW 11-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (388 seedlings).	-	-	✓	In progress
25.330 to 25.440	SW 11-096-04 to SE 10-096-04	Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Mounding. Plant black spruce.	Intersection with existing road. Mounding will be excavated to approximately 0.3 m to 0.75 m deep. Black spruce will be planted two per mound to a target density of 1,400 trees/ha with a range of 800-2,000 trees/ha (339 seedlings).	-	✓	✓	In progress
25.440 to 25.607	SE 10-096-04	Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Minimal Disturbance	Flat terrain. Limited grading and soil salvage. Bend in ROW creates line-of-sight barrier.	✓	-	-	Complete
25.607 to 25.629	SE 10-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
25.629 to 25.918	SE 10-096-04	Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
25.918 to 25.940	SE 10-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A

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25.940 to 26.385	SE 10-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Minimal Disturbance	Limited grading and soil salvage. Bend in ROW creates line-of-sight barrier.	✓	-	-	Complete
26.385 to 26.492	SE 10-096-04 to NW 10-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (476 seedlings).	-	-	✓	In progress
26.492 to 26.594	NW 10-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
26.594 to 27.640	NW 10-096-04 to NE 09-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (4,788 seedlings).	-	-	✓	In progress
27.640 to 28.069	NE 09-096-04 to SE 16-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,196 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
28.069 to 29.284	SE 16-096-04 to SE 17-096-04	Upland Deciduous/Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (6,828 seedlings).	-	-	✓	In progress
29.284 to 29.836	SE 17-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
29.836 to 30.121	SE 17-096-04 to SW 17-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,818 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
30.121 to 30.144	SW 17-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Rare plant location; avoid during restoration. Terrain creates line-of-sight barrier.	-	✓	-	In progress
30.144 to 30.489	SW 17-096-04 to NW 17-096-04	Upland Deciduous/Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,482 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
30.489 to 30.587	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant lodgepole pine.	Next to open wellsite. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier between the wellsite and the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (424 seedlings).	-	✓	✓	In progress
30.587 to 30.664	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (570 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress

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30.664 to 30.756	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
30.756 to 30.778	NW 17-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
30.778 to 30.828	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
30.828 to 30.847	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
30.847 to 31.066	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Minimal Disturbance	Flat terrain. Limited grading and soil salvage. Bend in ROW creates line-of-sight barrier.	✓	-	-	Complete
31.066 to 31.288	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,680 seedlings).	-	-	✓	In progress
31.288 to 31.306	NW 17-096-04 to NE 18-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
31.306 to 31.358	NE 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (490 seedlings).	-	-	✓	In progress
31.358 to 31.378	NE 18-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
31.378 to 31.442	NE 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Access control Line-of-Sight Barrier	Mounding. Plant black spruce.	Intersection with existing road. Mounding will be excavated to approximately 0.3 m to 0.75 m deep. Black spruce will be planted two per mound to a target density of 1,400 trees/ha with a range of 800-2,000 trees/ha (419 seedlings). Bend in ROW creates line-of-sight barrier.	-	✓	✓	In progress
31.442 to 31.477	NE 18-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
31.477 to 32.451	NE 18-096-04 to NW 18-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
32.451 to 32.528	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Access control	Mounding. Plant black spruce.	Intersection with existing road. Mounding will be excavated to approximately 0.3 m to 0.75 m deep. Black spruce will be planted two per mound to a target density of 1,400 trees/ha with a range of 800-2,000 trees/ha (238 seedlings).	-	✓	✓	In progress
32.528 to 32.613	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (670 seedlings).	-	-	✓	In progress

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
32.613 to 32.618	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier and promote rapid vegetation recovery.	✓	-	-	Complete
32.618 to 32.646	NW 18-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
32.646 to 32.652	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier and promote rapid vegetation recovery.	✓	-	-	Complete
32.652 to 32.704	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (414 seedlings).	-	-	✓	In progress
32.704 to 32.777	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Access control	Mounding. Plant black spruce.	Intersection with existing road. Mounding will be excavated to approximately 0.3 m to 0.75 m deep. Black spruce will be planted two per mound to a target density of 1,400 trees/ha with a range of 800-2,000 trees/ha (225 seedlings).	-	✓	✓	In progress
32.777 to 33.225	NW 18-096-04 to NE 13-096-05	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (3,712 seedlings).	-	-	✓	In progress

NOTES:

1 Standard measures inherent to the Project design (e.g., bends in ROW, shared workspace and parallel routing) and site characteristics (e.g., topographic variation that breaks line-of-sight) that may contribute to habitat restoration or reduced effects on caribou are excluded.

2 Tree species are denoted as follows:
lodgepole pine = Pl
white spruce = Sw
black spruce = Sb

3 The implementation schedule for restoration measures is as follows:
C = Construction (winter 2013/2014) – applies to minimum disturbance construction measures (promotes natural regeneration in deciduous areas).
FC = Final Clean-Up and Initial Restoration (winter 2015) – applies to final clean-up, erosion control, bio-engineering riparian areas (e.g., soil stabilization) and site preparation (e.g., mounding).
R-NF = Restoration in Non-Frozen Conditions (summer/fall 2015) – applies to tree planting and shrub staking/planting in bio-engineering locations.

5 PREDICTED RESIDUAL EFFECTS

5.1 ASSUMPTIONS AND CONSIDERATIONS

The restoration of disturbed habitat is expected to result in increased use of the reclaimed area by caribou as natural habitat characteristics re-establish (Oberg 2001). Additionally, restoration of disturbed habitat is assumed to allow caribou to regain spatial separation from predators and other prey (e.g., moose, deer), and in doing so return to natural levels of mortality risk (Athabasca Landscape Team 2009). While habitat restoration cannot immediately eliminate the residual effects of the Project on caribou habitat, over the long term, the residual effects will decline to zero. Addressing direct residual effects on caribou habitat, will also address indirect residual effects on caribou habitat. While there is uncertainty surrounding the effectiveness of implemented restoration measures to restore caribou habitat, it is assumed that restoration efforts will be effective over the long-term. CHRP treatments that are applied within segments of the project footprint are expected to achieve the targets set out in the CHRP, and effectively eliminate Project residual effects in those segments in the long term.

Habitat restoration will not completely eliminate the adverse effects on caribou habitat relating to the Project. A ten meter wide area along the entire ROW centreline will not be restored, as this area must be left open for the maintenance and safety reasons described in Section 4.2.3. Although actual access required for maintenance and safety purposes will likely range from 6 to 10 m, NGTL is conservatively assuming that where the CHRP prescribes natural regeneration as the method for re-vegetation of the project footprint, a 10-m-wide area over the pipeline centreline will be mowed periodically to maintain access. This area is assumed to not achieve the measurable targets for the CHRP and therefore is quantified as residual caribou habitat loss.

Residual effects of the Project on caribou habitat are calculated here based on the assumption that restoration prescriptions described in Section 4.0 are implemented successfully and will achieve the goal of restoring caribou habitat in the long term (longer than 15 years). Monitoring of restoration treatments to assess actual restoration success, adaptive management to address unsuccessful restoration and habitat compensation offsets will be addressed in greater detail in the CHROMMP.

5.2 QUANTIFICATION OF DISTURBANCE

The area of the Project footprint, including the ROW and temporary workspace, was used to quantify the Project's 'direct' disturbance footprint (Table 6), i.e., habitat that was physically removed to construct the pipeline ROW. For the revised Final CHRP, as-built surveys were used to accurately calculate the total direct disturbance resulting from the Project footprint within caribou range. Where the Project footprint crosses or overlaps roads, the area of the overlap is excluded from the Project footprint. Areas of the Project footprint that cross existing pipeline corridors (e.g., 'foreign' pipeline crossings) have been designated for natural re-vegetation.

NGTL did not acquire permission from adjacent disposition holders to apply CHRP measures within foreign dispositions. These corridor crossings are included in the quantification of the Project's direct footprint, but are excluded from the quantification of residual habitat loss because the appropriate measures will be implemented to ensure that the area reclaims to preconstruction conditions (i.e., there is no loss of caribou habitat as a result of the Project). Where Project construction used shared temporary workspace on adjacent pipeline rights-of-way, the area of the shared or overlapping footprint is included in the Project's direct disturbance footprint, since the Project has affected regenerating vegetation on those existing disturbance features. Where the shared workspace is on an NGTL disposition, the recommended CHRP measures will be applied on the entire Project footprint, including the shared workspace on the adjacent disposition. Shared workspace on foreign dispositions will be allowed to naturally regenerate. This area of natural regeneration is not anticipated to affect the probability of achieving CHRP targets, therefore, is not quantified as a residual habitat loss.

Consistent with the method applied to the Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada (Environment Canada 2011, 2012), undisturbed caribou habitat is defined as habitat that has not burned in the past 40 years, and is not within 500 m of anthropogenic disturbance. Habitat that has been directly disturbed by fire or anthropogenic features, and habitat within 500 m of anthropogenic disturbances, is considered to be disturbed habitat. Incremental indirect disturbance (Table 6) includes areas within 500 m of the direct project footprint that were undisturbed prior to construction (i.e., outside of 500 m from existing footprint or within an area burned within the last 40 years). Existing footprint includes all human landscape features (e.g., roads, pipelines and cutblocks) visible on satellite imagery at a 1:50,000 scale.

The direct disturbance footprint of the Project is 121.0 ha (Table 6). The area of restored project footprint is 87.8 ha and the area of residual project disturbance is 33.2 ha. Incremental indirect disturbance is 1.3 ha.

Table 6 Quantification of Direct and Indirect Project Disturbance of Caribou Habitat

	Area (ha)			
	Direct Project Disturbance	**Restored Project Footprint**	**Residual Direct Project Disturbance**	**Incremental Indirect Disturbance**
Length of Pipeline Segment	121.0	87.8	33.2	1.3

5.2.1 Duration of Spatial Disturbance

The duration of the spatial disturbance of residual effects resulting from the Project was estimated using available studies and expert opinion (e.g., CLMA and FPAC 2007; ALT 2009). In northeastern Alberta, an area was considered reclaimed for caribou when caribou no longer

exhibited reduced use in the area of a land use feature (Athabasca Landscape Team 2009). Caribou in restored habitat are also assumed to experience natural levels of predator encounter rates (Athabasca Landscape Team 2009). Oberg (2001) determined the recovery of conventional seismic lines to functioning caribou habitat in west-central Alberta occurred within 20 years. Golder (2009) determined that recovery of seismic lines to an average height of 2 m through natural regeneration occurred within 20 to 25 years. The duration of residual effects resulting from direct and indirect habitat alteration and loss is expected to be medium-term (i.e., 10 years). Uncertainties regarding the duration of residual effects will be addressed in the OMP.

5.3 ASSESSMENT OF RESIDUAL EFFECTS

Predation by wolves is considered to be the main factor limiting caribou populations (Bergerud 1988, James 1999, James and Stuart-Smith 2000, Seip 1992, Stuart-Smith et al. 1997) and increased predation by wolves and possibly by other predators is facilitated by underlying landscape changes through apparent competition (Holt 1977). Although the proximate cause of caribou decline is predation, the ultimate cause of caribou decline is linked to a change in habitat and linear feature density (Boutin et al. 2012). Although the effect mechanisms are complex, the negative effects of increasing linear feature density includes changes in caribou distribution and movement and an increased vulnerability to predators (Oberg 2001; Dyer et al. 2002; Latham et al. 2011; Whittington et al. 2011).

The Chinchaga caribou population is not self-sustaining (Environment Canada 2012) due to a complex interaction of factors, all of which are ultimately related to changes in caribou habitat. Increases in primary prey and, therefore, wolves have led to otherwise suitable caribou habitat becoming unsuitable due to higher predation pressure.

Offset measures may be warranted to reduce the residual effects of the Project on the Chinchaga caribou range to acceptable levels. The residual effects of the Project quantified in Table 6 may be modified in the calculation of residual effects in the OMP and CHROMMP to factor in the uncertainty associated with the effectiveness of the CHRP measures, as well as the time lag or duration of residual effects. The result is an offset ratio greater than 1 to 1.

6 MONITORING AND ADAPTIVE MANAGEMENT

NGTL has created a CHROMMP to monitor the effectiveness of planned habitat restoration measures described in the revised Final CHRP. Adaptive management, i.e., the systematic process of monitoring and assessing outcomes and modifying restoration measures if necessary, will be implemented by adjusting and/or supplementing restoration measures, where warranted, to achieve the objectives of the CHRP. Given that science is still emerging on caribou habitat restoration methods and effectiveness, adaptive management principles will be an important means of addressing uncertainty.

Monitoring will be completed for up to 15 years, beginning in summer Q3 2016. At each monitoring interval (described in section 6.1.1 and 6.1.2), effectiveness measures will be evaluated and compared with restoration targets. If measures indicate that restoration has achieved or is on a trajectory to achieving targets, then no further mitigation will be completed. However, if measures indicate that targets are unlikely to be achieved after 15 years, an adjustment to mitigation will be needed and additional monitoring (longer than15 years) will be conducted. This could include implementation of existing mitigation (e.g., see Section 4.2) or new mitigation that is proving to be successful. For example, NGTL is engaged in linear feature restoration research with the Regional Industry Caribou Collaboration in northeastern Alberta so that lessons learned from this research can be applied to the Project. At Year 10, if monitoring results suggest that restoration was successful, then NGTL may request from the NEB an exemption from monitoring in Year 15. In addition, if monitoring results suggest that mitigation measures are meeting their targets, NGTL may request a variance from the NEB to discontinue monitoring at these locations or to conduct less intensive monitoring (e.g., less frequently). Monitoring results, as well as any necessary adaptive management actions, will be reported to the NEB, Environment Canada and AESRD in Q1 following each monitoring interval. Habitat restoration measures that require adaptive management at the conclusion of the 15 year monitoring program will require additional ground-based monitoring until they are successful. If adaptive management actions fail, a revised monitoring program and timeframe will be developed to address unsuccessful measures and their locations

The following sections of the CHRP include brief descriptions of the restoration targets and how they will be measured. Specific details on the monitoring program methods, frequency, timing and locations are included in the CHROMMP submitted in 2015. The CHROMMP describes a comprehensive monitoring program for three NGTL pipeline projects (Northwest Mainline, Leismer and Chinchaga) and a designated offset area in northeastern Alberta (Dillon River Wildland Park).

6.1 TARGETS AND PERFORMANCE MEASURES

Monitoring is divided into habitat restoration and access control programs. Habitat restoration monitoring includes measures of vegetation regrowth. Access control monitoring includes measures of human and wildlife use of the restored ROW.

6.1.1 Habitat Restoration Measures and Targets

Habitat restoration monitoring will be completed in the short term at intervals of 1, 3 and 5 years, and in the long term at intervals of 10 and 15 years. It will include both aerial and ground-based sampling protocols. Habitat restoration targets consist of three broad restoration unit types, including treed upland/transitional, treed lowlands and shrub/graminoid lowlands. Within each type, vegetation will be monitored following Alberta Regeneration Standards (AESRD 2013b; ASRD 2000), including monitoring stocking amount (percent), density (stems/ha) and early growth of regenerated trees.

Aerial monitoring consists of collecting 360° geo-referenced photography and high resolution light detection and ranging (LiDAR) imagery. High-resolution 360° geo-referenced photography provides a complete visual record of the entire ROW and thus will be used to assist in identifying areas that may require restoration adjustment (e.g., lack of vegetation regeneration). In addition, it can be used to verify use of the ROW by motorized vehicles for access control monitoring (see Section 6.1.2). LiDAR imagery provides data on vegetation height, percent ground cover and stem density along the entire ROW that can also be compared with ground-based monitoring plots. A total of 330 LiDAR sample plots (10 plots/km) will be completed along the ROW.

Ground-based monitoring will be conducted to measure habitat restoration performance and verify aerial monitoring data. It will be conducted at randomly placed sample plots within each restoration unit.

Restoration measures from aerial and ground-based surveys include: vegetation height, stem density (stem/ha), ground cover (%) and sight-line (m). In addition, ground-based monitoring will provide detailed information on species composition and percent cover of trees, palatable and non-palatable shrubs, forbs, grasses, nonvascular plants and non-native, invasive or weed species. Evidence of human and wildlife use of the ROW, soils and line-of-sight measurements using Robel poles will also be recorded.

6.1.2 Access Control and Line-of-Sight

Access control and line-of-sight blocking effectiveness will primarily be monitored using remote, motion-triggered cameras, in addition to aerial and ground-based measures described in section 6.1.1. Access control and line-of-sight monitoring will be completed every year for up to 15 years, across multiple seasons.

Remote cameras will be deployed at the beginning of Q3 of each monitoring year at randomly selected access control and line-of-sight block locations along the ROW. In addition, cameras will be deployed in randomly selected locations of the ROW where access control and line-of-sight block measures were not implemented. This will provide a comparison of human and wildlife use between mitigated and unmitigated ROWs (see CHROMMP). Photographs of wildlife will be evaluated by individual species and groups of species, including predators (e.g., wolf, grizzly bear, black bear, cougar, lynx and coyote) and prey (e.g., deer, moose, elk and caribou) to provide count-based statistics.

6.2 ADAPTIVE MANAGEMENT

The adaptive management process has been updated in the revised Final CHRP. It now includes a 15 year monitoring and adaptive management period instead of a 5 year period. It is also has been closely aligned with the CHROMMP.

Adaptive management will be implemented when measures indicate that restoration targets are not being met. Adaptive management actions will address the root cause of lack of performance and will be determined in consultation with regulators and in consideration of caribou recovery guidelines or policies available at that time (i.e., Action Plan and Range Plan). Adaptive management to achieve habitat restoration targets will be completed as recommended by a Registered Forestry Professional. Adaptive management for access control measures and line-of-sight blocking will consist of repair or realignment of mitigation measures as recommended by a reclamation specialist and provincial guidelines. The extent of additional monitoring required for adaptive management actions will be site specific.

Habitat restoration thresholds that will trigger adaptive management actions in upland restoration units include:

- Seedling density (planted seedlings and/or natural regeneration) <1600 stems/ha
- Spatial distribution of seedlings (planted seedlings and/or natural regeneration) <80% of the restoration unit/ha, or
- <80% seedlings (planted seedlings and/or natural regeneration) do not demonstrate sustained growth trends since time of planting (i.e., increasing values for height and percent cover)

Access control thresholds that will trigger adaptive management actions include:

- Evidence of motorized access (removal or destruction of barriers)
- Human use of the ROW is high, or
- Evidence of vegetation disturbance by humans in areas immediately adjacent to access controls

Line-of-sight thresholds that will trigger adaptive management actions include:

- Line-of-sight is >500 m along linear features in upland forested areas
- Physical barriers are not functional or are in poor condition
- Vegetation barriers do not demonstrate sustained growth trends since time of planting, or
- Human use of the ROW is high

7 CONSULTATION

Table 7 provides records of consultation for the CHRP, including records of consultation for other NGTL projects in caribou range that were relevant to the Project. Consultation for the Project will continue with Environment Canada and AESRD regarding the revised Final CHRP and during implementation of the CHRP, and development of the offset and monitoring plans. The revised Final CHRP was sent to AESRD and Environment Canada in April 2015 and further consultation is tracked in Table 7.

In general, consultation with Environment Canada included clarification of if and how habitat disturbance was quantified using the method applied in the Recovery Strategy, consideration of the time lag associated with restoration and addressing a mechanism for demonstrating effectiveness of restoration measures. Feedback from provincial regulators (AESRD) included a request to use an ecosite phase approach to determining restoration treatments, concerns with the retention of woody debris for various reasons (e.g., fire hazard, forest pests and merchantable timber sent to market), as well as recommendations to include woody debris as an important measure for controlling human access on the ROW. AESRD recommended that establishing trees and human access control should be prioritized over predator travel (e.g., line-of-sight and woody debris is ineffective for modifying predator movement/efficiency). Similar to comments from Environment Canada, provincial regulators suggested that, in general, the CHRP successfully identifies many useful tools and locations for restoration activities. Monitoring restoration measures to determine what is working and what requires adaptive mitigation is a key consideration.

Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Federal Agencies			
Environment Canada Department of Fisheries and Oceans Department of Transportation		April 2, 2012 Meeting and teleconference	• Discussion on alignment of environmental assessment with the current recovery strategy for caribou. NGTL committed to prepare CHRP and offset measures plan (OMP) for the Project. • Environment Canada indicated that they would be interested in participating in future discussions relating to how Project effects on caribou will be mitigated, and specifically are interested in reviewing and offering advice on reclamation, restoration, and offsetting plans. Environment Canada is bound to uphold the Federal Caribou Recovery Strategy.
Environment Canada	June Yoo Rifkin Andrew Robinson Paul Gregoire Stephen Virc Victoria Snable Hugo Gherbavaz Francois Blouin-Maurice Melissa Vance Cheryl Ann Johnson	October 9, 2012 Meeting and teleconference	• Discussion on the final federal recovery strategy for boreal caribou, including implications for the Project. NGTL discussed the status of the preliminary CHRP and provided an updated draft to Environment Canada for comment. Environment Canada also requested that NGTL work with them in the development of the OMP.
Environment Canada	Paul Gregoire	January 17, 2013 Conference Call	• Discussion on the CPP, CHRP and OMP. NGTL provided a history of the development of the caribou documents, from pre-construction through operations. The documents will be the toolbox for what will be done. • Preliminary CHRP explains how measures were arrived at and what could be done; Final CHRP allows for evaluation of detailed construction activities and quantification of measureable parameters to refine objectives (i.e., where, what, when, how). • Conduct a preliminary caribou habitat assessment that is robust, defensible and quantitative; Preliminary CHRP will not have the quantitative results, but they will be in the Final CHRP and in a separate report under Condition 7. • Environment Canada informed NGTL of its Conservation Allowances policy; also, that the recovery strategy lays out advice and approach for recovery. Environment Canada wants NGTL to focus on critical habitat, and on the guidance from the Province. • Environment Canada informed NGTL that they are not in a position to decide or inform whether critical habitat is/will be restored/offset. Environment Canada cannot support destruction of critical habitat, wants to know what is going on, and wants NGTL to consult with the Province. • NGTL (via Rob Staniland) provided an overview of the OMP, including initial thoughts on calculation of residual effects, measures to reduce residual effects, and ways to gauge effectiveness of mitigation • CHRP will focus on planting and restoration, but also on access and line-of-sight blocking. • NGTL indicated they were expecting feedback on NWML and Leismer from the NEB on the CHRPs for those projects.
Environment Canada	Paul Gregoire	January 23, 2013 Email received	• Environment Canada recommended addressing time delay in context of the ability of restoration to benefit caribou (time sensitive, given current population trends). Given the Threatened status of caribou, greater accountability and due diligence must be reflected accordingly. A mechanism to demonstrate the effectiveness of restoration is warranted. • Comments are addressed in the CHRP. Time to achieve restoration is addressed in Section 5.1. Monitoring and adaptive management (i.e., mechanism to demonstrate effectiveness of restoration) are described in Section 6.0 and will be elaborated on in the CHROMMP to be filed with the NEB.
Environment Canada	Paul Gregoire	April 12, 2013 Email sent to EC April 26, 2013 Email sent to EC	• Stantec emailed Mr. Gregoire on April 12 and provided a copy of the draft protocols for the ground based caribou habitat assessment to satisfy Condition 7 of Certificate GC-121. • A follow-up email was sent by Stantec to Mr. Gregoire on April 26 to ask whether Environment Canada would be providing feedback and if a date for this could be anticipated. • No feedback was received
Environment Canada	Paul Gregoire	April 17, 2013 Email sent to EC	• NGTL emailed Mr. Gregoire on April 2 and provided a copy of the draft Preliminary CHRP. • Mr. Gregoire indicated he found the report comprehensive, but wanted to hear from AESRD, especially with respect to Table 4 (Measureable Objective/ Project Implementation).

Consultation
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Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Federal Agencies (cont'd)			
Environment Canada	Paul Gregoire	December 6, 2013 Email sent	• In response to the Draft Final CHRP for the NGTL Northwest Mainline Expansion (NWML) and Leismer to Kettle River Crossover (Leismer) pipeline projects, Environment Canada provided written comments on the definition of critical habitat under the Federal Species at Risk Act and how it is to be defined within a range, and discussed future Project review documentation needs around boreal caribou critical habitat. Environment Canada also outlined mitigation principles and the application of these principals in the hierarchical sequence of Avoidance, Mitigation and Compensation for any residual environmental effects that cannot be avoided or sufficiently minimized and will not result in the destruction of critical habitat and/or jeopardize the survival or recovery of the species. Environment Canada identified that for the Project-specific cases of the NGTL Northwest Mainline Expansion and Leismer to Kettle River Crossover pipeline projects, that the application, approval and construction of the projects occurred during a period of transition between the Draft Recovery Strategy for Boreal Caribou (released August 26, 2011) and the final Recovery Strategy (October 5, 2012). The Draft Recovery Strategy did not identify the Project areas as critical habitat, whereas the Final Recovery Strategy identified the area as likely critical habitat. • Environment Canada reviewed the Draft Final CHRP for NWM L and Leismer and overall agrees with the approaches. Environment Canada notes that NGTL will continue consultations with AESRD on the finer details. The biggest challenge identified by Environment Canada is in the successful timely implementation of restoration and offset measures.
Environment Canada	Paul Gregoire	March 27, 2015 Email sent	• Sent revised Final CHRP for Chinchaga for review and comment.
Environment Canada	Paul Gregoire	April 21, 2015 Email received	• Noted that: – a large portion of the project parallels a large power line ROW, hence making restoration more challenging. – monitoring will be extended to 15 years. – access management will focus on areas where ROW's intersect the project. – Alberta Fish and Wildlife has been consulted – the proponent acknowledges that offsetting will be a ratio greater than 1:1 – the proponent's commitment to adaptive management. – a variety of appropriate methods to be used in restoration, line of sight and access control. • • Noted there is of risk of other projects undoing some of the restoration and recommend that the Province of Alberta track restoration areas and manage future development accordingly (the proponent, if aware, should advise the Province when it is notified of potential conflicts). • Suggests the use of more Alder over willows where appropriate (and other less palatable species). • Suggest that although there is a 15 year timeframe for effectiveness of mitigation, any measures that offer potential benefits in the short term should be vigorously pursued and monitored for efficacy, e.g., access management, some line of sight, as the caribou's predicament is time sensitive. • Overall, agreed with the approach of the report and did not otherwise identify any major concerns.
Provincial Agencies			
AESRD	Don Williams Dave Moyles Norm Van Vliet Gerry Matthews Marcus Ruehl Ryan Minchau	December 8, 2011 Meeting and teleconference	• Discussion regarding use and limitations of rollback for access management.
AESRD	Dave Moyles	June 13, 2012 Telephone	• Discussion between Mr. Moyles (AESRD) and Albert Lees (Stantec) regarding boreal caribou along the Chinchaga section. Mr. Moyles suggested that NGTL seek a coordinated approach to caribou protection planning across projects. • Mr. Moyles also indicated that he could provide telemetry data for the Chinchaga herd.
AESRD	Dave Hervieux	November 16, 2012 Telephone	• A telephone discussion was held between Dana Charlton (NGTL) and Mr. Hervieux on November 16 regarding CHRP and offset measures.

Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Provincial Agencies (cont'd)			
AESRD	Dave Hervieux	December 17, 2012 Phone call	• AESRD expects it will be the owner for the caribou Range Plans, as called for under the Federal Recovery Plan and the Alberta Caribou Policy. The Range Plans will be components of broader Action Plans. Range Plans will focus on habitat; Action Plans will extend from habitat to other elements, such as population management. Range Plans will work to move caribou range from the current state to that which facilitates the persistence of caribou, by means including conservation and phased development. AESRD intends to develop the Range and Action Plans in communication with key industry partners (e.g., industry working groups). • There are several pilot projects underway, or soon to be underway, by oil and gas production companies to do restoration work on linear and polygonal features (i.e., old industrial features that are not their holdings). The objective of the habitat restoration is to establish tree growth of equivalent capacity to adjacent lands. • NGTL is advised to strive to enable regrowth on substantial portions of the Project footprint (length and width) to that equivalent to the adjacent forest. Mr. Hervieux indicated that regrowth of herbaceous and deciduous species is not beneficial for caribou and noted that there should be consideration given to how this would be managed. Mr. Hervieux indicated that he feels that caribou are not forage-limited and there is no science to support line-of-sight measures affecting predator travel. However, line-of-sight breaks and rollback are effective measures to block human access and use, and rollback is helpful for re-vegetation. Overall comments regarding habitat restoration: – Habitat restoration measures are good. – Controlling/blocking human access is valuable. – Line-of-sight breaks can be advantageous to some extent; a good restoration project will, in time, address line-of-sight. – The role of companies is to monitor the success of restoration planting, to assess what worked, what needs to be corrected or done differently. – Even with extensive planting, there would be negative effects on caribou. • Habitat for many years until trees mature.
AESRD	Don Williams	February 25, 2013 Telephone	• Discussion between Jim Cochrane (NGTL) and Mr. Williams regarding use of timber for rollback.
AESRD	Dave Moyles	April 2, 2013 Email sent to AESRD April 15, 2013 Email sent to AESRD April 29, 2013 Email received by NGTL	• Christine Nicholls (NGTL) emailed Mr. Moyles on April 2 and provided a copy of the draft Preliminary CHRP. • Ms. Nicholls followed up on April 15. • Mr. Moyles emailed Ms. Nicholls (NGTL) on April 29 with comments on the preliminary CHRP. Mr. Moyles main concern was the use of natural regeneration on the Project ROW and the lack of access management outlined in the plan. • AESRD advised that on a broad scale, upland forested areas (pine-dominated and mixedwood) that are close to treed muskegs are important habitat. Caribou in the Chinchaga range move into these upland forests particularly during winters of early, deep snow (i.e., snow depths approaching a metre by early December). "Wet" white spruce (AVI classification) is also used by caribou throughout the year. During the rut in fall, caribou in the Chinchaga range frequent open wetlands composed of willows and sedges. The openness of this habitat is ideal for bull caribou "showing off" their attributes. • AESRD expressed concern with natural regeneration of deciduous-dominated vegetation communities and use of willow and poplar cuttings, both of which provide good habitat for moose and deer. AESRD recommended NGTL to consider restoration measures to restore upland areas to conifer-dominated stands by planting conifers. • The staffed access check point on the Chinchaga Trunk Road was not operated during the past winter and AESRD has not been advised of any plans that this check point would be operated in the future. There is relatively heavy traffic along the Chinchaga Trunk Road. The existing gate on the road, previously known as the Wintershal road (east of the Cranberry Section), was put in place after a small group of caribou were shot. The potential for unauthorized traffic to do damage is real. • Comments are addressed in the CHRP. Restoration of both upland and lowland habitats, avoidance of reclaiming habitats to shrub-dominant communities with palatable browse for moose and deer, and encouraging regeneration of conifer stands, where appropriate, were incorporated into the habitat restoration prescription.
AESRD	Dave Hervieux	April 2, 2013 Email sent to AESRD April 15, 2013 Email sent to AESRD	• Ms. Nicholls emailed Mr. Hervieux on April 2 and provided a copy of the draft Preliminary CHRP. • Ms. Nicholls followed up on April 15. • NGTL will continue dialogue to seek input from Mr. Hervieux during the preparation of the Final CHRP.

Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Provincial Agencies (cont'd)			
AESRD	Dave Moyles Don Williams	April 12, 2013 Email sent to AESRD April 26, 2013 Email received by Stantec June 6, 2013 Email sent to AESRD	• Michael Preston (Stantec) emailed Mr. Moyles on April 12 and provided a copy of the draft protocols for the pre-construction caribou habitat assessment to satisfy Condition 7 of Certificate GC-121. • Mr. Moyles emailed Mr. Preston on April 26. His main comments are below: – Mr. Moyles indicated that description of critical attributes of caribou habitat should be expanded based AESRD knowledge of the Chinchaga herd range. A description of habitat types important to caribou was provided based on AESRD knowledge of the range. – Mr. Moyles stated that the construction and operation of the Chinchaga Section would have impacts extending further than 30 m from the ROW and that habitat data could be collected 500 to 1000 m outside the Project footprint. – Mr. Moyles asked if the proposed effort of 60 to 80 survey sites was finalized and if the sites had been chosen. • On June 6 Lisa May (NGTL) emailed a letter from Mr. Preston to Mr. Moyles responding to Mr. Moyles comments of the draft protocols. Mr. Preston's key response points are below: – All of the habitats described by Mr. Moyles would be considered as part of the ecosite identification component of the habitat assessment. Mr. Preston agreed that these habitats are important to caribou, and that they are a component of Table 1 of the federal recovery strategy. – Mr. Preston indicated that an assessment of Project effects had been completed at both local and regional scales and that the pre-construction caribou habitat assessment was designed to help develop the Final CHRP and OMP specific to the ROW. – The final number and location of sites was yet to be determined. Plots would be established in appropriate locations subject to habitat variability and replication.
AESRD	Dave Moyles Don Williams Austin Babb	June 26, 2013 Meeting	• Mr. Moyles confirmed he agreed with the "like for like" restoration approach of planning restoration to match the existing landscape of upland and lowland/wetland vegetation. • Mr. Moyles confirmed he like the mounding approach for line of sight barriers especially in lowland/black spruce areas. • Range plans haven't been started for the Chinchaga Herd. He doesn't want to commit to any "special areas" of concern or priority for Offset Measures because of shifts in behavior that may not be reflected in the development of the plan as well as yearly weather and snow conditions. • Mr. Moyles would like to be consulted and possibly work with TransCanada PipeLines Limited to explore more site specific locations for Offsets. • Mr. Williams wasn't sure how the Offsets Measures strategy and the existing land disposition system will work together but he would open the conversation when TransCanada PipeLines Limited has more specific locations in mind.
AESRD	Dave Moyles	June 13, 2013 Phone call	• AESRD requested a coordinated approach to caribou protection planning across NGTL's projects. • NGTL has collaborated with federal and provincial regulators in various jurisdictions, promoted a cooperative group of project and consulting staff to achieve consistency between projects and made an effort to coordinate and combine project meetings with regulators.
AESRD	Dave Moyles	June 21, 2013 Field visit	• Aerial overflight of the NWML Timberwolf and Cranberry Sections to review work completed to date and to discuss potential restoration measures to be implemented. AESRD noted that access is not an issue specifically on the Timberwolf Section and acknowledged the challenges of restoration. Mr. Moyles suggested that different treatments could be applied in an effort to learn what is most effective. • Comments are addressed in the CHRP. The habitat restoration prescription considered locations where access control is a priority. The prescribed measures were developed to include various restoration treatments. Combined with monitoring the implementation of the CHRP is expected to contribute important information regarding effectiveness of habitat restoration in boreal habitats.
AESRD	Dave Moyles	June 26, 2013 Field visit	• AESRD indicated the like-for-like restoration approach is preferred, whereby restoration planning aims to match the existing landscape of upland and lowland/wetland vegetation. Mounding for (access) barriers in lowland/black spruce areas is an accepted approach by AESRD. • AESRD has not yet started Range Plans and cannot commit to any special areas of concern or priority for restoration measures at that time. • Comments are addressed in the CHRP. like-for-like habitat restoration is incorporated into the goals, objectives and restoration prescription

Consultation
April 30, 2015

Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Provincial Agencies (cont'd)			
AESRD	Dave Moyles, Don Williams, Alan Carson, Austin Babb	August 29, 2013 Conference call	• Project status, objectives and timelines of the NWML CHRP were briefly reviewed. Discussion points focused on the use of woody debris, controlling invasive species and grasses from adjacent rights-of-way, mounding, shrub staking, line-of-sight breaks and revegetation. • Rollback is useful for access control. Forest Officer has seen the log berms on the Cranberry Section; since they are isolated features, they are likely not enough to create a continuous ladder or fire hazard. It is comparable to the brush piles that forest harvest operators leave in cutblocks without issue. Refer to Tim Vinge's work related to mounding densities and rollback. Contact Marty O'Byrne for information on planting densities and target survival. In general, 1,200-1,600 stems/ha is common in forest industry for planting densities, depending on the species and site. Avoid the hinge of the mound pile for planting (variable with site conditions and species). • From wildlife management perspective, recommend that focus should be on avoiding attraction of wildlife to the ROW. There have been issues with seeded barley along the Chinchaga Trunk Road attracting bears and ungulates. Herbicide application is a viable option to control graminoid species competing with seedlings; to be used with caution and in consideration of sensitivities (proximity to water, etc.). • Ramp-over areas in black spruce lowlands are a good measure. Recommend protecting in winter clean-up and not planting anything to extend them (unlikely success of tree seedlings; do not introduce willow). Natural regeneration as a revegetation method in the lowland areas makes sense. Targeting regeneration of natural vegetation (% cover) as opposed to tree stem density is logical. No noxious weeds is a good target. • Like-for-like restoration is ideal. Where willows are present, willow staking is a viable option. Do not plant willows in areas where they don't currently grow. Willow staking in bio-engineered riparian banks should be done in a manner that will not compromise the effectiveness of erosion control measures (e.g., soil wraps). • Open sight-lines are the nature of the vegetation communities in the lowland areas. Concern with line-of-sight is relevant to the upland forest areas. Access control and line-of-sight measures should be implemented where they make sense; control measures are not warranted where they will be ineffective (e.g., adjacent to roads) for the sole purpose of breaking the line-of-sight every 500 m. • AESRD encourages trying different measures and monitoring to see what is effective. • Comments are incorporated into the goals, objectives, targets, restoration prescription and monitoring plan.
AESRD	Dave Moyles	March 27, 2015 Email sent	• Sent revised Final CHRP for Chinchaga for review and comment. • Email response form Mr. Moyles on April 7, 2015 indicating that the CHRP was received and comments would be provided. • Comments will be incorporated when provided.

Consultation
April 30, 2015

Regards,

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APPENDIX A

Preliminary Caribou Habitat Restoration Plan for the Nova Gas Transmission Ltd. Chinchaga Lateral Loop No. 3 (Chinchaga Section)

Preliminary Caribou Habitat Restoration Plan for the Chinchaga Lateral Loop No. 3 (Chinchaga Section)

July 2013

Prepared for:
NOVA Gas Transmission Ltd.
A Wholly Owned Subsidiary of
TransCanada PipeLines Limited
Calgary, Alberta

Prepared by:
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Calgary, Alberta

Project Number: 123510572

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Abbreviations

AESRD ..... Alberta Environment and Sustainable Resource Development
CHRP ..... Caribou Habitat Restoration Plan
CHROMMP ..... Caribou Habitat Restoration and Offset Measures Monitoring Program
CPP ..... Caribou Protection Plan
EAS ..... Environmental Alignment Sheets
EPP ..... Environmental Protection Plan
NEB ..... National Energy Board
NGTL ..... NOVA Gas Transmission Ltd
OMP ..... Offset Measures Plan
ROW ..... right-of-way

1 INTRODUCTION

NOVA Gas Transmission Ltd. (NGTL), a wholly owned subsidiary of TransCanada PipeLines Limited, has applied to the National Energy Board (NEB) under Section 52 of the *NEB Act* for authorization to construct and operate the Chinchaga Lateral Loop No. 3 (the Project) (see Figure 1). The Project is 33 km long, and is parallel and contiguous with 31 km (94%) of existing ROW. Of this contiguous section, 29.2 km is parallel to one or two transmission lines. This report has been prepared in accordance with Certificate Condition 10a of Certificate GC-121 (Table 1).

Table 1 Certificate Condition 10 – Caribou Habitat Restoration Plan

Caribou Habitat Restoration Plan Certificate Condition
10. Caribou Habitat Restoration Plan NGTL shall file with the Board for approval, in accordance with the timelines below, preliminary and final versions of a CHRP for the Chinchaga Section. NGTL shall provide a copy of the filings to Environment Canada and the appropriate provincial authorities.
a. Preliminary CHRP –to be submitted at least 180 days prior to commencement of construction for the Chinchaga Section. This version of the CHRP shall include, but not be limited to: i. the objectives of the CHRP; ii. a decision tree(s) that will be used to (1) prioritize potential caribou habitat restoration sites and (2) prioritize mitigation to be used at different types of sites. The decision tree(s) should be based on a literature review identifying temporal and spatial caribou habitat restoration methodologies and their relative effectiveness, as well as based on typical site factors that may constrain implementation; iii. the quantifiable targets and performance measures that will be used to evaluate: (1) the extent of predicted, residual effects, (2) the extent to which the objectives have been met and the need for consequent compensation offsets; iv. a schedule indicating when mitigation measures will start and the estimated completion date; and v. evidence and a summary of consultation with Environment Canada and provincial authorities 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 for the Chinchaga Section. This updated version of the CHRP shall include, but not be limited to: i. the preliminary CHRP, with any updates identified in a revision log that includes the rationale for any changes to decision making criteria; ii. a complete table of caribou habitat restoration sites, including but not limited to location, spatial area, description of habitat quality, site-specific restoration activities and challenges; iii. maps or Environmental Alignment Sheets showing the locations of the sites; iv. evidence and summary of consultation with Environment Canada and provincial authorities regarding the Final CHRP; and v. a quantitative and qualitative assessment of the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the aerial extent of the resulting residual effects to be offset, which also includes indirect disturbance.

This Preliminary CHRP will be followed by a Final CHRP, which will address Certificate Condition 10b. The Final CHRP will expand on the Preliminary CHRP to provide specific information on the location of restoration sites and specific restoration measures selected, as well as an assessment of residual project effects on caribou habitat. An Offset Measures Plan (OMP; Preliminary and Final as per Certificate Condition 20) and a Caribou Habitat Restoration and Offset Measures Monitoring Program (CHROMMP; as per Certificate Condition 21) will be prepared and filed separately in accordance with the timelines outlined in the Certificate Conditions.

1.1 Guidelines for Boreal Caribou

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, and 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 herd range has not yet been developed.

Similar to the provincial policy, the final Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada (Environment Canada 2012) 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 incorporating adaptive management. One of the management approaches suggested in the 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 2012).

NGTL is continuing to work with Alberta Environment and Sustainable Resource Development (AESRD) to ensure caribou habitat restoration plans undertaken for this Project align with the provincial caribou policy and the future provincial Caribou Action Plan for the Chinchaga caribou herd. Herd-specific Caribou Action Plans, as part of the province's commitment to the federal Recovery Strategy, are required.

N

ESA 548

KP 33.29

KP 30

KP 25

KP 20

KP 15

KP 10

KP 5

KP 0

Dugout #4

Dugout #3

Dugout #2

Dugout #1

Meikle River

Hotchkiss River

Kilometre Post

Chinchaga Section

Non-contiguous

Contiguous

Hotchkiss Water Line

Chinchaga_LEGEND

Dugout

Existing

New

Stockpile Site (Existing)

Road

Watercourse

Caribou Range

Environmentally Significant Area

Water Body

0 1 2 3 4 5

Kilometres - 1:150,000

123510572-0106

British Columbia

Alberta

Rainbow Lake

High Level

Chinchaga Section

Manning

Fort St. John

Grimshaw

Peace River

Fairview

Dawson Creek

Spirit River

Falher

McLennan

NT

Area of Interest

BC

AB

SK

USA

Chinchaga Lateral Loop No. 3 (Chinchaga Section) Project Location

Chinchaga Lateral Loop No. 3 (Chinchaga Section) Project Location

Acknowledgements: Base data supplied by the Government of Alberta. Route information provided by TransCanada Pipelines Ltd. and MidWest Surveys Inc.

PREPARED BY Stantec

PREPARED FOR NGTL

FIGURE NO. 1

Last Modified: 3/18/2013 By: arocha

1.2 Organization of the Preliminary CHRP

Consistent with the requirements of Certificate Condition 10(a), this preliminary CHRP is organized into the following Sections:

- **Objectives** - Section 2.0 (Certificate Condition 10(a)(i)): introduces the primary objectives of the preliminary CHRP including: (i) restore as much caribou habitat as possible and (ii) provide a means to assess the extent of habitat loss that will require compensatory efforts. This section also outlines NGTL's commitment to develop a study design that will help to evaluate the extent to which the CHRPs objectives have been met.
- **Literature Review** - Section 3.0 (Certificate Condition 10(a)(ii)): focuses on a literature review of current and historical habitat restoration initiatives and techniques, and their reported successes and failures. The literature review provides a basis for understanding general decision-making criteria with regard to prioritization of restoration sites and mitigation measures. The literature review provides key results and measures suited for caribou range, but the application of those restoration measures will be specific to the Project and dependent on site conditions. Therefore, not all restoration measures discussed in Section 3.0 may be appropriate or necessary for the Project, but are nonetheless provided for completeness and consideration.
- **Prioritization of Caribou Habitat Restoration Sites and Mitigation** - Section 4.0 (Certificate Condition 10(a)(ii)): General decision-making criteria derived from the literature review was used to develop habitat-specific decisions trees for the Project. The decision trees aid in the process of identifying and prioritizing the selection of caribou habitat restoration locations and proposed mitigation.
- **Evaluation of Residual Effects and Restoration Objectives** - Section 5.0 (Certificate Condition 10(a)(iii)): provides the quantifiable targets and performance measure criteria by which the effectiveness of the proposed habitat restoration objectives will be evaluated. Limitations and assumptions specific to the Project are included in this section.
- **Schedule** – Section 6.0 (Certificate Condition 10(a)(iv)): provides a schedule of activities indicating when mitigation measures will begin and the estimated completion date.
- **Consultation with Environment Canada (EC) and Alberta Environment and Sustainable Resource Development (AESRD)** - Section 7 (Certificate Condition 10(a)(v)): summarizes the consultation and dialogue that has taken place with EC and AESRD regarding the Preliminary CHRP.

The Preliminary and Final CHRPs are intended to supplement the measures provided in the Project Environmental Protection Plan (EPP) (ESA Section 20A), Caribou Protection Plan (CPP) (ESA Section 20A Appendix H) and the Environmental Alignment Sheets (EAS) ESA Section 20B). The EPP, CPP and EAS were developed in consideration of the Project location within caribou range, and therefore incorporate standard best practices for working in this particular caribou range. The Preliminary CHRP builds on those caribou protection measures to provide detail on NGTL's commitment to restore the

Project footprint in the Chinchaga caribou range and provides potential measures, objectives and criteria for evaluation.

2 OBJECTIVES

The Project will potentially affect caribou in the Chinchaga caribou range as a result of direct loss of habitat and an indirect change in habitat suitability; a small increase in mortality risk may occur as a result of small changes in access and associated travel efficiency by humans and predators. The intent of the Preliminary CHRP is to provide decision-making criteria and decision trees for evaluation of habitat restoration treatments to reduce Project residual effects on caribou and caribou habitat. The objectives of the Preliminary CHRP are:

- Habitat Restoration: promote habitat restoration (*i.e.*, native vegetation re-establishment) within the Project footprint in a manner that will achieve re-establishment of natural ecosystem types adjacent to the Project footprint, where feasible.
- Access Control: implement access control to discourage human use, and possibly predator travel, along or into the Project right of way (ROW).
- Line-of-Sight Blocking: establish line-of-sight blocks, where feasible (*i.e*., new alignment, or locations along parallel alignment that have existing line-of-sight blocks), to reduce caribou mortality risk along the Project ROW.
- Monitoring Program: evaluate predicted residual effects and restoration treatment effectiveness using a quantitative design in order to modify or implement new restoration treatments, if required.
- Adaptive Management: identify unsuccessful restoration treatments, microsite conditions that are either not conducive or suitable for establishment of vegetation, and need to be adjusted or supplemented to achieve the objectives of the CHRP.

Project effects on caribou, resulting either from direct or indirect change in habitat suitability or a change in mortality risk, are key metrics for determining habitat restoration targets, measureable objectives and final determination of residual effects that might require offsetting. As reported in the Supplemental Report on Potential Effects on Caribou (Stantec 2012), the Project was not predicted to result in any incremental increase in indirect effects on habitat. Direct effects were estimated to range from 119.19 to 127.01 ha, depending on the method of calculation (Stantec 2012). The estimated incremental increase in linear density resulting from the Project was less than 0.01 km/km^2. Final determination of direct effects (i.e., loss of habitat) cannot be known until Project construction is complete, as Project specific mitigation might result in lower total disturbance. Furthermore, quantification of effects on habitat and line-of-sight is part of an ongoing ground-based caribou habitat assessment under Condition 7, and linkages between the habitat assessment, caribou critical habitat attributes, and actual direct Project effects will be forthcoming.

Restoration through accelerated revegetation will address habitat directly disturbed by the Project ROW, with the exception of a 6-10 m wide area along the pipeline centreline required for maintenance practices and CSA standards. By addressing direct habitat loss through revegetation, indirect effects on habitat

effectiveness in surrounding habitats will be minimized as a direct proportion of restoration implemented within the Project ROW. Time lags and uncertainties associated with restoration treatment effectiveness and other areas on the Project ROW that are not addressed by the CHRP (i.e., centreline) will be compensated for by the OMP, but elsewhere within caribou range. A final assessment of whether the quantifiable targets and performance measures were achieved for each restoration unit (e.g., Upland Deciduous/Mixedwood; see Appendix B) along the Project ROW will be conducted upon completion of the CHRP monitoring program (i.e., for 5 years following commencement of operation). The total area of habitat-specific restoration units that underperform and are statistically significant from their respective target or performance measure will also be addressed by the OMP.

Restoration will be achieved through a variety of measures, including construction mitigation measures, natural regeneration, site preparation, seeding with woody vegetation species, bio-engineering, and seed or seedling planting of native species. Pursuant to Condition 7, a pre-construction habitat assessment will aid in understanding the quality, quantity, variability, and areal extent of caribou critical habitat along the Project ROW, and provide a basis for setting quantifiable targets for restoration.

Objectives provide a means by which the effectiveness of the CHRP can be evaluated through monitoring. Section 5.0 provides detail on the rationale and assumptions of quantifiable targets and performance measures used to evaluate predicted residual effects and restoration objectives, and the quantitative design of the monitoring program.

While not an explicit goal of this Preliminary CHRP, the measures implemented through this plan will have the added advantage of benefiting a number of other species and environmental values. For example, habitat restoration and access control will reduce the potential for negative human-wildlife interactions. In Alberta, controlling access to reduce human-caused grizzly bear mortality is a key recommendation in Alberta's grizzly bear recovery plan (Alberta Grizzly Bear Recovery Team 2008). Bayne *et al.* (2011) also demonstrated positive effects of habitat restoration along linear features (notably seismic lines) for black bear, marten and several bird species.

3 LITERATURE REVIEW

Restoration of disturbed habitat has become one of the key components for caribou conservation, and has been identified in the federal recovery strategy (Environment Canada 2012) and in provincial boreal caribou recovery planning efforts (Government of Alberta 2011). The purpose of this literature review is to provide an understanding of the current state of knowledge of the value and purpose of habitat restoration in caribou range, to provide a review of historical and ongoing habitat restoration initiatives, and to summarize the various techniques that have been implemented and along with their associated effectiveness. The results of the literature review have been used to develop decision trees that will aid in the prioritization of caribou habitat restoration sites as well as mitigation measures at different types of sites (see Section 4). The literature review was conducted using a systematic approach and standard research techniques including the use of in-house reference material and querying scholarly databases using keywords and phrases. Literature cited in peer-reviewed scientific papers was also consulted where appropriate.

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, Environment Canada 2011). 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 ROWs, seismic and cut lines) have been associated with increased predator mobility, potentially putting caribou 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) modeled 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.* (2011) 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 ROWs (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, because 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 return to 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 (e.g., AENV 2010, AENV 2011). 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 learning's 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 Associates [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. Inoculation of reclaimed landscapes with lichen fragments has been effective in re-establishing lichen forage over the long term (17-45 years) in disturbed areas (Stokes et al.2009). While lichen establishment is valuable to long-term habitat restoration as an important caribou habitat attribute, the long time frame associated with lichen growth is not expected to be a short-term attractant to caribou while efforts to reduce predator presence are also undertaken.

Common among many of these initiatives are learning's 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 lessons learned. The summary is based on publicly-available information that NGTL considers to be the most recent, relevant, and comprehensive with regard to caribou habitat restoration initiatives for the Chinchaga range.

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 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 ROW, in particular in deciduous habitats (TERA 2011a, 2012). 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 (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).

Salvage and transplanting of native vegetation is a means of introducing small scale island mat transplants containing native flora and soil fauna important to regeneration. Transplanting native materials can 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 require 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.

Table 2 Historic and Current Habitat Restoration Initiatives

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
AXYS Environmental	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
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 ROW 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.	Diversified Environmental Services (DES) 2004

Table 2 Historic and Current Habitat Restoration Initiatives (cont'd)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
Canadian Natural Resources Limited (CNRL), Diversified Environmental Services (cont'd)			• 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.	
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 Historic and Current Habitat Restoration Initiatives (cont'd)

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, 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 rollback.
			• 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 rollback);
			  • included planting of tree seedlings on a variety of different ecosites, treatment types and disturbances;
			  • 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.
				Suncor 2007
				CRRP 2007a,b
				Neufeld 2006

Table 2 Historic and Current Habitat Restoration Initiatives (cont'd)

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]) (cont'd)			• Conducted trials of transplanting existing trees under winter and summer conditions. • Sponsored trials of frozen tree seedling planting. • 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.	
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

Table 2 Historic and Current Habitat Restoration Initiatives (cont'd)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports

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
			  • 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 Historic and Current Habitat Restoration Initiatives (cont'd)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports

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;
			  • 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.	

Table 2 Historic and Current Habitat Restoration Initiatives (cont'd)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
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 ROW on areas of erosion concern only; promoting the growth of native species from seed; planting tree and shrub seedlings; transplanting existing shrubs; and using 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. • 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 (an update report was not available for review). • 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 ROW by ATV damaged many seedlings. • Seedlings planted in conjunction with rollback were not damaged.	Enbridge 2010 Golder 2011

Table 2 Historic and Current Habitat Restoration Initiatives (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
			• Planting sites are currently subject to monitoring over a five year period
			• 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 (an update report was not available for review).
			• Good survival of seedlings where mechanical seeding 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

Table 2 Historic and Current Habitat Restoration Initiatives (cont'd)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
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.	

	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;
			  • rollback; and
			  • frozen tree seedling planting.	

Table 2 Historic and Current Habitat Restoration Initiatives (cont'd)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
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

NOTE:
Table modified from Golder 2012b.

A standard alternative to salvage and transplanting is to source seeds and/or seedlings from a nursery. Typically, trees and shrubs are sourced about one year prior to planting, either as seeds or seedlings from a source in the same geographic region as the Project. Seed mixes for plants and agronomic grasses can be sourced on a shorter timeframe, often in the range of three to four months. Consideration of the species mix, and the ratio of each species in the mix, will be provided in the Final CHRP.

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 revegetate 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). The federal recovery strategy for boreal caribou indicates that forested stands less than 40-50 years of age, depending on stand type, do not meet critical habitat requirements for the Chinchaga range (Environment Canada 2012).

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, or ability to reduce variability, of access control measures is likely dependent on suitable placement (*e.g.*, placed to prevent detouring around access control point), enforcement, and public education on 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 that ATV access is no longer facilitated. However, when a pipeline must be operated free of trees in the range of 6-10m wide above the ditch line, other means of access control at key access points would be required (e.g., use of berms, boulders or gates). Where the Project RoW is contiguous with another operator, as is the case for 29.2 km of transmission line that is parallel to the Project, the challenge of effective access control is greater.

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 revegetation of disturbed areas (CLMA and FPAC 2007). Expediting growth of visual barriers along linear features can be achieved by concentrating restoration 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.

Line-blocking is another potential measure that may have benefits for controlling access and reducing wolf use. Neufeld (2006) conducted a preliminary assessment of tree-felling along seismic lines to block access in the Little Smoky herd range in Alberta during the summer and fall of 2004. While she did not observe statistical significance between wolf use of blocked versus non-blocked seismic lines, there was an indication that wolves tended to use areas with unblocked seismic lines more often than areas with blocked seismic lines (Neufeld 2006). Neufeld (2006) concludes that if tree-felling is to be used as a line-blocking measure, it should be investigated more thoroughly, and not relied upon solely as a mitigation tool. Preferably, line-blocking should be used in combination with other management actions such as habitat restoration (Neufeld 2006), and continue to be evaluated for effectiveness using an adaptive management approach.

To date, vegetation recovery in the medium and long-term following the creation of pipeline ROWs 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 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 techniques are having a positive effect on caribou populations. However, based on modeling 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 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, and has marginal results.

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

- restoration 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, as well as to access control and line-of-sight management; and

- long-term monitoring of vegetation recovery on linear disturbances and of predator response to access control.

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 • maintain natural drainage	Grubbing on the ROW is restricted to the trench width, allowing the integrity of the root layer to be maintained on the majority of the ROW, and allowing rapid recovery of herbaceous and deciduous woody vegetation species. Snow padding or matting on work areas of the ROW 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 and mulching 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 2012).
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

Table 3 Habitat Restoration Methods Best Suited for Caribou Areas (cont'd)

Type of Mitigation Prescription	Objective(s)	Specifications	Comments	References
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	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 Habitat Restoration Methods Best Suited for Caribou Areas (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 ROW. 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

Table 3 Habitat Restoration Methods Best Suited for Caribou Areas (cont'd)

Type of Mitigation Prescription	Objective(s)	Specifications	Comments	References
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 rollback decomposes over time • provide microsites for natural seed ingress	Spread rollback evenly across the entire ROW width. Ensure coarse woody debris is consistently dense enough on the ground to discourage ATV use along a ROW. Osko and Glasgow (2010) recommend rollback loads do not exceed 400 tonnes/ha. Locations where 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 100 - 200 m or more 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%; 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 use and length of a rollback segment is dependent on sufficient quantities of rollback during clearing of new disturbance and the trade-off between its use and the ability/space to store it during construction. Longer segments are a more effective treatment at controlling human access since ATV riders will be less inclined to try to ride through the rollback or traverse around the rollback in adjacent forest stands if rollback continues for an extended distance. Rollback can also conserve soil moisture, moderate soil temperatures and provide nutrients as 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. Rollback is effective immediately following implementation.	CRRP 2007b Enbridge 2010 Osko and Glasgow 2010 Golder 2010, 2011 Government of Alberta 2012 OSLI 2012

4 PRIORITIZATION OF RESTORATION SITES AND MITIGATION

4.1 Habitat Restoration Measures and Site Selection

Based on the literature review, and on specific Project knowledge, general decision-making criteria were used to develop habitat-specific decision trees for the Chinchaga Section. The decision trees were developed to guide the process of identifying areas for habitat restoration, access control and line-of-sight measures in caribou range, and determining which kinds of measures are expected to be most applicable and effective. The general decision-making criteria and habitat-specific decision trees include consideration of best management practices, Project design and construction techniques, industry standards (*i.e.*, Canadian Standards Association [CSA] Z-662-11 (CSA 2011) and preliminary habitat information. The decision trees also allow for consideration of habitat information being collected as part of the detailed caribou habitat assessment specified in Condition 7.

Habitat-specific Decision Trees: initial restoration units and associated suitable restoration measures were identified using information from the general decision-making criteria that would be applicable to the Chinchaga caribou range. The purpose was to identify Project-specific habitat types, construction factors and habitat restoration measures that may be applied based on general decision-making criteria. Details on the restoration units identified for the Project within the Chinchaga caribou range are provided in Appendix B, and decision trees for determining which restorative measures could be used for each restoration unit or objective under different scenarios are provided in Figures 2a-b. A decision tree for access control and line-of-sight blocks has also been developed using general decision-making criteria and consideration of Project-specific factors to improve effectiveness (Figure 2c). This information was used as the basis for developing quantifiable targets and performance measures for restoration of the Project footprint for the Preliminary CHRP. In addition, pursuant to Condition 7, the Pre-construction Caribou Habitat Assessment will identify, describe and quantify critical habitat types, including their biophysical attributes and areal extent within the Chinchaga Section ROW. This information may be used to adjust quantifiable targets and performance measures consistent with Condition 10 (CHRP), and the general decision-making framework and Appendix B will be revised so as to directly relate to caribou critical habitat attributes as requested in Condition 7 and described in the final federal recovery strategy. Monitoring and adaptive management will facilitate identification of unsuccessful restoration techniques, microsite conditions that are either not conducive or suitable for establishment of vegetation, and measures that need to be adjusted or supplemented to achieve the objectives of the CHRP. Section 5.4 provides additional details on Monitoring and Adaptive Management. Where restoration and other mitigation measures are applied on contiguous NGTL lines, these measures will qualify as offsets.

4.1.1 Project Considerations

Certain opportunities and constraints exist for applying site-specific restoration measures for the Project. Site-specific factors that may constrain or restrict restoration measures include:

- locations necessary for access during operations and maintenance;
- locations that are recognized by other resource users for future developments (*i.e.*, publicly disclosed, applied for and/or approved but not yet completed projects) and would require habitat disturbance within or adjacent to the Project footprint;
- locations that are considered traditional access;

In contrast, site-specific factors that will provide suitable conditions to apply restoration treatments include:

- other linear features (except roads) that intersect the Project footprint. Results from the pre-construction assessment of line-of-site at intersecting linear features as part of Condition 7 will be used as a basis for determining target sites and determining the extent to which line-of-site blocking and access control is needed;
- locations adjacent to watercourse crossings, where extending riparian construction methods and restoration efforts beyond the riparian area is feasible;
- areas rated as having moderate to high habitat capability as caribou habitat (*e.g.*, suitable forage, adequate cover/security, located away from human disturbance);
- areas that are accessible to restoration crews and equipment. Some restoration techniques may be limited by ground conditions (e.g., placement of rollback during frozen ground conditions) or by season (e.g., planting occurs in summer) when certain areas such as muskeg or wetlands may be difficult to access;
- availability of suitable material and provincial regulatory approval for rollback and berms. This will include consideration of potential hazards (e.g., fire) associated with using large volumes of timber for rollback and berms;
- on each side of an intersection with a linear feature that is not an all season road;
- at least 100 m of space required on each side of roads and permanent watercourses crossed by the ROW;
- 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%, and;
- on temporary access (i.e., shoo-flies) and false rights-of-way created for vehicle crossings of watercourses.

Final site selection for the habitat restoration measures will require as-built construction information to allow for validation of site-specific conditions, and input from the NGTL construction and operation/maintenance staff, Project biologists and reclamation specialists, as well as AESRD

representatives. A thorough review of site characteristics will facilitate determination of the suitability of particular sites for restoration, and selection of appropriate restoration treatments. Results from the pre-construction critical habitat assessment obtained as part of Condition 7 will also be used to identify final site selection. Information pertaining to as-built construction will also be considered, including proactive mitigation such as drilling/boring under vegetation buffers, narrowing the ROW, reducing temporary workspace, and avoiding improvement of access and line-of-sight. Experience from implementing the CHRP for the NGTL Horn River Mainline Project (TERA 2011a, 2012) will be incorporated in the decision process.

4.2 Access Control and Line-of-Sight Management

Techniques that reduce human access and possibly predator travel and hunting efficiency also need consideration when restoring habitat in caribou range. These are discussed below and are part of the decision trees in Figure 2c. Where access control and line-of-sight management is applied on the contiguous NGTL line that is adjacent to, but not part of, the Chinchaga Section, these measures will qualify as offsets.

ACCESS CONTROL

Access control measures will include rollback, vegetation planting, mounding or installation of berms (Figure 2c). Locations for access management measures will focus on intersections of the Project with other linear features, such as roads, utility rights-of-way, seismic lines or watercourses. No existing access control measures were noted during wildlife surveys or overflight surveys. Since public awareness of the reasons for access restrictions may influence the effectiveness of access control measures, signs will be installed in appropriate locations to facilitate understanding and respect for access closures.

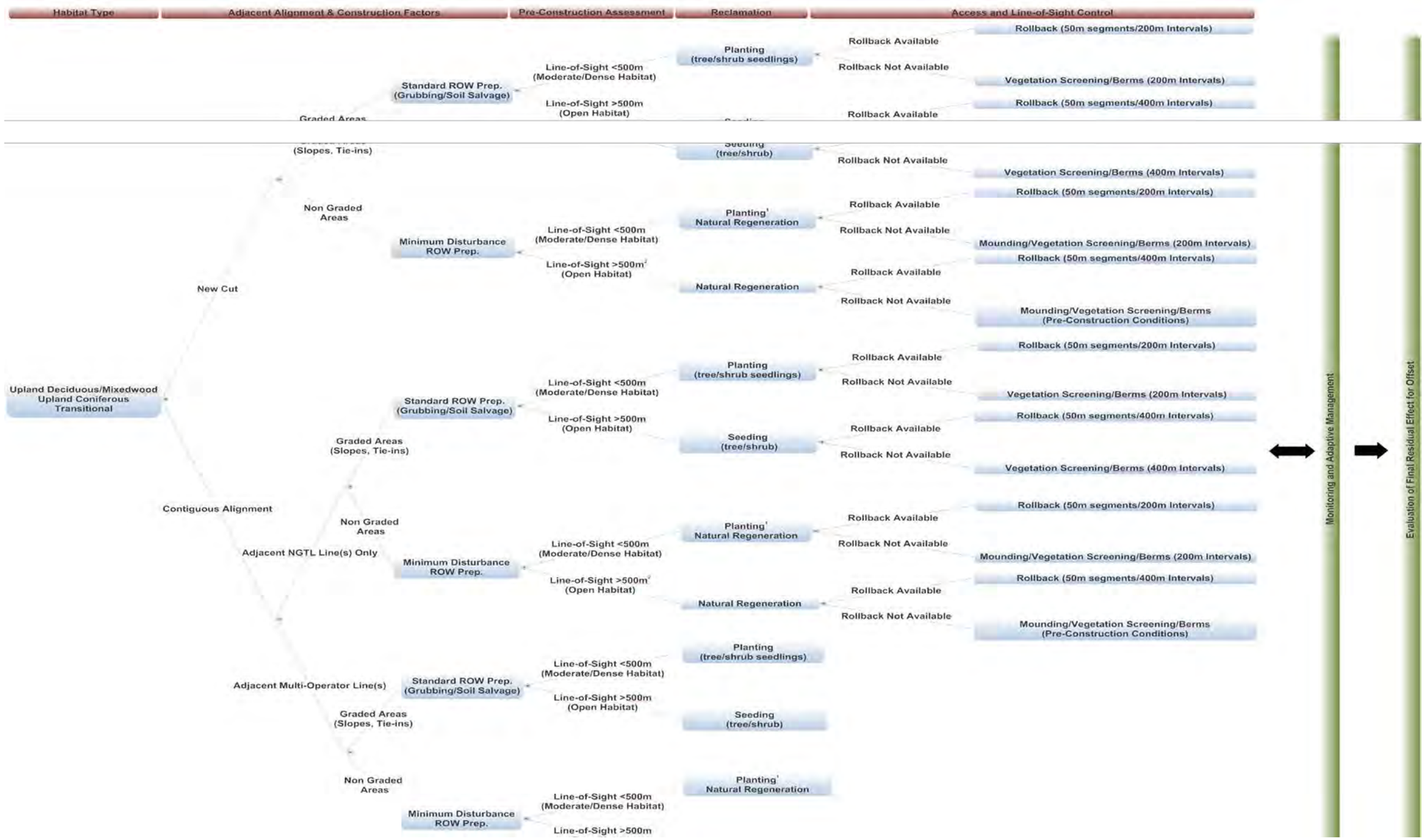
Planning considerations during the preconstruction phase include limiting the creation of new access for construction activity and identifying existing intersecting linear features. Preliminary locations for retention of rollback will be reviewed and refined in the field prior to construction by the Environmental Inspector and construction manager, based on factors such as availability of material and storage space. Implementation will occur 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 or planted with tree or shrub seedlings (e.g., upland areas that are graded, upland and lowland areas where adjacent vegetation is characterized by a treed component).

LINE-OF-SIGHT MANAGEMENT

Measures to reduce sight-lines may discourage human use and may also decrease predator efficiency. 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 linear feature. Bends in the ROW (*e.g.*, dog-legs) are an effective method of limiting line-of-sight distances, but limited opportunities for dog-legs exist where the Project is

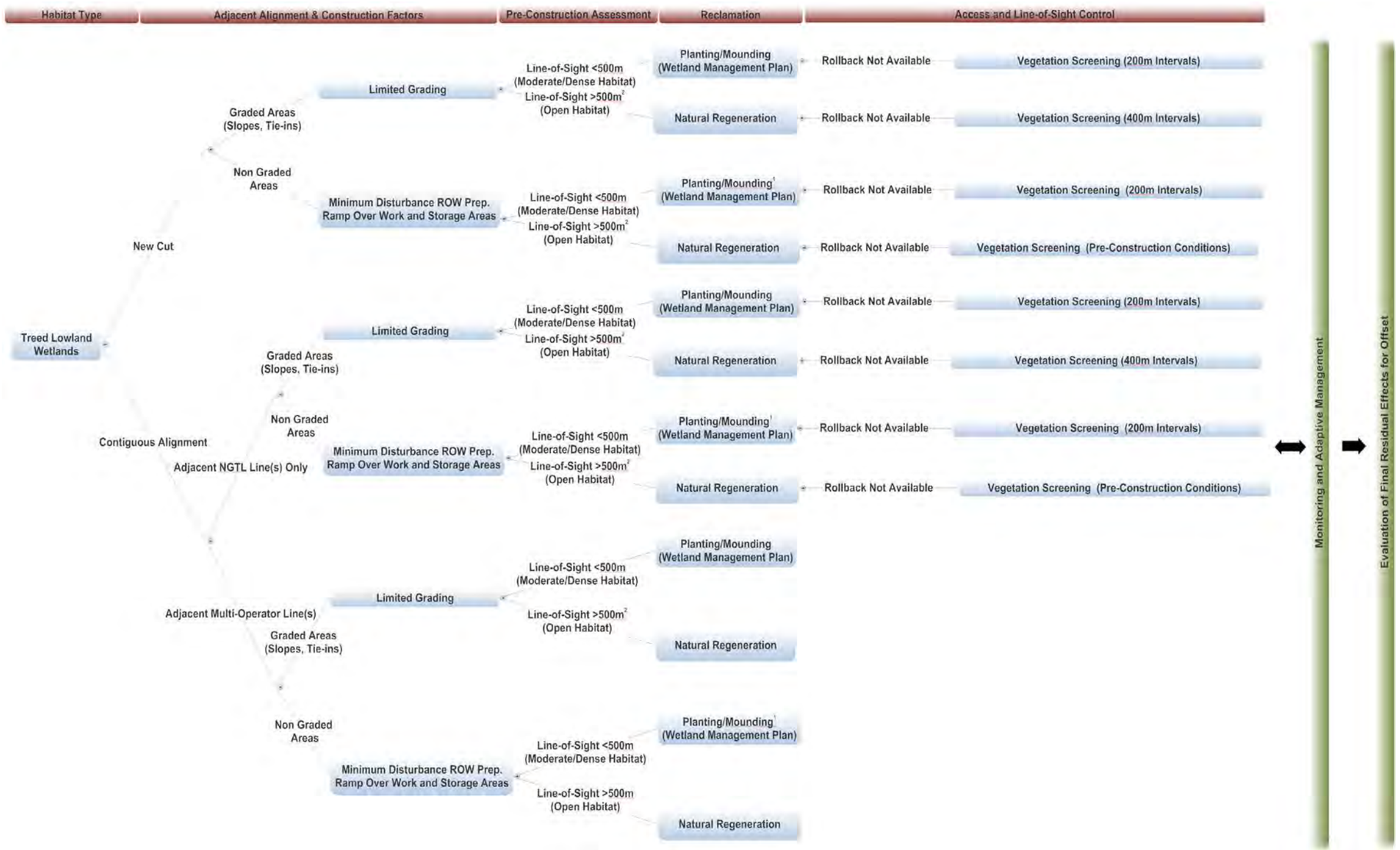
adjacent to an existing ROW. Line-of-sight can also be reduced through the use of short-term measures (*e.g.*, rollback or earth berms constructed to an approximate height of 2 m; fences) and/or long-term measures (*e.g.*, vegetation screening). Although berms and fences can be an effective measure to 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. Vegetation screening, combined with bends in the ROW, are better suited for reducing line-of-sight in caribou range. In addition to natural regeneration, vegetation screens that avoid forage species (*e.g.*, willows, legumes) attractive to ungulates can be planted across the ROW.

Planning considerations during the pre-construction phase for the Project include identifying potential candidate sites for short-term (*e.g.*, rollback, fences or berms) and/or long-term measures (*e.g.*, vegetation screening) for line-of-sight blocks. In addition, as part of Condition 7, a pre-construction assessment of line-of-sight at all linear features intersecting the Project ROW will be completed and used to aid in determining baseline targets for line-of-sight restoration. Based on previous experience (*i.e.*, NGTL Horn River Project), the final locations for rollback, berms or vegetation screening are most effectively determined post-construction when final clearing is complete, when the as-built construction footprint is known, and following discussions with provincial regulators.



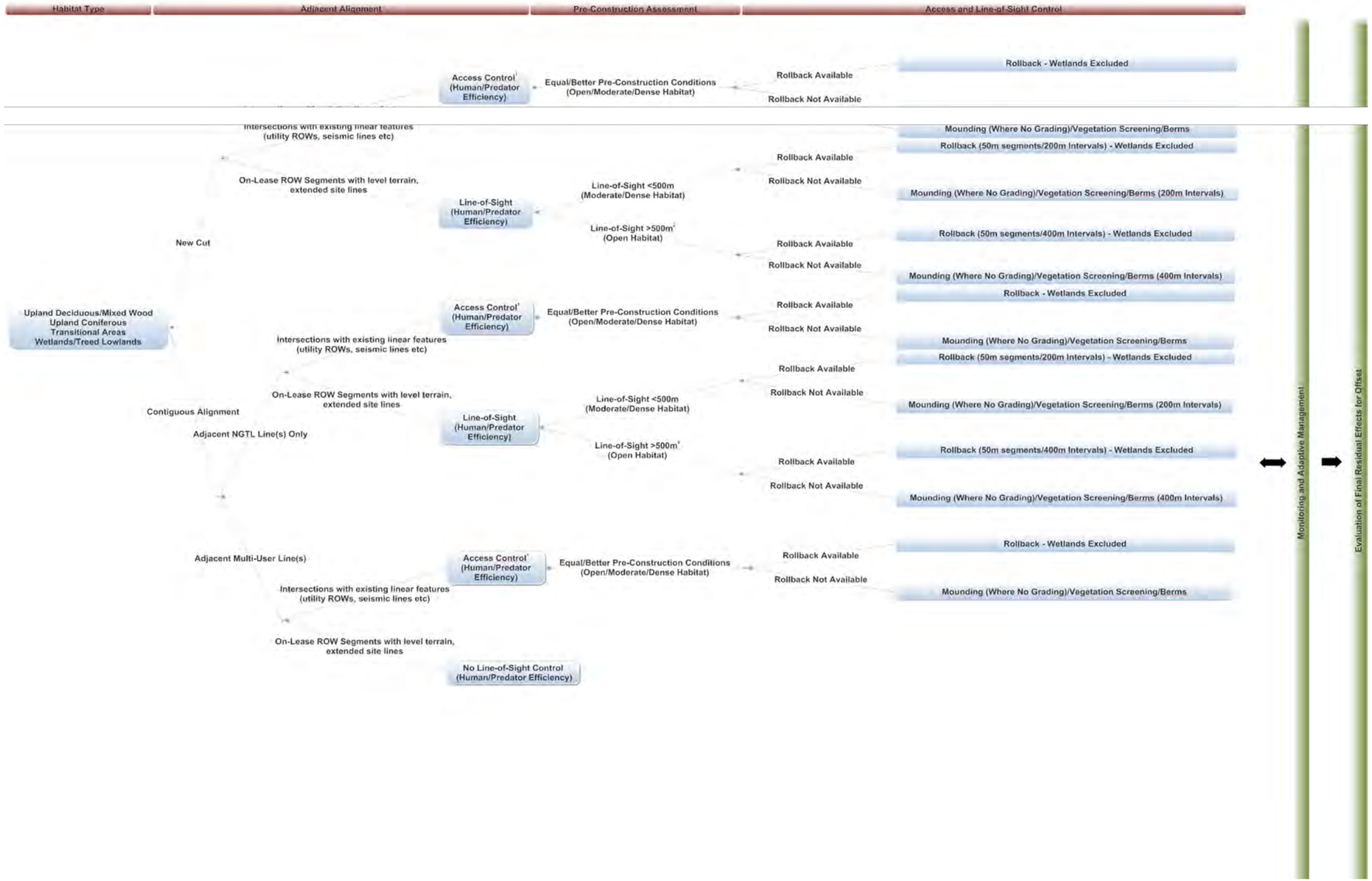
NOTE: (1) Habitat-specific planting to accelerate natural regeneration in areas of minimal disturbance ROW preparation with line-of-sight < 500 m will be obtained from detailed habitat information as part of Condition 7 of Certificate GC-121 (Pre-construction Caribou Habitat Assessment).

Figure 2a Chinchaga Lateral Loop No.3 – Caribou Habitat Restoration Site Selection and Mitigation Prioritization Decision Tree (Upland Mixedwood/Upland Coniferous/Transitional Habitat)



NOTE: (1) Habitat-specific planting to accelerate natural regeneration in areas of minimal disturbance ROW preparation with line-of-sight < 500 m will be obtained from detailed habitat information as part of Condition 7 of Certificate GC-121 (Pre-construction Caribou Habitat Assessment).

Figure 2b Chinchaga Lateral Loop No.3 – Caribou Habitat Restoration Site Selection and Mitigation Prioritization Decision Tree (Treed Lowlands and Wetlands)



NOTE: (1) Access control at intersecting existing linear features (i.e., roads, utility ROW, seismic lines etc.) will not be implemented in areas identified through consultation as traditional use.

Figure 2c Chinchaga Lateral Loop No.3 – Caribou Habitat Restoration Site Selection and Mitigation Prioritization Decision Tree (Line-of-Sight and Access Control)

5 EVALUATION OF RESIDUAL EFFECTS AND RESTORATION OBJECTIVES

This section provides additional detail on the quantifiable targets and performance measures, including methods for evaluating predicted residual effects and restoration objectives, and a discussion of the rationale associated with uncertainty. A summary of the quantifiable targets and performance measures identified for the Project and evaluation criteria are provided in Table 4. In the event that provincial guidelines related to restoration objectives are updated, Table 4 will be re-evaluated for the Final CHRP in consideration of any updates.

5.1 Habitat Restoration

NGTL's commitments to caribou habitat restoration for the Chinchaga Section within caribou range are summarized in Table 4. The preliminary restoration units used to derive the initial restoration targets in Table 4 are provided in Appendix B. These units will be re-evaluated, and potentially adjusted, following a review of results from the pre-construction caribou habitat assessment (see Condition 7).

The Reclamation Assessment Criteria for Pipelines (AENV 2001, AENV 2010) recommends that Equivalent Land Capability should take into account natural variability, which considers the range of landscape attributes that are encountered and influenced by slope, drainage, vegetation composition and organic matter. Evaluation criteria have been identified (Table 4), and are expected to vary depending on the site conditions. For example, the target stem density will vary for different sites, depending on the characteristics of the location and adjacent habitat (*e.g.*, lower stem density naturally occurs in some lowland forests).

Based on the literature review (Section 3.0), previous project experience and NGTL's commitment to implement minimal surface disturbance construction techniques, the Project footprint is expected to revegetate naturally in areas of upland deciduous and mixedwood forests, and in graminoid and shrub-dominated wetland communities. Additional restoration measures such as site preparation (*e.g.*, mounding) and/or planting trees/shrubs will be implemented in transitional and treed lowlands, and potentially in graded areas, to accelerate revegetation and achieve the performance measures of habitat restoration. The actual proportions will be defined in the Final CHRP.

The measurable objectives in Table 4 specifically related to habitat restoration should be considered preliminary and subject to change. Restoration and variables such as the extent of grading, the potential need for clearing of access over the centreline of pipe during the operations phase of the Project (*i.e.*, evaluation criteria are affected by 6 to 10 m wide area centered over the pipeline) and shared workspace on adjacent existing linear corridors. Assumptions are made in order to address uncertainty. Additional variables that may be encountered over the course of this process and identified through consultation with AESRD and Environment Canada will be addressed in the Final CHRP.

Table 4 Evaluation Criteria for Measurable Objectives

Objective/Project Implementation[1]	Rationale / Limitations / Assumptions	Evaluation Criteria	Performance Measures / Targets

Habitat Restoration:
• Based on a review of the restoration units (Appendix B), pre-construction survey drawings, and NGTL's commitment to minimum disturbance construction, NGTL estimates the following proportion of restoration measures will be undertaken on the Project footprint:
  • ~47% of the available[2] footprint = natural regeneration (upland deciduous and mixedwood areas);
  • ~1% of the available[2] footprint = combination of natural encroachment/revegetation from the existing adjacent seed bank and strategic seeding/planting of coniferous species (upland coniferous areas);
  • ~41% of the available[2] footprint = combination of treatments including natural regeneration, site preparation techniques (*e.g.*, mounding and rollback to create microsites) and strategic seeding/planting of tree/shrub species (treed lowlands and poorly drained transitional areas (11%) and previously disturbed land (30%)); and
  • ~11% of the available[2] footprint = natural regeneration (wetlands including open water wetlands and graminoid or shrub-dominated lowlands).
	• Successful native vegetation re-establishment through the set of habitat restoration measures proposed will achieve trajectories toward natural ecosystem types, which will eventually re-establish native wildlife habitat.
	• The Project footprint in caribou range is the proposed clearing of new area (i.e., excludes overlapping/shared areas with existing disturbances).
	• NGTL's operation and maintenance practice includes vegetation control over the pipe centreline (approximately 6-10 m wide area centred over the pipeline) (TCPL 2011) as a corporate mechanism to meet compliance with CSA-Z662-11. This Standard requires that vegetation shall be controlled along rights-of-way to maintain clear visibility from the air and provide ready access for maintenance crews (CSA 2011). Although there is flexibility in NGTL's vegetation control practice to allow for wildlife habitat objectives yet remain in compliance with CSA-Z662-11, NGTL acknowledges limitations for sustained revegetation success along the pipe centreline while the pipeline is in operation. NGTL understands its obligations for achieving equivalent land capability at the end-of-life of the pipeline.
		• Quantitative measures of success will include comparisons of regeneration parameters (e.g., vigour, height, percent cover, species composition) between years 1, 3 and 5 following commencement of operation with the objective of ensuring the establishment of each habitat type and a trend towards achieving equivalent land capability. Regeneration success will also be compared to pre-construction habitat assessments (see Condition 7) to determine whether caribou critical habitat attributes are successfully being restored.
		• GPS location, number and type of restoration treatments and the frequency of monitoring sessions will be defined and mapped in the final CHRP.
			Upland Deciduous/Mixed Wood/Transitional
			• Achieve 70% or higher survival rate for planted seedlings within 5 years following commencement of operation.
			• Demonstrate sustained growth trends across 70% of restoration locations within 5 years following commencement of operation.
			
			Upland Coniferous
			• Achieve 70% or higher survival rate for planted seedlings within 5 years following commencement of operation.
			• Demonstrate sustained vegetation growth trends across 70% of restoration locations within 5 years following commencement of operation.

Table 4 Evaluation Criteria for Measurable Objectives (cont'd)

Objective/Project Implementation[1]	Rationale / Limitations / Assumptions	Evaluation Criteria	Performance Measures / Targets
Habitat Restoration (cont'd):	• Although restoration measures will be undertaken across the entire Project footprint, expectations for intermittent maintenance on the pipeline centreline (discussed above), approximately 70% of the Project footprint will be available for sustained revegetation during the operational life of the pipeline. • The length of ROW requiring grading cannot be accurately determined prior to clearing; however, the extent of grading is anticipated to be limited given the low-grade nature of the terrain. Therefore, the proportion of the ROW requiring grading is excluded from the estimated restoration for the purposes of this Preliminary CHRP. • Areas of the Project footprint that parallel existing footprints with grass cover may have limited successful survival of planted species, due to competition from species ingress from adjacent disturbance. • Overlapping dispositions such as a gravel roads or facilities may limit long-term restoration prior to end-of-life.	• Where revegetation success is inadequate, NGTL will use adaptive management to determine an appropriate course of action. For example, if seedling mortality is unexpectedly high, NGTL may choose to do additional planting, improve site conditions for seedling success, or improve restoration efforts at other sites.	Wetlands/Treed Lowlands • Achieve 50% or higher survival rate for planted seedlings/transplants within 5 years following commencement of operation. • Demonstrate sustained growth trends across 50% of restoration locations within 5 years following commencement of operation.

Table 4 Evaluation Criteria for Measurable Objectives (cont'd)

Objective/Project Implementation[1]	Rationale / Limitations / Assumptions	Evaluation Criteria	Performance Measures / Targets

Access Control:
• Access control measures will include rollback, vegetation planting, mounding or installation of berms (Figure 2). Refer to Section 4.2 for additional information.
	• The Chinchaga Section of the route is located in a relatively remote area. Observations from field studies conducted for the project and anecdotal observations from AESRD indicate there are low levels of human use on the adjacent existing pipeline ROW.
	• Access control measures are most effective when implemented at intersections of the Project ROW with existing perpendicular linear features (*e.g.*, roads, utility corridors, seismic lines, etc.).
	• Access by NGTL staff and contractors, including operation personnel as well as reclamation and monitoring crews, will be recorded and monitored. Access by Project personnel within the footprint in caribou range will be limited to the extent practical.
		• Evidence and level of vehicular (ATV, truck) use along the Project ROW using subjective criteria ratings such as:
		  • access evident: yes/no;
		  • access type: ATV/ truck/ snowmobile/ other;.
		• access level: low (*e.g.*, tracks/ trail evident but difficult to discern or appear to be infrequently used)/ high (tracks/trails appear to be well used; vegetation is trampled down, bare ground may be visible from frequent use)
		An evaluation of whether the objective for access control is achieved will consider all of the criteria ratings
			Access Control:
			• Where existing linear features intersect the Project ROW (i.e., seismic and other utility ROWs), use access control measures in the form of rollback/berms/mounding to achieve and maintain their functionality as a barrier within 5 years following commencement of operation.
			• In areas where vegetation screening has been used to control access, achieve 70% or higher survival rate for planted seedlings within 5 years following commencement of operation.

Table 4 Evaluation Criteria for Measurable Objectives (cont'd)

Objective/Project Implementation[1]	Rationale / Limitations / Assumptions	Evaluation Criteria	Performance Measures / Targets
Line-of-Sight • Appropriate locations for line-of-sight blocks will be identified post-construction when final clearing is complete. • A combination of measures including vegetation screening, rollback and mounding will be applied. Feasibility of installing berms or fencing will be investigated further.	• There are no provincial guidelines in Alberta for line-of-sight management for linear features. Reclamation programs for previous developments in Alberta have targeted maximum sight lines of 400 m (Golder 2007, DES 2004). Operating practices for energy development in sensitive caribou range in BC (BC Ministry of Environment 2011) suggest implementing line-of-sight management every 500 m on linear features that do not share a ROW boundary with a road. • Bends in the pipeline (doglegs) can reduce line-of-sight, but there are limited opportunities to do this for the Chinchaga Section because it is adjacent to another ROW for most of its length. • Wetlands and some treed lowlands encountered by the Project footprint naturally have low and/or open vegetation structure. The line-of-sight distance in these areas is naturally long and, therefore, sight-line management techniques are not practical for these locations. • Limitations associated with construction of slash and earth berms or fencing to reduce sight lines in the short-term include concern from provincial regulators regarding fire hazard and forest health (pathogen spread), availability of material, suitability of substrate to support structures (*i.e.*, peat does not support fencing), introduction of weeds from imported material, and potential for alteration in surface hydrology (particularly from earth berms).	• Establish line-of-sight blocks in forested areas of the footprint within caribou range that will achieve a sight-line distance of 500 m or less in areas of new cut or in sections contiguous with, and adjacent to, NGTL lines only.	Line-of-Sight: • Along the Project ROW, in areas of new cut or contiguous Project ROW with NGTL lines only, achieve sight line distances of < 500m within 5 years following commencement of operation. • Along the Project ROW, in areas of new cut or contiguous Project ROW with NGTL lines only, where planting for future vegetation screens in combination with or without rollback have been installed, achieve 70% or higher survival rate for planted seedlings that are intended as line-of-sight blocks within 5 years following commencement of operation. • Where existing linear features intersect the Project ROW (i.e., seismic and other utility ROWs), achieve line-of-sight distances equal to or less than pre-construction distances

Table 4 Evaluation Criteria for Measurable Objectives (cont'd)

Objective/Project Implementation[1]	Rationale / Limitations / Assumptions	Evaluation Criteria	Performance Measures / Targets
Line-of-Sight (cont'd)	• Fewer limitations are associated with using vegetation screening to reduce line-of-sight. However, this method is a long-term solution (refer to Table 3). • Paralleling an existing linear corridor presents challenges for line-of-sight where the adjacent line is owned by a different company. Application of sight-line management techniques should extend across the width of the Project footprint and adjacent disturbance to be effective.		

NOTES:
[1] Restoration objectives will continue to be evaluated for the Final CHRP to consider any updated consultation with ESRD or other information that becomes available
[2] Available footprint is the area of the Project footprint that is not anticipated to be disturbed by future operation and maintenance activities during the life of the Project

Some grading is expected to facilitate Project construction. The extent of grading is influenced by a number of factors such as terrain variability and weather conditions. A detailed grade plan cannot be completed until clearing of the ROW is completed. The grade plan will be prepared by the contractor and approved by NGTL. The implementation of measures outlined in the EPP (ESA Section 20A) is designed to limit grading to the maximum extent feasible. Areas of grading will be delineated in the grade plan and considered in the siting of restoration measures for the Final CHRP.

5.2 Access Control

Access control measures are most effective when implemented at intersections of the Project ROW with existing perpendicular linear features (*e.g.*, roads, utility corridors, seismic lines, etc.). Given that the Chinchaga Section parallels an existing ROW (including two transmission lines for much of its length), the issues associated with the creation of new access opportunities are largely avoided. Reducing access potential into the ROW from existing linear features will be completed. Determining where access control (e.g., rollback) will occur in part depends on results from the pre-construction caribou habitat assessment (see Condition 7). However, where seasonal or all-weather roads cross the ROW, access control will be implemented at these junctions. Subjective criteria ratings (Table 4) were developed to evaluate the effectiveness of access control measures.

Observations from field studies conducted for the Project and anecdotal observations from AESRD indicate there are relatively low levels of human use on the adjacent existing pipeline rights-of-way paralleled by the Chinchaga Section. Relating changes in access to the Project can be difficult, given the potential for increased access associated with other developments and activities in the Project area. However, the success of access control measures within the Project ROW can be evaluated using the subjective criteria developed for the CHRP (Table 4). Although the importance of access control in establishment and growth of vegetation on reclaimed sites is well understood (refer to Section 3.0), there is uncertainty related to the functional response of caribou, predator and primary prey populations to access control measures, given the lack of empirical studies and published literature on this topic.

5.3 Line-of-Sight

In forested areas of the Project footprint that are new cut or are adjacent to and contiguous with NGTL lines only, line-of-sight blocks and rollback will be established to reduce human use and possibly predator travel and hunting efficiency. Because lines-of-sight are often naturally longer in more open habitats, such as lowland muskeg communities compared to upland forest communities, line-of-sight distances will vary, depending on the location and structure of the adjacent vegetation community. Determining where line-of-sight restoration will occur in part depends on results from the pre-construction caribou habitat assessment (see Condition 7). However, at locations where linear features intersect the Project ROW (i.e., seismic or other utility ROWS), pre-construction estimates of line-of-sight as determined from the caribou habitat assessment (see Condition 7) will be used as a basis for establishing restoration targets.

Similar to access control, evaluating the success of line-of-sight reduction is challenging. Paralleling an existing linear corridor presents challenges for line-of-sight management. The evaluation criteria (Table 4) will allow determination of whether sight-line management objectives within the Project are achieved, although there is uncertainty related to the functional response of caribou, predator and primary prey populations to reduced lines-of-sight given the lack of empirical studies and published literature on this topic.

5.4 Monitoring Program

NGTL has initiated the development of a monitoring program to evaluate the extent of predicted residual effects and restoration objectives of the Preliminary CHRP. Quantifiable targets and performance measures have been developed to provide overlapping benefits for the assessment of both residual effects and restoration objectives. Restoration targets and performance measures (Table 4) will evaluate the success of vegetation restoration in addition to line-of-sight blocking. Access control and line-of-sight barriers constructed at strategic locations within the Project ROW will be evaluated using measures associated with their ongoing function as a sufficient barrier/deterrent.

5.4.1 Methodology

The Project ROW traverses several ecosite phases within the Chinchaga caribou range. Restoration units have been developed to promote native vegetation re-establishment for each ecosite phase (Appendix B). Additional restoration units may be developed at strategic locations to reduce line-of-sight or mitigate areas requiring grading during construction.

Coarse and fine-scale monitoring of vegetation re-establishment will be conducted across varying spatial and temporal gradients. Monitoring will be conducted across the entire Project ROW prior to construction and during years 1, 3 and 5 following Project completion. A repeated measures design will be employed to evaluate the effectiveness of restoration units. The repeated measures design for coarse and fine-scale monitoring will conform to the following model:

$$y_{ijk} = \mu + \alpha_i + \tau_{ik} + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk}$$

Where y_{ijk} is the predicted response of the restoration target or performance measure, α_i is the effect of restoration unit, τ_{ik} is the random variation attributed to sample plots within restoration unit, β_j is the effect year, $(\alpha\beta)_{ij}$ is the interaction between restoration unit and year, and ε_{ijk} is the natural variation attributed to the repeated measure on each sample plot for each respective year (Kuehl 2000). The model term τ_{ik} defines the repeated measure component associated with natural variation between sample plots for each restoration unit and provides a more accurate estimate of the restoration target or performance measure (Kuehl 2000; Montgomery 2001)

5.4.2 Coarse-Scale Monitoring

Coarse-scale monitoring will be conducted across the entire Project ROW via aerial surveys using a high resolution geo-referenced 360 degree camera. Targets and performance measures used to evaluate vegetation re-establishment will be used as baseline estimates to test restoration units re-establishment effectiveness. The specific observations and selected coarse-scale measures (i.e., aerially visible characteristics relevant to the fine-scale monitoring) will be judged to stratify restoration units by performance. This stratification becomes the basis for the fine-scale subsampling. The objectives of coarse-scale monitoring include:

- provide a baseline estimate of vegetation re-establishment performance and define within-restoration unit condition.
- identification of site-specific areas and/or line segments that require restoration unit adjustment or additional mitigation (*i.e.*, erosion, stability)
- assess localized biophysical features that may affect vegetation re-establishment and performance (*i.e*., slope, aspect).
- provide an efficient methodology for the spatial evaluation of quantifiable targets and performance measures for each restoration unit.
- estimate restoration effectiveness against quantifiable targets and performance measures, and test for positive growth trends across a temporal scale.

5.4.3 Fine-Scale Monitoring

Fine-scale monitoring will provide the primary mechanism for evaluating predicted residual effects and restoration unit effectiveness of the CHRP. Each restoration unit will comprise a representative number of sample plots to efficiently represent the Project Footprint. Fine-scale monitoring will also be conducted where line-of-sight and/or site-specific restoration treatments are applied (*i.e*., grading). The objectives of fine-scale sampling include:

- provide detailed raw estimates of vegetation re-establishment for evaluation of restoration targets and performance measures
- spatial and temporal representation of restoration targets and performance measure estimates for each restoration unit.
- ground truth coarse-scale monitoring estimates obtained aerial surveys using high resolution geo-referenced 360 degree camera.
- evaluate line-of-sight blocking treatments applied at site-specific locations.
- estimate restoration effectiveness against quantifiable targets and performance measures, and test for positive growth trends across a temporal scale.

5.4.4 Access Control

Monitoring effectiveness of access control measures will be conducted through an assessment of:

- ATV/snowmobile use (e.g., track presence/absence, U-turn evidence at rollback locations, reduced seedling mortality due to crushing)
- wolf, moose, and deer use of blocked and unblocked linear features (e.g., track or scat/pellet surveys)
- monitoring cameras installed at access control locations where the Project intersects existing linear features (i.e., utility ROW and seismic lines)

Monitoring changes in pre- and-post restoration conditions, including line-of-sight, will be documented in order to evaluate the need for adaptive management within the 5-year period following commencement of operation.

5.5 Adaptive Management

Given the inherent uncertainty associated with caribou habitat restoration, assumptions are made in the development of quantifiable targets and performance measures. The ability to successfully achieve the CHRP objectives is uncertain. Monitoring and adaptive management provide the means by which this uncertainty can be addressed.

The CHROMMP, as required in Certificate Condition 21 (see Section 1), will provide further detail on the criteria and protocols by which the effectiveness of the CHRP and OMP will be evaluated.

The adaptive management component of the monitoring program will facilitate identification of unsuccessful restoration techniques, microsite conditions that are either not conducive or suitable for establishment of vegetation, and measures that need to be adjusted or supplemented to achieve the objectives of the CHRP.

6 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 collection of seed and production of nursery seedlings, and appropriate timing for restoration efforts. Commencement of clean-up and reclamation activities are expected to begin immediately following construction (*i.e.*, winter 2013/2014). Final site selection for caribou habitat restoration treatments and seed collection, if required, will be completed during the first summer following construction (July/August 2014). Scheduling of caribou habitat restoration measures will be coordinated with completion of clean-up and reclamation of the Project footprint (winter 2014/2015 and summer 2015). Effectiveness monitoring and adaptive management will be ongoing from construction to 5 years following commencement of operation. At the end of this 5-year period, , final restoration success will be evaluated (i.e., targets and objectives are being met) and a review of potential residual effects will be completed in consideration of the OMP (see Condition 20).

The following is a summary of key scheduling and logistical

1. July to September 2013: Completion of pre-construction habitat assessment and filing of report.
2. September to November 2013: Review results of Condition 7 and determine whether additional mitigation measures can be accommodated to reduce potential Project effects on caribou critical habitat. Information from the completion of Condition 7 is also expected to aid in the identification and refinement of restoration sites. Baseline targets for restoration will be updated in the Final CHRP and will be include information from the results of Condition 7.
3. October 2013: Provide updated construction schedule 14 days prior to commencement of construction of the Chinchaga Section. Additional modifications to the schedule will be filed with the NEB as they are identified.
4. April to June 2014: Tree and shrub seeds or seedlings to be locally sourced by a nursery for planting in 2015.
5. November 2014: File with the NEB the Final CHRP. Include in the Final CHRP a list of proactive mitigation measures that were applied during construction.
6. Summer 2015: Habitat restoration activities which include active planting commence.
7. Ongoing (1-5 years following commencement of operation): Evaluation of mitigation, restoration and adaptive management activities. First report to be produced on or before January 31 after each of the first, third and fifth growing seasons following the commencement of operation of the Chinchaga Section (in accordance with Condition 18) .
8. Ongoing (1-5 years following commencement of operation): Performance and effectiveness monitoring. First report to be produced one year after the first complete growing season following

construction, and subsequent reports at 3 and 5 years after the first complete growing season following construction.

Effectiveness monitoring and adaptive management will be ongoing from construction to 5 years following commencement of operation , as part of the Post-Construction Monitoring Program (see Condition 13). This program will take into consideration the performance measures and quantifiable targets set out in this document. For example, supplemental plantings may occur in treatment areas if survival rates are lower than expected, and locations of natural regeneration may be considered for supplemental plantings if regeneration does not appear to be meeting established targets. At the end of 5 years following commencement of operation, final restoration success will be evaluated (i.e., targets and objectives are being met) and a review of potential residual effects will be completed in consideration of the OMP (see Condition 20).

7 CONSULTATION

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

Table 5 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Federal Agencies			
Environment Canada Department of Fisheries and Oceans Department of Transportation		April 2, 2012 Meeting and teleconference	Discussion on alignment of environmental assessment with the current recovery strategy for caribou. NGTL committed to prepare CHRP and offset measures plan (OMP) for the Project. Environment Canada indicated that they would be interested in participating in future discussions relating to how Project effects on caribou will be mitigated, and specifically are interested in reviewing and offering advice on reclamation, restoration, and offsetting plans. Environment Canada is bound to uphold the Federal Caribou Recovery Strategy.
Environment Canada	June Yoo Rifkin Andrew Robinson Paul Gregoire Stephen Virc Victoria Snable Hugo Gherbavaz Francois Blouin-Maurice Melissa Vance Cheryl Ann Johnson	October 9, 2012 Meeting and teleconference	Discussion on the final federal recovery strategy for boreal caribou, including implications for the Project. NGTL discussed the status of the preliminary CHRP and provided an updated draft to Environment Canada for comment. Environment Canada also requested that NGTL work with them in the development of the OMP.
Environment Canada		January 17, 2013	Discussion on the CPP, CHRP and OMP. NGTL provided a history of the development of the caribou documents, from pre-construction through operations. The documents will be the toolbox for what will be done. Preliminary CHRP explains how measures were arrived at and what could be done; Final CHRP allows for evaluation of detailed construction activities and quantification of measureable parameters to refine objectives (i.e., where, what, when, how). Conduct a preliminary caribou habitat assessment that is robust, defensible and quantitative; Preliminary CHRP will not have the quantitative results, but they will be in the Final CHRP and in a separate report under Condition 7 EC informed NGTL of its Conservation Allowances policy; also, that the recovery strategy lays out advice and approach for recovery. EC wants NGTL to focus on critical habitat, and on the guidance from the Province.

Table 5 Summary of Consultation with Federal and Provincial Authorities (cont'd)

Agency	Name	Date and Method	Details
Federal Agencies (cont'd)			
Environment Canada (cont'd)			EC informed NGTL that they are not in a position to decide or inform whether critical habitat is/will be restored/offset. EC cannot support destruction of critical habitat, wants to know what is going on, and wants NGTL to consult with the Province. NGTL (via Rob Staniland) provided an overview of the OMP, including initial thoughts on calculation of residual effects, measures to reduce residual effects, and ways to gauge effectiveness of mitigation CHRP will focus on planting and restoration, but also on access and line-of-sight blocking. NGTL indicated they were expecting feedback on NWML and Leismer from the NEB on the CHRPs for those projects.
Environment Canada	Paul Gregoire	April 12, 2013 Email sent to EC April 26, 2013 Email sent to EC	Stantec emailed Mr. Gregoire on April 12 and provided a copy of the draft protocols for the ground based caribou habitat assessment to satisfy Condition 7 of Certificate GC-121. A follow-up email was sent by Stantec to Mr. Gregoire on April 26 to ask whether Environment Canada would be providing feedback and if a date for this could be anticipated. No feedback was received
Environment Canada	Paul Gregoire	April 17, 2013 Email sent to EC	NGTL emailed Mr. Gregoire on April 2 and provided a copy of the draft Preliminary CHRP. Mr. Gregoire indicated he found the report comprehensive, but wanted to hear from AESRD, especially with respect to Table 4 (Measureable Objective / Project Implementation).

Table 5 Summary of Consultation with Federal and Provincial Authorities (cont'd)

Agency	Name	Date and Method	Details
Provincial Agencies			
AESRD	Don Williams Dave Moyles Norm Van Vliet Gerry Matthews Marcus Ruehl Ryan Minchau	December 8, 2011 Meeting and teleconference	Discussion regarding use and limitations of rollback for access management.
AESRD	Dave Moyles	June 13, 2012 Telephone	Discussion between Mr. Moyles (AESRD) and Albert Lees (Stantec) regarding boreal caribou along the Chinchaga section. Mr. Moyles suggested that NGTL seek a coordinated approach to caribou protection planning across projects. Mr. Moyles also indicated that he could provide telemetry data for the Chinchaga herd.
AESRD	Dave Hervieux	November 16, 2012 Telephone	A telephone discussion was held between Dana Charlton (NGTL) and Mr. Hervieux on November 16 regarding CHRP and offset measures.
AESRD	Don Williams	February 25, 2013 Telephone	Discussion between Jim Cochrane (NGTL) and Mr. Williams regarding use of timber for rollback.
AESRD	Dave Moyles	April 2, 2013 Email sent to AESRD April 15, 2013 Email sent to AESRD April 29, 2013 Email received by NGTL	Christine Nicholls (NGTL) emailed Mr. Moyles on April 2 and provided a copy of the draft Preliminary CHRP. Ms. Nicholls followed up on April 15. Mr. Moyles emailed Ms. Nicholls (NGTL) on April 29 with comments on the preliminary CHRP. Mr. Moyles main concern was the use of natural regeneration on the Project ROW and the lack of access management outlined in the plan.

Table 5 Summary of Consultation with Federal and Provincial Authorities (cont'd)

Agency	Name	Date and Method	Details
Provincial Agencies			
AESRD	Dave Hervieux	April 2, 2013 Email sent to AESRD April 15, 2013 Email sent to AESRD	Ms. Nicholls emailed Mr. Hervieux on April 2 and provided a copy of the draft Preliminary CHRP. Ms. Nicholls followed up on April 15. NGTL will continue dialogue to seek input from Mr. Hervieux during the preparation of the final CHRP.
AESRD	Dave Moyles Don Williams	April 12, 2013 Email sent to AESRD April 26, 2013 Email received by Stantec June 6, 2013 Email sent to AESRD	Michael Preston (Stantec) emailed Mr. Moyles on April 12 and provided a copy of the draft protocols for the pre-construction caribou habitat assessment to satisfy Condition 7 of Certificate GC-121. Mr. Moyles emailed Mr. Preston on April 26. His main comments are below: 1) Mr. Moyles indicated that description of critical attributes of caribou habitat should be expanded based AESRD knowledge of the Chinchaga herd range. A description of habitat types important to caribou was provided based on AESRD knowledge of the range. 2) Mr. Moyles stated that the construction and operation of the Chinchaga Section would have impacts extending further than 30 m from the ROW and that habitat data could be collected 500 to 1000m outside the Project footprint. 3) Mr. Moyles asked if the proposed effort of 60 to 80 survey sites was finalized and if the sites had been chosen. On June 6 Lisa May (NGTL) emailed a letter from Mr. Preston to Mr. Moyles responding to Mr. Moyles comments of the draft protocols. Mr. Preston's key response points are below: 1) All of the habitats described by Mr. Moyles would be considered as part of the ecosite identification component of the habitat assessment. Mr. Preston agreed that these habitats are important to caribou, and that they are a component of Table 1 of the federal recovery strategy.

Table 5 Summary of Consultation with Federal and Provincial Authorities (cont'd)

Agency	Name	Date and Method	Details
Provincial Agencies (cont'd)			
AESRD (cont'd)			2) Mr. Preston indicated that an assessment of Project effects had been completed at both local and regional scales and that the pre-construction caribou habitat assessment was designed to help develop the final CHRP and OMP specific to the ROW. 3) The final number and location of sites was yet to be determined. Plots would be established in appropriate locations subject to habitat variability and replication.
AESRD	Dave Moyles Don Williams Austin Babb	June 26, 2013 Meeting	Mr. Moyles confirmed he agreed with the "like for like" restoration approach of planning restoration to match the existing landscape of upland and lowland/wetland vegetation. Mr. Moyles confirmed he like the mounding approach for line of sight barriers especially in lowland/black spruce areas. Range plans haven't been started for the Chinchaga Herd. He doesn't want to commit to any "special areas" of concern or priority for Offset Measures because of shifts in behavior that may not be reflected in the development of the plan as well as yearly weather and snow conditions. Mr. Moyles would like to be consulted and possibly work with TCPL to explore more site specific locations for Offsets. Mr. Williams wasn't sure how the Offsets Measures strategy and the existing land disposition system will work together but he would open the conversation when TCPL has more specific locations in mind.

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APPENDIX A

Restoration Considerations for Select Revegetation Species

Table A-1 Restoration Considerations for Select Revegetation 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 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 2005), 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).

APPENDIX B

Restoration Units for the Chinchaga Section in the Chinchaga Caribou Range

Table B-1 Chinchaga Section Area of Restoration Units in Chinchaga Caribou Range

Restoration Unit[1]	Ecosite Phase	Caribou Range	
		Area (ha)	Percent (%)
Upland Deciduous/Mixedwood	B1 – blueberry / jack pine – aspen (white birch)	1.5	1.2
	D1 – low-bush cranberry / aspen	10.5	8.6
	D2 – low-bush cranberry / aspen – white spruce – black spruce	36.2	29.6
	D3 – low-bush cranberry / white spruce	8.5	7.0
	E1 – Dogwood balsam poplar - aspen	0.9	0.7
Upland Deciduous/Mixedwood Total		*57.6*	*47.1*
Upland Coniferous	C1 – common Labrador tea / mesic jack pine – black spruce	1.2	1.0
Upland Coniferous Total		*1.2*	*1.0*
Transitional	G1 – common Labrador tea / moist black spruce – jack pine	10.7	8.7
Treed Lowlands	Treed fen	1.6	1.3
	Treed bog	1.3	1.1
Transitional and Treed Lowlands Total		*13.6*	*11.1*
Open water wetlands, graminoid and shrub-dominated lowlands	Shrubby bog	2.1	1.7
	Shrubby fen	10.8	8.8
	Shallow open water	0.0	0.0
Wetland/Lowland Total		*12.9*	*10.5*
	Previously disturbed lands	37.1	30.4
Riparian	Riparian areas are not quantified separately. They are classified based on vegetation community (*e.g.*, ecosite phase and site characteristics).		

NOTES:
[1] Restoration Treatment Units correspond to the Habitat Types in Figure 2: Conceptual Guide for Habitat Restoration Measures in Caribou Range. Treed lowlands, open water wetlands, graminoid and shrub-dominated lowlands correspond to the Wetland habitat type in Figure 2. Transitional areas are variable; site characteristics may tend to be more like upland coniferous sites, or treed lowlands and, therefore, restoration methods will vary accordingly.

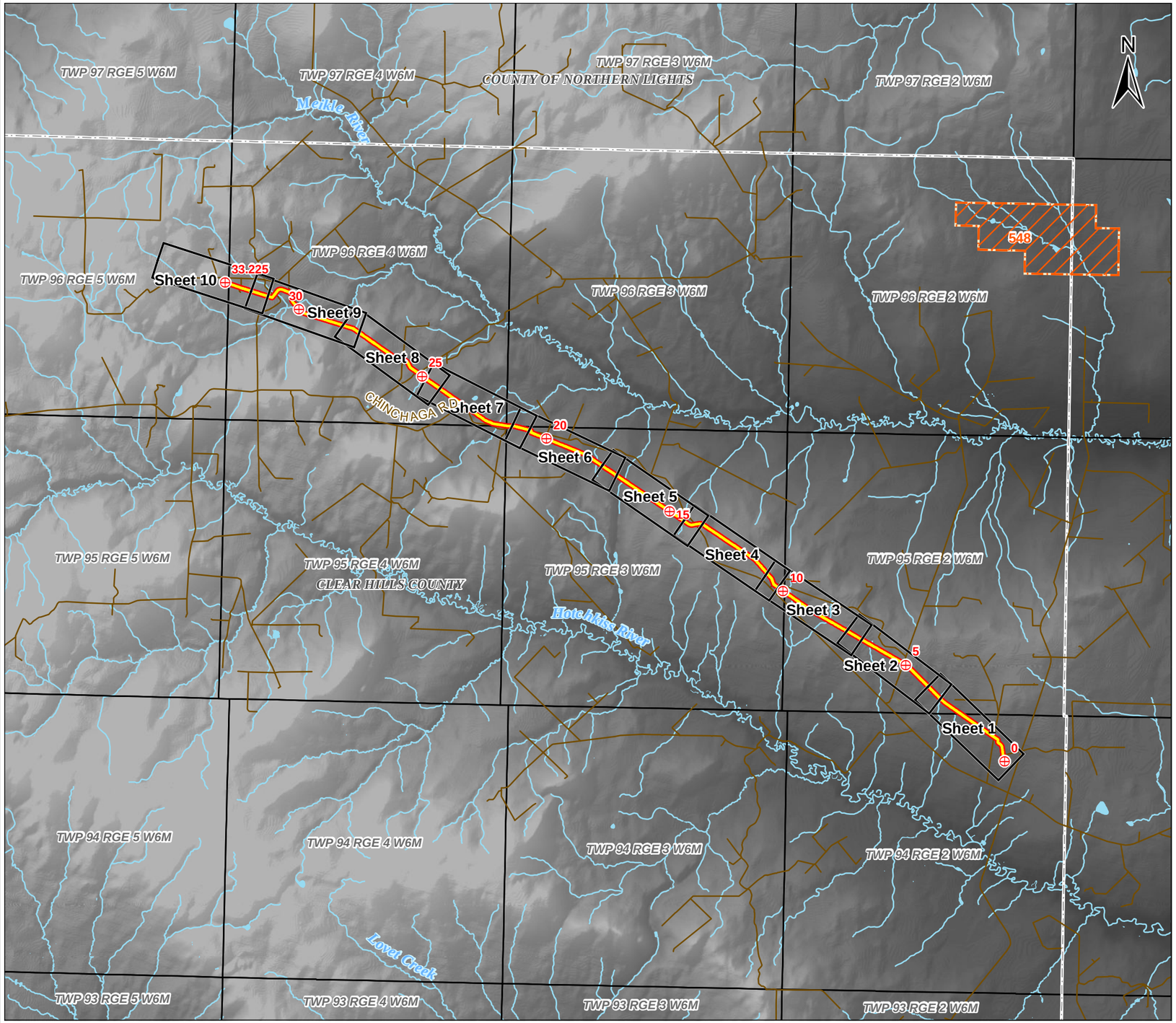
APPENDIX B

Chinchaga Lateral Loop No. 3 (Chinchaga Section) Project

Environmental Alignment Sheets

ENVIRONMENTAL ALIGNMENT SHEETS
CARIBOU HABITAT RESTORATION PLAN

NOVA Gas Transmission Ltd. – Chinchaga Lateral Loop No. 3
(Chinchaga Section)
Revision 1



Environmental Notes

Restoration Objectives:

BWS	Bioengineering / Willow Staking
HR - ACR	Habitat Restoration - Access Control using Rollback
HR - ACM	Habitat Restoration - Access Control Mounding
HR - MDPNR	Habitat Restoration - Minimal Disturbance to Promote Natural Regeneration
HR - SP	Habitat Restoration - Seeding and Planting
LSB - FVS	Line-of-Sight Breaks - Fabricated Visual Screen
LSB - VR	Line-of-Sight Breaks - Vegetation Retention
NR - FD	No Restoration - Foreign Disposition
NR - OD	No Restoration - Other Disposition

Restoration Measures Notes:

Note 1	Fabricated line of sight screens will be staggered across right-of-way to allow access.
Note 2	Do not disturb hand-cut vegetation to maintain line of sight buffer for caribou habitat restoration.
Note 3	Excavate mounds to a depth of 0.30 m to 0.75 m. Do not excavate within 5 m of the pipeline. Minimum Length of 50 m .Plant black spruce two trees per mound to achieve 800-2,000 stems/ha.
Note 4	Minimize disturbance to seed bank.
Note 5	No restoration required.
Note 6	Plant to target density. 2,000 stems/ha = range of 1,600-2,400 stems/ha. 1,400 stems/ha = range of 800-2,000 stems/ha.
Note 7	Plant to target density. 2,000 stems/ha = range of 1,600-2,400 stems/ha.
Note 8	Plant to target density. 2,000 stems/ha = range of 1,600-2,400 stems/ha.
Note 9	No restoration required. Avoid rare plant locations during all activities.
Note 10	Place rollback where the right-of-way narrows to maximize the length of rollback. Minimum length of 50 m. Stack layers of logs on top of each other at a perpendicular angle to a minimum of 1 m high, spaced a few meters apart to allow for trees to be planted among the logs. Plant to target density. 2,000 stems/ha = range of 1,600-2,400 stems/ha.
Note 11	Source native willows or other shrubs (e.g., alder) from nearby locations with high densities. Install within soil layers of restored riparian areas.

Soils Units:

O	Organic
M	Mineral

Ecosite:

Phase	Name/Description
b1	blueberry - jack pine - trembling aspen (white birch)
d1	low-bush cranberry - trembling aspen
d2	low-bush cranberry - trembling aspen - white spruce - black spruce
d3	low-bush cranberry - white spruce
g1	Labrador tea-hygric - black spruce - jack pine
h1	Labrador tea – horsetail – white spruce – black spruce
h2	shrubby bog
i1	treed poor fen
i2	shrubby poor fen
j2	shrubby rich fen
DL	disturbed land

Canadian Wetland Classification:

Map Code	Wetland Group
ShB	Shrubby Bog
ShF	Shrubby Fen
TrB	Treed Bog
TrF	Treed Fen
TrS	Treed Swamp

Kilometre Post
Pipeline
Road
Watercourse
Environmental Alignment Sheet
Environmentally Significant Area
Waterbody

SHEET REVISION: 1
INTERNAL ID: 1
PROJECTION: UTM Zone 11
DATUM: NAD 1983
DATE: 20141106

Acknowledgements: Base data supplied by the Government of Alberta. Route information provided by TransCanada Pipelines Ltd. and MidWest Surveys Inc.

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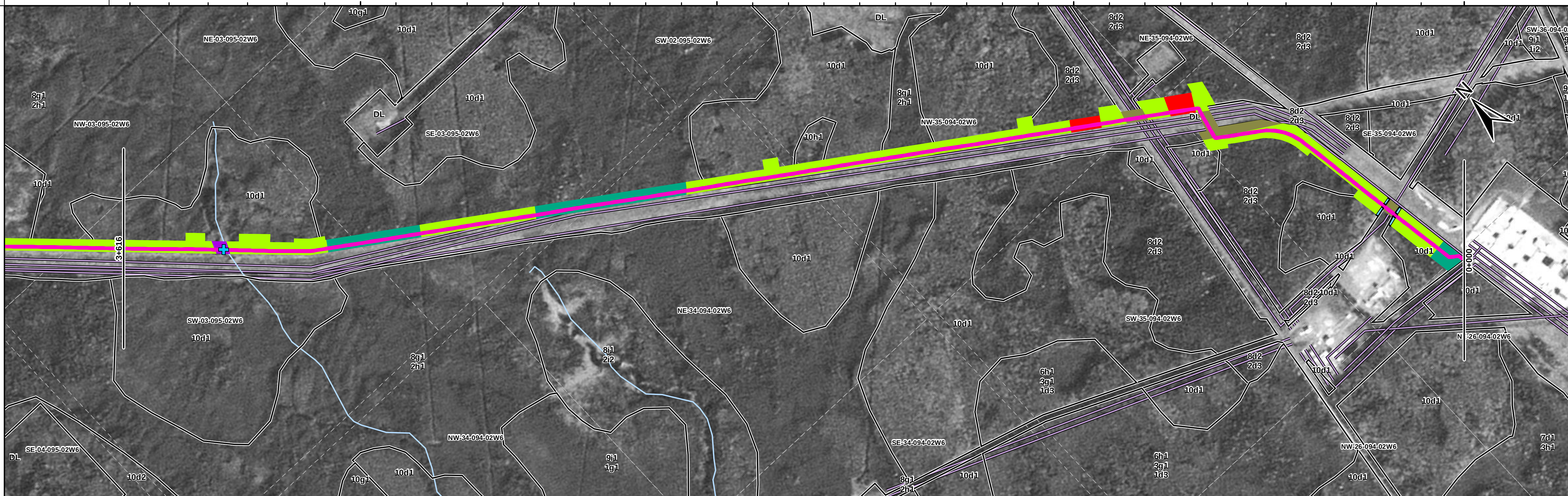
PREPARED BY: Stantec
PREPARED FOR: NGTL

NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3
(Chinchaga Section)
Caribou Habitat Restoration Plan
Index Map

Environmental Settings

Watercourse	Unnamed tributary to Hotchkiss River (CH1)
Pipeline Crossing Method	Isolated open cut / open cut
Ecosite	DL; d2; d1; DL; d1; DL
Wetland	
Wildlife Habitat	Chinchaga Caribou Range and Secondary Grizzly Bear Habitat
Soil Unit	O; M
Bisecting Linear Unit	Road; Pipeline; Pipeline; Pipeline; Pipeline; Pipeline; Pipeline; Road; Pipeline
Kilometre Post	3; 2; 1; 0

Date of Photography: 2011



Restoration Measure

Restoration Objective	HR - SP; BWS; HR - SP; HR - MDPNR; HR - SP; HR - MDPNR; HR - SP; HR - ACR; HR - SP; NR - FD; HR - SP; HR - ACR; HR - SP; NR - FD; HR - SP; LSB - VR; NR - FD; LSB - VR; HR - SP; HR - MDPNR; NR - FD
Restoration Measure	Note 8; Note 11; Note 8; Note 4; Note 6; Note 4; Note 8; Note 6; Note 8; Note 10; Note 8; Note 5; Note 8; Note 10; Note 8; Note 5; Note 8; Note 6; Note 8; Note 2; Note 5; Note 2; Note 8; Note 4; Note 5
Planting Species	Sw; Sw; Sb; Sw; Sb; Sw; Sw; Sw; Sb; Sw; Sw
Planting Density	2000; 2000; 2000; 2000; 2000; 2000; 2000

Legend

- Rare Plant
- Watercourse Crossing
- Ecosite

Construction Footprint Restoration

- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition
- Road
- Existing Pipeline
- Watercourse
- Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
1	1	UTM Zone 11	NAD 1983

Acknowledgements: Base data supplied by the Government of Alberta. Route information provided by TransCanada Pipelines Ltd. and MidWest Surveys Inc. Imagery provided by BlackBridge.

DATE 20141106

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Original Page Size: 11 x 17

PREPARED BY Stantec

PREPARED FOR NGTL

NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3

(Chinchaga Section)

Caribou Habitat Restoration Plan

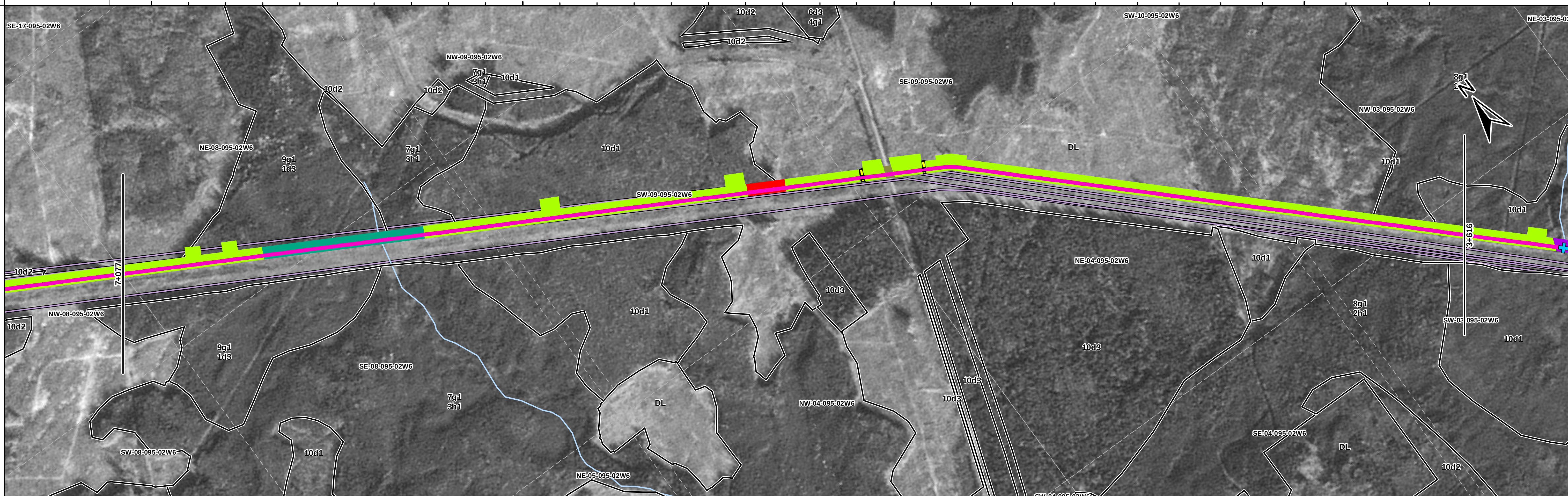
0+000 to 3+616

Sheet 001

Environmental Settings

Watercourse	
Pipeline Crossing Method	
Ecosite	DL / g1 / d1 / DL
Wetland	TrS
Wildlife Habitat	Chinchaga Caribou Range and Secondary Grizzly Bear Habitat
Soil Unit	M / O / M / O
Bisecting Linear Unit	Road
Kilometre Post	7 / 6 / 5 / 4

Date of Photography: 2011



Restoration Measure

Restoration Objective	HR - SP	HR - MDPNR	HR - SP	HR - ACR	HR - SP	LSB - FVS	HR - SP	NR - FD	HR - SP	LSB - FVS	HR - SP
Restoration Measure	Note 8	Note 4	Note 8	Note 10	Note 8	Note 1	Note 8	Note 5	Note 8	Note 1	Note 8
Planting Species	Sw		Sw						Sw	Sw	Sw
Planting Density	2000		2000						2000	2000	2000

Rare Plant
Watercourse Crossing
Ecosite

Construction Footprint Restoration
- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition

Road
Existing Pipeline
Watercourse
Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
1	1	UTM Zone 11	NAD 1983

Acknowledgements: Base data supplied by the Government of Alberta. Route information provided by TransCanada Pipelines Ltd. and MidWest Surveys Inc. Imagery provided by BlackBridge.

DATE 20141106

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PREPARED FOR NGTL

NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3

(Chinchaga Section)

Caribou Habitat Restoration Plan

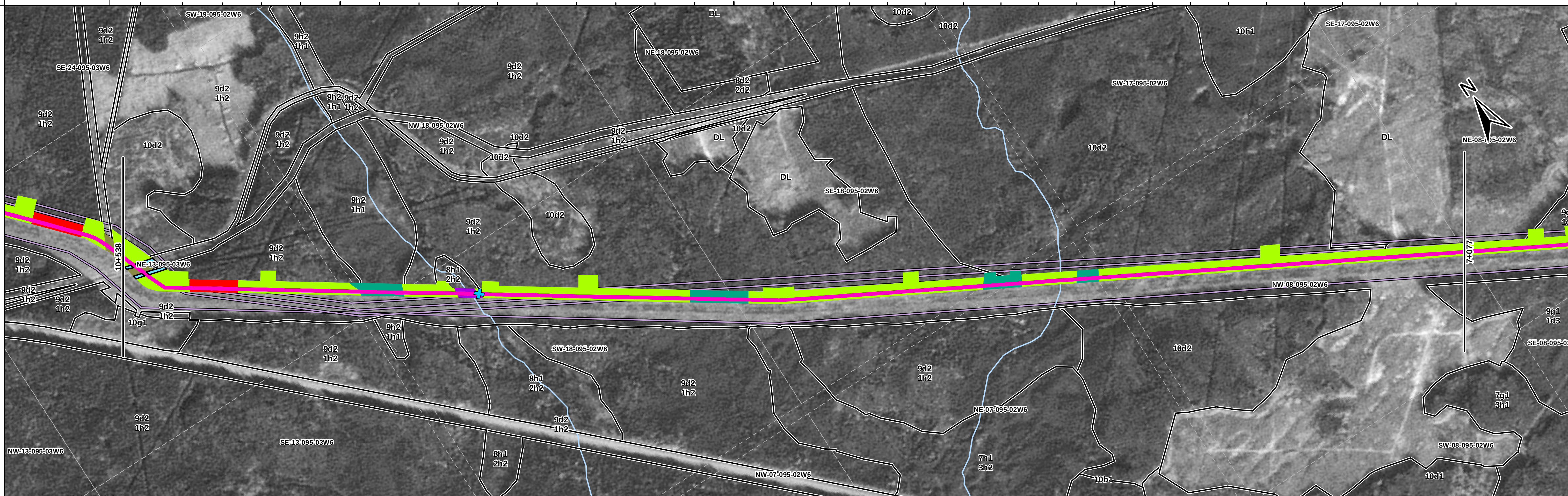
3+616 to 7+077

Sheet 002

Environmental Settings

Watercourse	Unnamed tributary to Meikle River (CH4)
Pipeline Crossing Method	Isolated open cut / open cut
Ecosite	DL, d2, DL, d2, h2, d2, h1, d2, DL
Wetland	ShB, TrB
Wildlife Habitat	Chinchaga Caribou Range and Secondary Grizzly Bear Habitat
Soil Unit	M, O, M, O, M
Bisecting Linear Unit	Road
Kilometre Post	10, 9, 8

Date of Photography: 2011



Restoration Measure

Restoration Objective	HR - SP, LSB - VR, NR - FD, LSB - VR, HR - SP, HR - ACR, HR - SP, HR - MDPNR, HR - SP, BWS, HR - SP, HR - MDPNR, HR - SP, HR - MDPNR, HR - SP, HR - MDPNR, HR - SP
Restoration Measure	Note 8, Note 2, Note 5, Note 2, Note 8, Note 10, Note 8, Note 4, Note 8, Note 11, Note 8, Note 4, Note 6, Note 8, Note 6, Note 4, Note 6, Note 4, Note 8
Planting Species	Sw, Sw, Sw, Sw, Sb, Sw, Sb, Sb, Sw
Planting Density	2000, 2000, 2000, 2000, 2000, 2000, 2000

Rare Plant
Watercourse Crossing
Ecosite

Construction Footprint Restoration
- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition
- Road
- Existing Pipeline
- Watercourse
- Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
1	1	UTM Zone 11	NAD 1983

Acknowledgements: Base data supplied by the Government of Alberta. Route information provided by TransCanada Pipelines Ltd. and MidWest Surveys Inc. Imagery provided by BlackBridge.

DATE 20141106

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NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3

(Chinchaga Section)

Caribou Habitat Restoration Plan

7+077 to 10+538

Sheet 003

Environmental Settings

Watercourse	
Pipeline Crossing Method	
Ecosite	d2 | DL | d2 | DL | d2 | DL | d2 | h1 | d2 | DL
Wetland	TrB
Wildlife Habitat	Chinchaga Caribou Range and Secondary Grizzly Bear Habitat
Soil Unit	M | O | M
Bisecting Linear Unit	Road
Kilometre Post	14 | 13 | 12 | 11

Date of Photography: 2011

Restoration Measure

Restoration Objective	HR - ACR | HR - SP | NR - FD | HR - SP | HR - ACR | HR - SP | HR - MDPNR | HR - SP | HR - MDPNR | HR - SP | HR - MDPNR | HR - SP | HR - ACR | HR - SP | NR - FD | HR - SP
Restoration Measure	Note 11 | Note 8 | Note 5 | Note 8 | Note 10 | Note 8 | Note 6 | Note 4 | Note 8 | Note 4 | Note 8 | Note 4 | Note 8 | Note 10 | Note 8 | Note 5 | Note 8
Planting Species	Sw | Sw | Sb | Sw | Sw | Sw | Sw
Planting Density	2000 | 2000 | 2000 | 2000 | 2000 | 2000

Rare Plant
Watercourse Crossing
Ecosite

Construction Footprint Restoration
- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition

Road
Existing Pipeline
Watercourse
Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
1	1	UTM Zone 11	NAD 1983

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NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3

(Chinchaga Section)

Caribou Habitat Restoration Plan

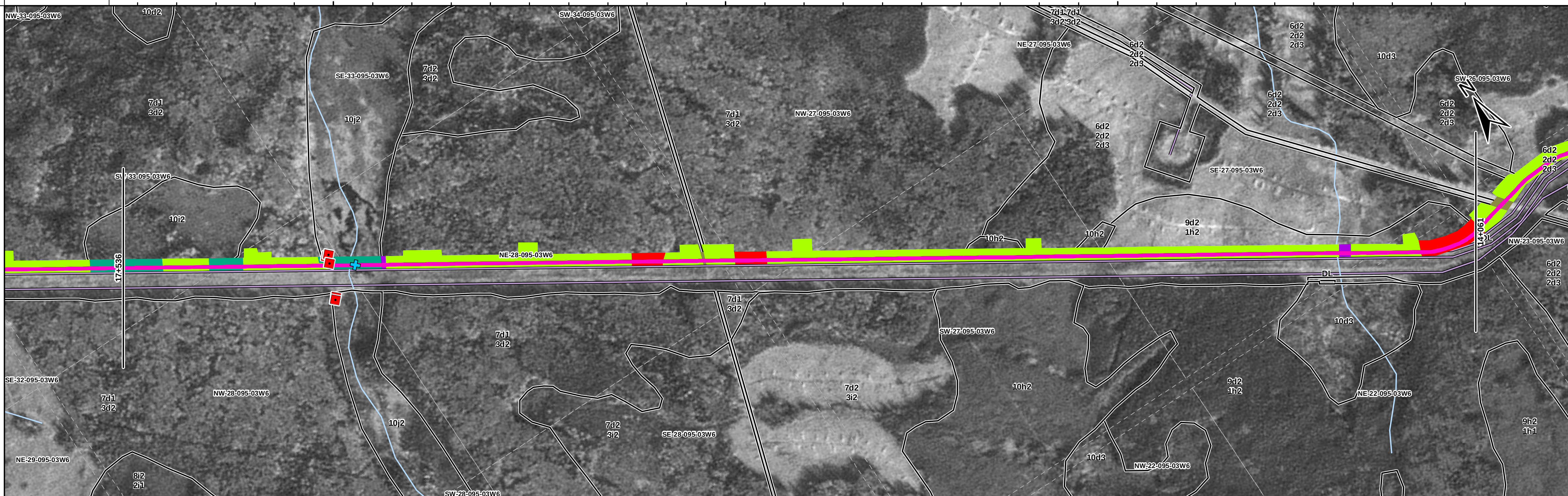
10+538 to 14+061

Sheet 004

Environmental Settings

Watercourse	Unnamed tributary to Meikle River (CH6)
Pipeline Crossing Method	Isolated open cut / open cut
Ecosite	DL | d2 | DL | d2
Wetland	
Wildlife Habitat	Chinchaga Caribou Range and Secondary Grizzly Bear Habitat
Soil Unit	O | M
Bisecting Linear Unit	
Kilometre Post	17 | 16 | 15

Date of Photography: 2011



Restoration Measure

Restoration Objective	HR - MDPNR	HR - SP	HR - MDPNR	HR - SP	BWS	HR - MDPNR	BWS	HR - SP	HR - ACR	HR - SP	HR - FD	HR - SP	HR - ACR	HR - SP	BWS	HR - SP	HR - ACR

Restoration Measure	Note 4	Note 8	Note 4	Note 8	Note 12	Note 4	Note 11	Note 7	Note 11	Note 8	Note 5	Note 8	Note 10	Note 8	Note 7	Note 8	Note 11	Note 8	Note 10

Planting Species		Sw		Sw		Pl	Sw	Sw	Pl	Sw	Sw

Planting Density		2000		2000		2000	2000	2000

Rare Plant
Watercourse Crossing
Ecosite

Construction Footprint Restoration
- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition
- Road
- Existing Pipeline
- Watercourse
- Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
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NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3
(Chinchaga Section)

Caribou Habitat Restoration Plan

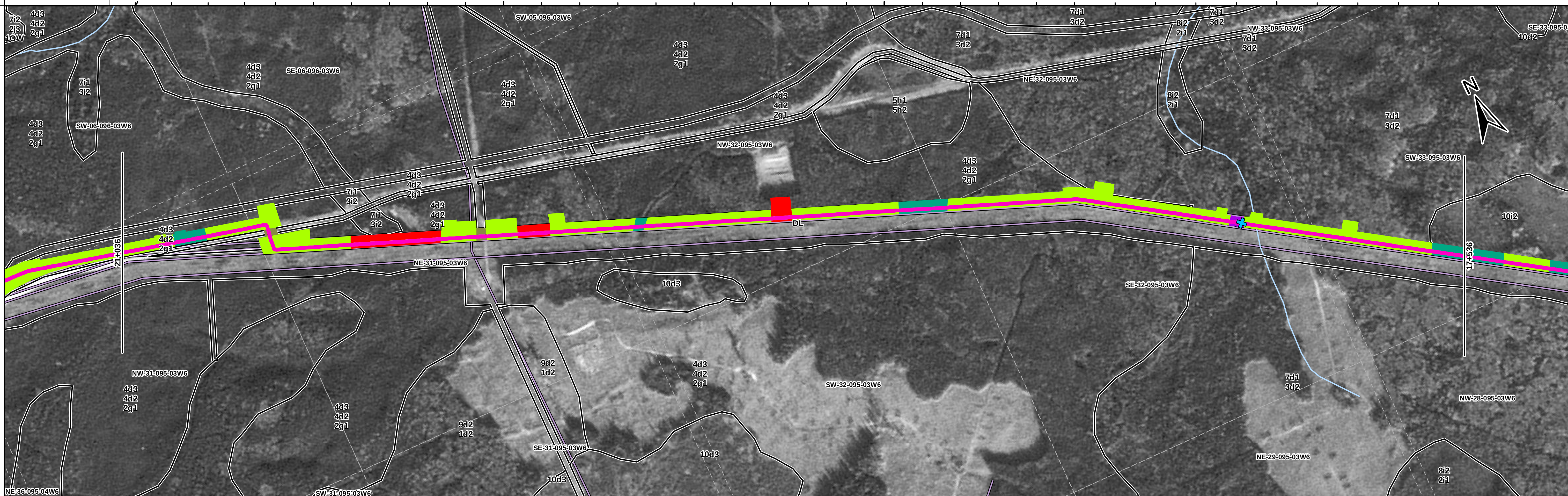
14+061 to 17+536

Sheet 005

Environmental Settings

Watercourse	Unnamed tributary to Meikle River (CH7)
Pipeline Crossing Method	Isolated open cut / open cut
Ecosite	d3 / DL / d3 / DL
Wetland	
Wildlife Habitat	Chinchaga Caribou Range and Secondary Grizzly Bear Habitat
Soil Unit	M / O
Bisecting Linear Unit	Pipeline, Pipeline, Pipeline, Pipeline, Road, Pipeline, Pipeline, Road
Kilometre Post	21, 20, 19, 18

Date of Photography: 2011



Restoration Measure

Restoration Objective	HR - SP	HR - MDPNR	HR - SP	NR - FD	HR - SP	HR - ACR	HR - SP	NR - FD	HR - SP	HR - ACR	HR - SP	HR - MDPNR	HR - SP	HR - ACR	HR - SP	HR - MDPNR	HR - SP	BWS	HR - SP	HR - MDPNR
Restoration Measure	Note 6	Note 4	Note 8	Note 5	Note 8	Note 10	Note 8	Note 5	Note 8	Note 10	Note 8	Note 4	Note 8	Note 10	Note 8	Note 4	Note 8	Note 11	Note 8	Note 4

Planting Species	Sb		Sw		Sw		Sw		Sw		Sw		Sw		Sw	
Planting Density	2000		2000		2000		2000		2000		2000		2000		2000	

Rare Plant
Watercourse Crossing
Ecosite

Construction Footprint Restoration

- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition

- Road
- Existing Pipeline
- Watercourse
- Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
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NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3

(Chinchaga Section)

Caribou Habitat Restoration Plan

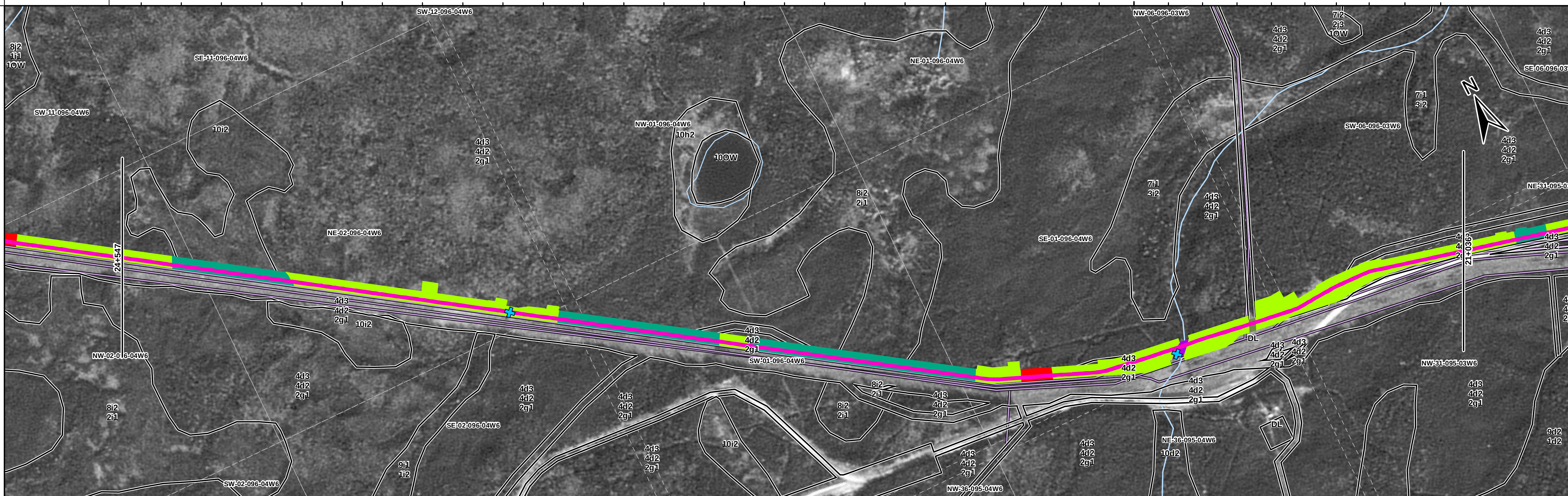
17+536 to 21+036

Sheet 006

Environmental Settings

Parameter										
Watercourse	Unnamed Tributary to Midget Creek (CH8.5)					Unnamed tributary to Meikle River (CH8)				
Pipeline Crossing Method	Isolated open cut / open cut					Isolated open cut / open cut				
Ecosite	DL	d3	DL	d3	DL	d3	DL	d3		
Wetland										
Wildlife Habitat	Chinchaga Caribou Range and Secondary Grizzly Bear Habitat									
Soil Unit	O	M								
Bisecting Linear Unit	PipelinePipelinePipelinePipelinePipelinePipelinePipelinePipelinePipelinePipeline									
Kilometre Post	24	23	22							

Date of Photography: 2011



Restoration Measure

Restoration Objective		HR - SP	HR - MDPNR	HR - SP	HR - MDPNR	HR - SP	HR - MDPNR	HR - SP	HR - ACR	HR - SP	BWS	HR - SP	NR - OD	HR - SP	
Restoration Measure		Note 7	Note 4	Note 7	Note 4	Note 8	Note 4	Note 7	Note 10	Note 8	Note 11	Note 8	Note 5	Note 8	Note 6
Planting Species		Pl		Pl		Sw		Pl		Sw		Sw		Sw	Sb
Planting Density		2000		2000		2000		2000				2000		2000	

Rare Plant
Watercourse Crossing
Ecosite

Construction Footprint Restoration
- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition

Road
Existing Pipeline
Watercourse
Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
1	1	UTM Zone 11	NAD 1983

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NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3

(Chinchaga Section)

Caribou Habitat Restoration Plan

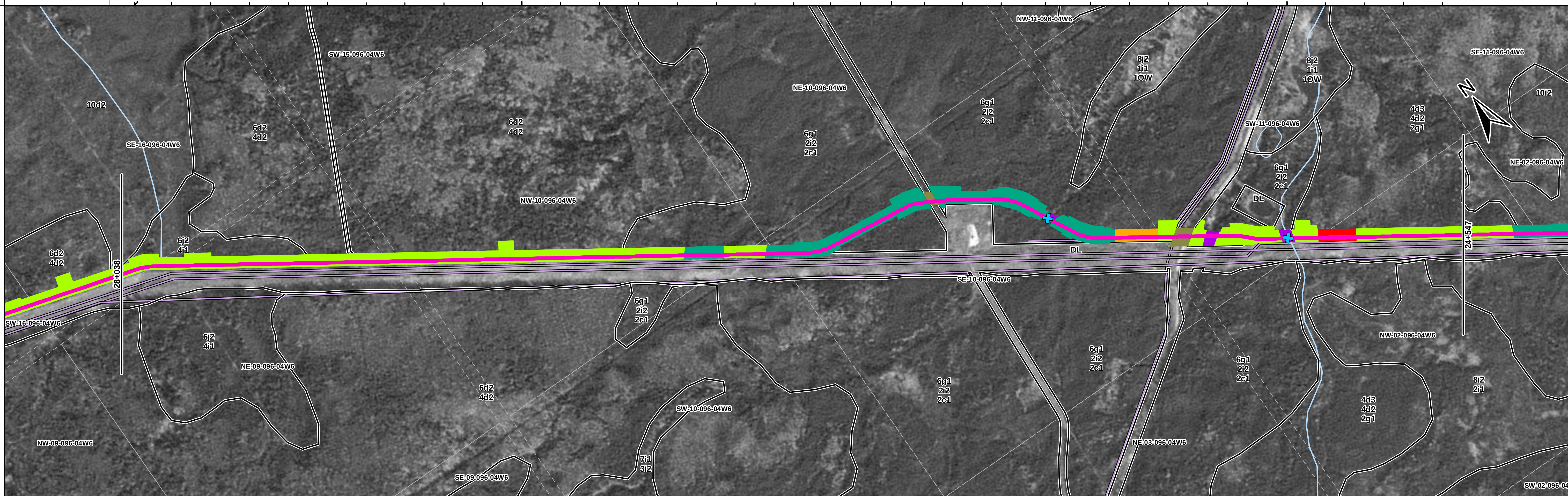
21+036 to 24+547

Sheet 007

Environmental Settings

Watercourse	Unnamed Tributary to Midget Creek (CH9.5); Unnamed Tributary to Midget Creek (CH9)
Pipeline Crossing Method	Isolated open cut / open cut; Isolated open cut / open cut
Ecosite	j2; d2; DL; d2; g1; DL; g1; DL; g1; DL
Wetland	ShF; TrS; TrS; TrS
Wildlife Habitat	Chinchaga Caribou Range and Secondary Grizzly Bear Habitat
Soil Unit	O; M; O
Bisecting Linear Unit	Pipeline; Road; Pipeline; Pipeline; Pipeline; Pipeline; Road; Pipeline
Kilometre Post	28; 27; 26; 25

Date of Photography: 2011



Restoration Measure

Restoration Objective	HR - SP; HR - MDPNR; HR - SP; HR - MDPNR; NR - FD; HR - MDPNR; BWS; HR - MDPNR; HR - ACM; HR - SP; NR - FD; HR - SP; BWS; HR - SP; BWS; HR - SP; HR - ACR; HR - SP
Restoration Measure	Note 6; Note 7; Note 4; Note 7; Note 4; Note 5; Note 4; Note 11; Note 4; Note 3; Note 6; Note 5; Note 7; Note 11; Note 7; Note 11; Note 7; Note 10; Note 7
Planting Species	Sb; Pl; Pl; Sb; Pl; Pl; Pl
Planting Density	2000; 2000; 1400; 2000; 2000; 2000; 2000

Rare Plant
Watercourse Crossing
Ecosite

Construction Footprint Restoration
- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition
- Road
- Existing Pipeline
- Watercourse
- Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
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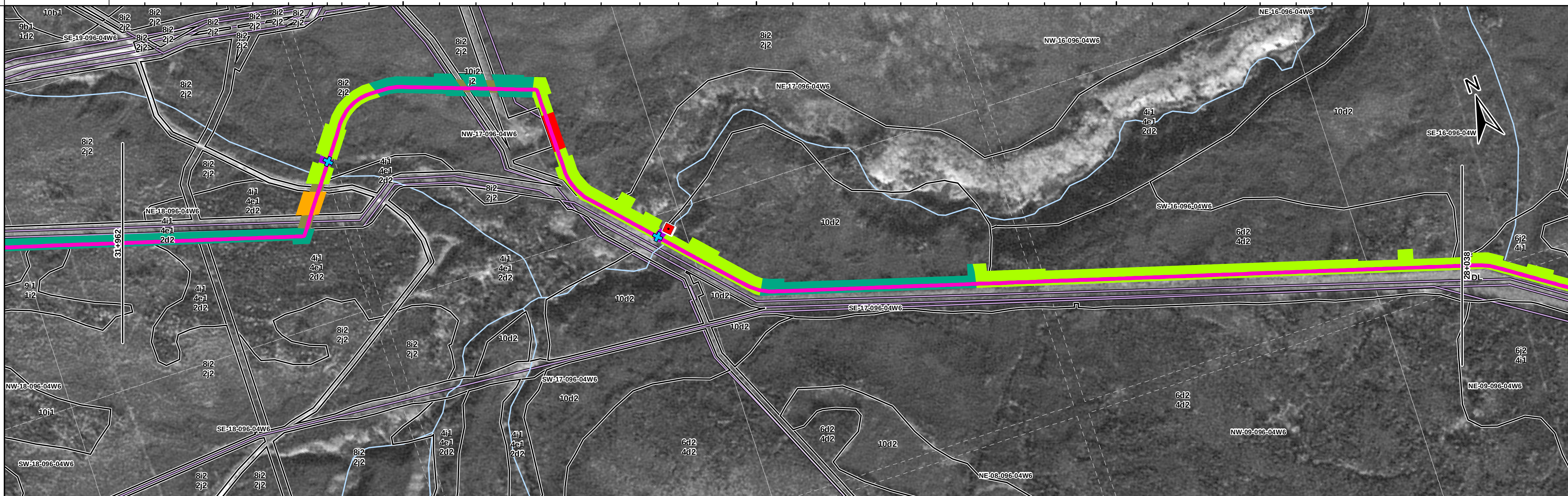
NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3
(Chinchaga Section)
Caribou Habitat Restoration Plan
24+547 to 28+038

Sheet 008

Environmental Settings

Watercourse	Unnamed tributary to Midget Creek (CH101); Midget Creek (CH100)
Pipeline Crossing Method	Isolated open cut / open cut; Isolated open cut / open cut
Ecosite	i2, i1, DL, i1, DL, i1, DL, i1, i2, DL, i2, DL, i2, i1, DL, d2, j2
Wetland	ShF, TrF, TrF, TrF, TrF, ShF, ShF, ShF, TrF, ShF
Wildlife Habitat	Chinchaga Caribou Range and Secondary Grizzly Bear Habitat
Soil Unit	M, O
Bisecting Linear Unit	Pipeline, Pipeline, Road, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Pipeline, Road, Pipeline
Kilometre Post	31, 30, 29

Date of Photography: 2011



Restoration Measure

Restoration Objective	HR - MDPNR, NR - FD, HR - ACM, NR - FD, HR - SP, BWS, HR - SP, HR - MDPNR, NR - FD, HR - MDPNR, NR - FD, HR - MDPNR, HR - SP, HR - ACR, HR - SP, BWS, HR - SP, HR - MDPNR, HR - SP
Restoration Measure	Note 4, Note 5, Note 3, Note 5, Note 7, Note 11, Note 7, Note 4, Note 5, Note 4, Note 5, Note 4, Note 7, Note 10, Note 7, Note 11, Note 7, Note 4, Note 7, Note 6
Planting Species	Sb, Pl, Pl, Pl, Pl, Pl, Sb
Planting Density	1400, 2000, 2000, 2000, 2000, 2000

Rare Plant
Watercourse Crossing
Ecosite

Construction Footprint Restoration
- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition
- Road
- Existing Pipeline
- Watercourse
- Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
1	1	UTM Zone 11	NAD 1983

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NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3
(Chinchaga Section)

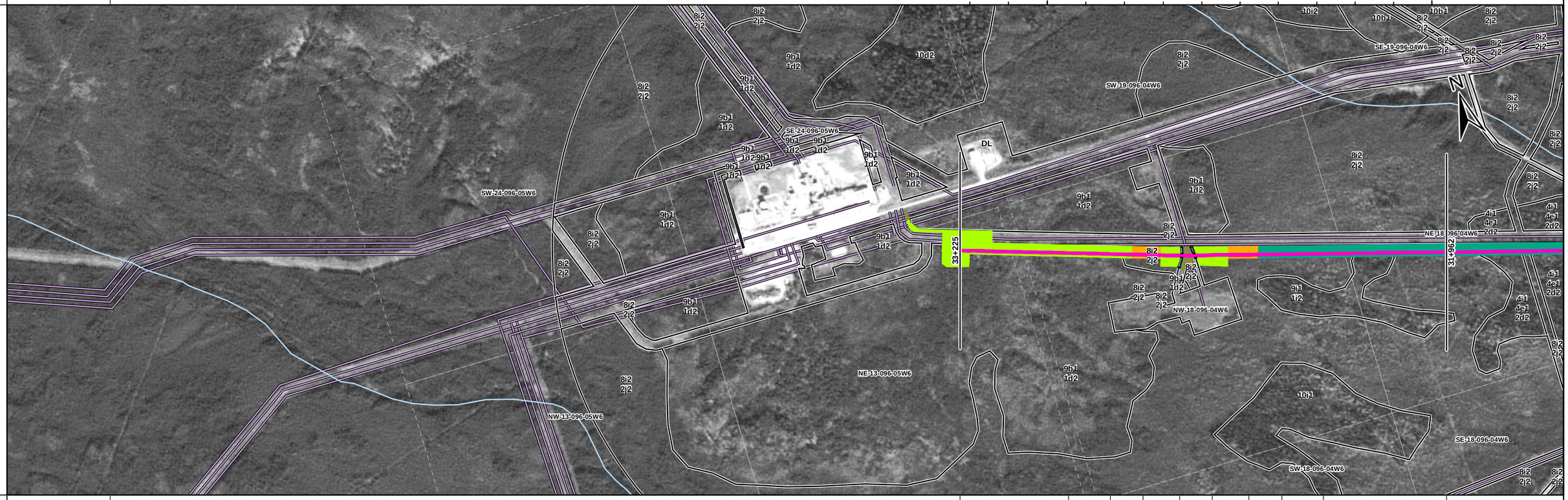
Caribou Habitat Restoration Plan

28+038 to 31+962

Sheet 009

Environmental Settings

Watercourse										
Pipeline Crossing Method										
Ecosite		b1	i2	DL	i2	DL	i2	i1	i2	
Wetland			ShF		ShF		ShF	TrF	ShF	
Wildlife Habitat		Chinchaga Caribou Range and Secondary Grizzly Bear Habitat								
Soil Unit		M	O						M	
Bisecting Linear Unit	Road									
Kilometre Post		33							32	



Restoration Measure

Restoration Objective		HR - SP	HR - ACM	HR - SP	LSB - VR	NR - FD	LSB - VR	HR - SP	HR - ACM	HR - MDPNR
Restoration Measure		Note 7	Note 3	Note 6	Note 2	Note 5	Note 2	Note 6	Note 3	Note 4
Planting Species		Pl		Sb			Sb			
Planting Density		2000		1400	2000		2000	1400		

Rare Plant
Watercourse Crossing
Ecosite

Construction Footprint Restoration
- Bioengineering / Willow Staking
- Foreign Disposition
- Pipeline Access
- Habitat Restoration – Access Control using Rollback
- Habitat Restoration - Access Control Mounding
- Habitat Restoration – Minimal Disturbance to Promote Natural Regeneration
- Habitat Restoration – Seeding and Planting
- Line of Sight Break - Fabricated Visual Screen
- Line of Sight Break - Vegetation Retention
- Other Disposition
- Road
- Existing Pipeline
- Watercourse
- Waterbody

SHEET REVISION	INTERNAL ID	PROJECTION	DATUM
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PREPARED BY: Stantec

PREPARED FOR: NGTL

NOVA Gas Transmission Ltd. (NGTL) - Chinchaga Lateral Loop No. 3
(Chinchaga Section)

Caribou Habitat Restoration Plan

31+962 to 33+225

Sheet 010

Revised Final Caribou Habitat Restoration Plan for the Chinchaga Lateral Loop No. 3 (Chinchaga Section) May 2015

Prepared for:
NOVA Gas Transmission Ltd.
A Wholly Owned Subsidiary of
TransCanada PipeLines Limited
Calgary, Alberta

Prepared by:
Stantec Consulting Ltd.
Sidney, British Columbia
and
TransCanada PipeLines Limited
Calgary, Alberta

May 1, 2015

~~Date Submit~~	~~Author/ Submitter~~	~~Reason~~	~~Date Review~~	~~Reviewer/ Approved By~~	~~Approval Type/ Recommendation~~
~~Oct. 28, 2014~~	~~Tyler Muhly~~	~~Draft for Quality Review~~	~~Oct. 28, 2014~~	~~Derek Ebner~~	~~Quality Review~~
~~Nov. 7, 2014~~	~~Tyler Muhly~~	~~Final for Issue~~			

~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)~~
REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

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REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

Abbreviations

AESRD	Alberta Environment and Sustainable Resource Development
CHRP	Caribou Habitat Restoration Plan
CHROMMP	Caribou Habitat Restoration and Offset Measures Monitoring ~~Program~~ Plan
CPP	Caribou Protection Plan
CSA	Canadian Standards Association
EAS	Environmental Alignment Sheets
EC	Environment Canada
GoA	Government of Alberta
Ha	hectare
M	metre
NEB	National Energy Board
NGTL	NOVA Gas Transmission Ltd.
OMP	Offset Measures Plan
ROW	right-of-way
~~TCPL~~	~~TransCanada PipeLines Ltd.~~

~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)~~
REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

1 INTRODUCTION

This report describes the revised Final Caribou Habitat Restoration Plan (CHRP) for the NOVA Gas Transmission ~~Ltd~~ Limited. (NGTL) Chinchaga Lateral Loop No. 3 project (the Project). The Final CHRP for the Project was originally filed on November 7, 2014 (NEB Filing ID: A64196). However, based on feedback received from the National Energy Board (NEB) in March 2015, NGTL has revised the Final CHRP for the Project and made the following modifications:

- Additional text about how line-of-sight will be mitigated, including how topography and bends in the right-of-way were considered, has been added to Section 2.5. In addition, details on the location of line-of-sight breaks were added to Table 5.
- Clarification was added to Section 2.1 that greater than one vegetation species is expected to re-vegetate naturally, without planting.
- Effectiveness ~~M~~monitoring ~~cameras~~ of access control and line-of-sight blocking measures using remote, motion-triggered cameras ~~have~~ has been incorporated into Section 6.1.2 of the revised Final CHRP.
- Further detail on monitoring targets and measures and how they link to the Caribou Habitat Restoration and Offset Measures and Monitoring Plan (CHROMMP) is provided throughout Section 6.0.
- The monitoring period of the ~~R~~revised Final CHRP has been increased from five years to fifteen years.
- The consultation tables in Section 7 contain an updated record of correspondence specific to the Final CHRP.

NGTL, a wholly owned subsidiary of TransCanada PipeLines Limited ~~(TCPL)~~, applied to the ~~National Energy Board~~ ~~(~~NEB~~)~~ under ~~Section~~ section 52 of the National Energy Board Act (NEB Act) for authorization to construct and operate the Project. The Project is a 33 km long pipeline that parallels an existing right-of-way (ROW) for 31 km, 94% of the route (

~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) ~~MAY 2015~~REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

Introduction
April 30, 2015

Figure 1). ~~In response to the application, t~~The NEB ~~required~~ requires that NGTL meet several ~~Conditions~~ conditions of Certificate GC-121. NGTL ~~has~~ prepared this revised Final CHRP in accordance with Certificate GC 121, Condition 10b. The Preliminary CHRP (NEB Filing ID: A54279) ~~summarized~~ focused on lessons learned from existing literature on habitat restoration to identify the strategies and actions that can be feasibly implemented to promote restoration of disturbed caribou habitat within the Project footprint (i.e., the construction ~~right-of-way (~~ROW~~)~~ and temporary workspace) located in the Chinchaga caribou range. Based on the literature review, ~~a suite of~~ measures suitable for implementation were identified, and a guide ~~was~~ developed to identify sites within the Project footprint where certain restoration measures would be appropriate. This revised Final CHRP provides site-specific information on the implementation of restoration measures and an assessment of residual effects of the Project on caribou habitat.

~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE ~~CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015~~REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

Introduction
April 30, 2015

1.1 ORGANIZATION OF THE FINAL CHRP

The revised Final CHRP ~~has been~~is organized to address each requirement of Certificate Condition 10b (**Error! Reference source not found.**). The requirements of Certificate Condition 10b state that the Final CHRP must include~~s~~:

- The Preliminary CHRP, with any updates identified in a revision log that includes the rationale for any changes to decision making criteria
- A complete table of caribou habitat restoration sites, including but not limited to location, spatial area, description of habitat, site-specific restoration activities and challenges
- Maps or Environmental Alignment Sheets showing the locations of the sites
- Evidence and summary of consultation with Environment Canada and provincial authorities regarding the Final CHRP
- A quantitative and qualitative assessment of the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the ~~aerial~~ areal extent of the resulting residual effects to be offset, which also includes indirect disturbance

The restoration goals and objectives of the revised Final CHRP are described in Section 2.0. Specifically, Section 2.0 ~~will~~ build~~s~~ on the Preliminary CHRP and describe~~s~~ how habitat will be restored for boreal woodland caribou (*Rangifer tarandus caribou*). Section 3.0 describes information from the Preliminary CHRP (8Appendix A) that was updated in the Final CHRP. This includes results of an updated literature review (completed June 2014 and revised throughout preparation of the Final CHRP). Section 4.0 describes the specific restoration sites. This section includes a table describing the location, habitat, timing and restoration activities and challenges along the entire Project ROW. This information is supplemented by Environmental Alignment Sheets that are provided in 8Appendix B. Section 5.0 describes the predicted direct and indirect residual effects of the Project on caribou habitat. Section 6.0 describes the monitoring and adaptive restoration framework for the Project. Finally, Section 7.0 provides a summary of consultation with Environment Canada (EC) and Alberta Environment and Sustainable Resource Development (AESRD) ~~that was completed~~. The revised Final CHRP expands on the Preliminary CHRP to provide more specific information on the location of restoration sites and specific restoration measures, as well as an assessment of residual effects of the Project on caribou habitat. A Final Offset Management Plan (OMP) in 2016 (Certificate Condition 20) and a Final ~~Caribou Habitat Restoration and Offset Measures and Monitoring Plan (~~CHROMMP~~)~~ (~~as per~~ Certificate Condition ~~20 and~~ 21~~, respectively~~), which describes the monitoring program for restoration measures applied to the Project footprint and the offset locations, will be filed in 2015.

~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY ~~2015~~REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

Introduction
April 30, 2015

Table 1 Certificate Condition 10:~~–~~ Caribou Habitat Restoration Plan

Certificate Condition	Details and Location in Report
10. Caribou Habitat Restoration Plan NGTL shall file with the Board for approval, in accordance with the timelines below, preliminary and final versions of a CHRP for the Chinchaga Section. NGTL shall provide a copy of the filings to Environment Canada and the appropriate provincial authorities.	
a. Preliminary CHRP –to be submitted at least 180 days prior to commencement of construction for the Chinchaga Section. This version of the CHRP shall include, but not be limited to: i. The objectives of the CHRP.	• The Preliminary CHRP is provided in 8Appendix A. • The goals and objectives of the revised Final CHRP (Section 2.0) have been modified from the Preliminary CHRP to provide more detail and clarity on measurable targets and evaluation criteria.
ii. A decision tree(s) that will be used to (1) prioritize potential caribou habitat restoration sites and (2) prioritize mitigation to be used at different types of sites. The decision tree(s) should be based on a literature review identifying temporal and spatial caribou habitat restoration methodologies and their relative effectiveness, as well as based on typical site factors that may constrain implementation.	• 8Appendix A (Preliminary CHRP) and Figure 2a, 2b and 2c in the revised Final CHRP
iii. The quantifiable targets and performance measures that will be used to evaluate: (1) the extent of predicted, residual effects, (2) the extent to which the objectives have been met and the need for consequent compensation offsets.	• 8Appendix A (Preliminary CHRP) • The evaluation criteria and measurable targets are provided in the Section ~~2~~6.1 of the revised Final CHRP.
iv. A schedule indicating when mitigation measures will start and the estimated completion date.	• 8Appendix A (Preliminary CHRP) • Updated and revised schedule is in Section 4.1 of the revised Final CHRP.
v. Evidence and a summary of consultation with Environment	• 8Appendix A (Preliminary CHRP)

Certificate Condition	Details and Location in Report
Canada and provincial authorities regarding the CHRP.	• Section 7.0 of the revised Final CHRP
b. Final CHRP – ~~to be~~was submitted on ~~or before 1~~7 November ~~after the first complete growing season following the commencement of operation for the Chinchaga Section~~. This updated version of the CHRP ~~shall~~ included, but was not be limited to: i. Preliminary CHRP, with any updates identified in a revision log that includes the rationale for any changes to decision making criteria. 1. Note that this version of the CHRP has been revised to address additional comments provided by the NEB (see Section 1.0 of the revised Final CHRP) and submitted 1 May 2015	• Deadline extended to May 2015 to align with CHROMMP • 8Appendix A (Preliminary CHRP) • Updates to the Preliminary CHRP are outlined in Section 3.0 and the revision log (**Error! Reference source not found.**), including: – Updates to objectives in Section 2.0 of the revised Final CHRP. – Updates and further detail on criteria to evaluate effectiveness in Section ~~2~~6.1 of the revised Final CHRP. – Updates and further detail on the Schedule in Section 4.1 of the Final CHRP.
ii. A complete table of caribou restoration sites, including but not limited to location, spatial area, description of habitat quality, site-specific restoration activities and challenges.	• Section 4.0 (**Error! Reference source not found.**) of the revised Final CHRP
iii. Maps or Environmental Alignment Sheets showing the locations of the sites.	• 8Appendix B: Environmental Alignment Sheets
iv. Evidence and summary of consultation with Environment Canada and provincial authorities regarding the Final CHRP.	• 8Appendix A (Preliminary CHRP) • Section 7.0 of the Final CHRP (**Error! Not a valid result for table.**)
v. A quantitative and qualitative assessment of the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the ~~aerial~~ areal extent of the resulting residual effects to be offset, which also includes indirect disturbance.	• Section 5.0 of the Final CHRP

Figure 1 Chinchaga Lateral Loop No. 3 (Chinchaga Section) Project Location

~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE ~~CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015~~REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

1.2 GUIDELINES FOR BOREAL CARIBOU

~~The~~ This CHRP ~~has been~~was developed in ~~consideration of the~~considering current regulatory policies specific to boreal woodland caribou. This includes the~~e~~ *Woodland Caribou Policy for Alberta* (Government of Alberta [GoA] 2011), which 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, and legislative and social considerations. A key strategy in this policy is the development of range-specific assessments and objectives (i.e., Action Plans), 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). ~~However, an~~ A specific Action Plan for the Chinchaga ~~caribou~~ Caribou ~~herd~~ Herd range has not yet been completed, but strategies in the *Woodland Caribou Policy for Alberta* were followed in the CHRP.

Similar to the provincial policy, the ~~final~~ recovery strategy for the woodland caribou, boreal population, in Canada (Environment Canada 2012) stresses the importance of landscape level planning, incorporating caribou habitat requirements into fire management plans, establishing key protected areas and incorporating adaptive management. One of the management approaches suggested in the federal recovery strategy to address the effects of habitat alteration on caribou is to undertake coordinated actions to reclaim boreal caribou habitat through restoration efforts. This includes restoration of industrial features such as roads, seismic lines, pipelines, cut lines and clearings (Environment Canada 2012). The revised Final CHRP defines caribou habitat in the same terms as the recovery strategy, i.e., any habitat within defined caribou herd ranges. Therefore, all habitat affected by the Project is considered caribou habitat, as the Project is ~~completely~~ entirely within the Chinchaga ~~caribou~~ Caribou ~~herd~~ Herd range. NGTL ~~is continuing to~~continues to ~~work~~ engage with AESRD to align ~~the~~ all of their caribou habitat restoration, offsetting and monitoring plans ~~undertaken for this Project~~ with ~~the~~ emerging provincial caribou ~~policy~~policies, plans and priorities ~~and the future provincial Action Plan for the Chinchaga caribou herd range~~ (see ~~record of consultation,~~ Section 7.0).

2 GOAL AND OBJECTIVES OF THE FINAL CARIBOU HABITAT RESTORATION PLAN

The goal of the revised Final CHRP is to minimize "~~'~~residual effects~~'~~" of the Project on caribou habitat. Residual effects are ~~caribou habitat that ultimately is not restored~~environmental effects predicted to remain after mitigation is applied. The Final CHRP supplements the Preliminary CHRP by ~~describing~~ detailing the location and type ~~where and what type~~ of restoration ~~activities will be implemented~~that is planned along the Project ROW, and ~~the~~ by predict~~ing~~ed residual effects requiring caribou habitat offsetting measures. ~~Monitoring and evaluation of restoration success~~The approach to validate residual effects predictions and restoration success is ~~summarized~~ described in the revised Final CHRP, ~~but described in greater~~with the detailed adaptive management plan to be described in the ~~in the~~ CHROMMP. The CHROMMP also describes adaptive management action~~s~~ that will be implemented on the Project footprint if CHRP measures ~~do~~ don't achieve their ~~respective~~ targets.

The revised Final CHRP will achieve the goal of minimizing residual effects of the Project by implementing three mitigation objectives:

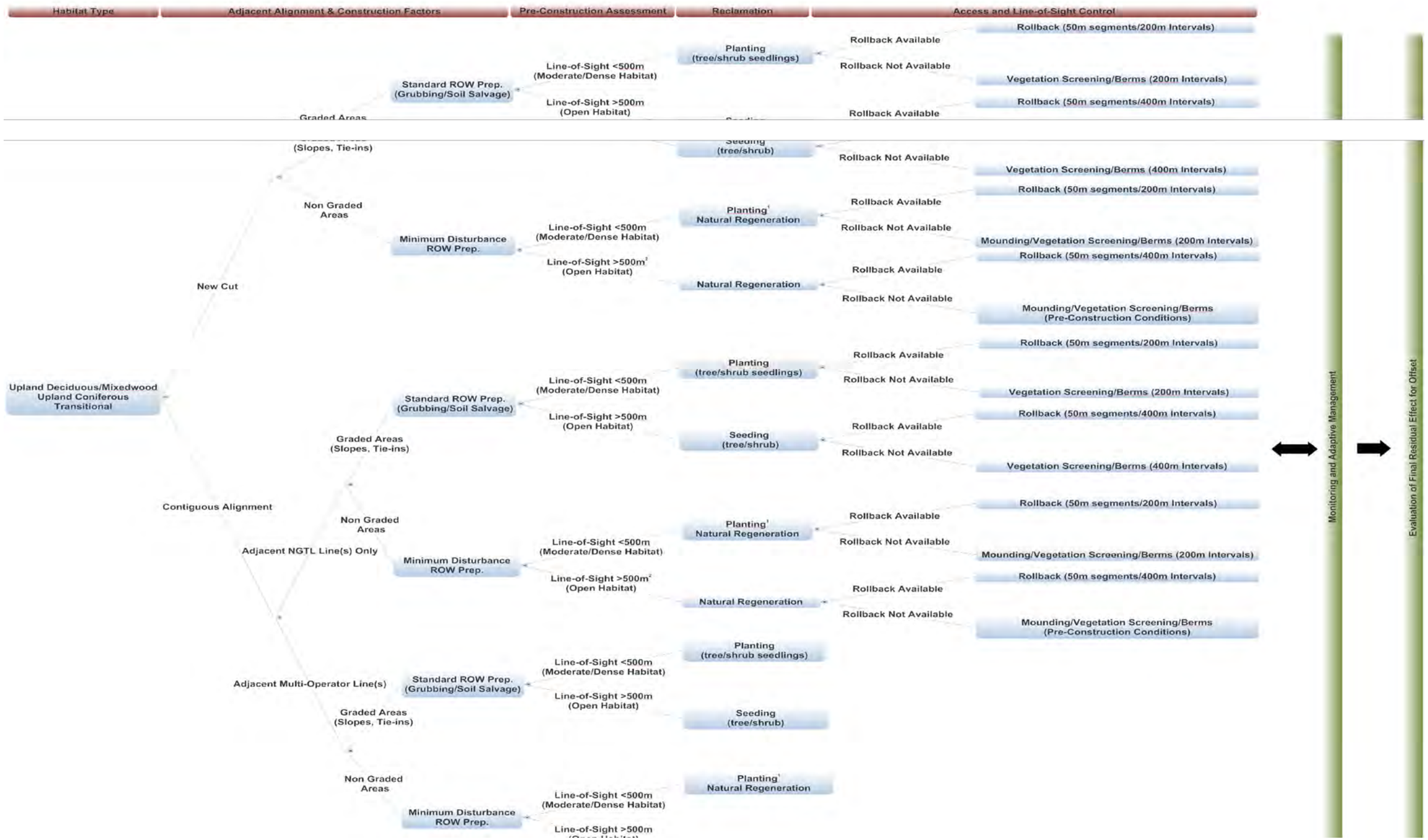
1. Habitat restoration through native re-vegetation that achieves establishment, survival and growth of target vegetation species in the short term, such that ecosystems on the ROW regenerate over the long term to similar ecosystems as those adjacent to the ROW
2. Effective access control over the short term within segments of the Project footprint
3. Line-of-sight reduction along the ROW using barriers, such as screens and vegetation

The rationale for applying these mitigations measures ~~is~~ was first described in detail in the Preliminary CHRP (Stantec 2013) and has been included in the revised Final CHRP~~(Stantec 2013), which~~. ~~It~~This rationale ~~also~~ includes 'decision trees' that describe how each of the mitigation measures ~~will be~~ was applied to the Project based on habitat type and site characteristics (Figure 2a, 2b and 2c). ~~The mitigation framework and decision trees described in the Preliminary CHRP are applied here in the Final CHRP.~~

2.1 EVALUATION CRITERIA AND MEASURABLE TARGETS

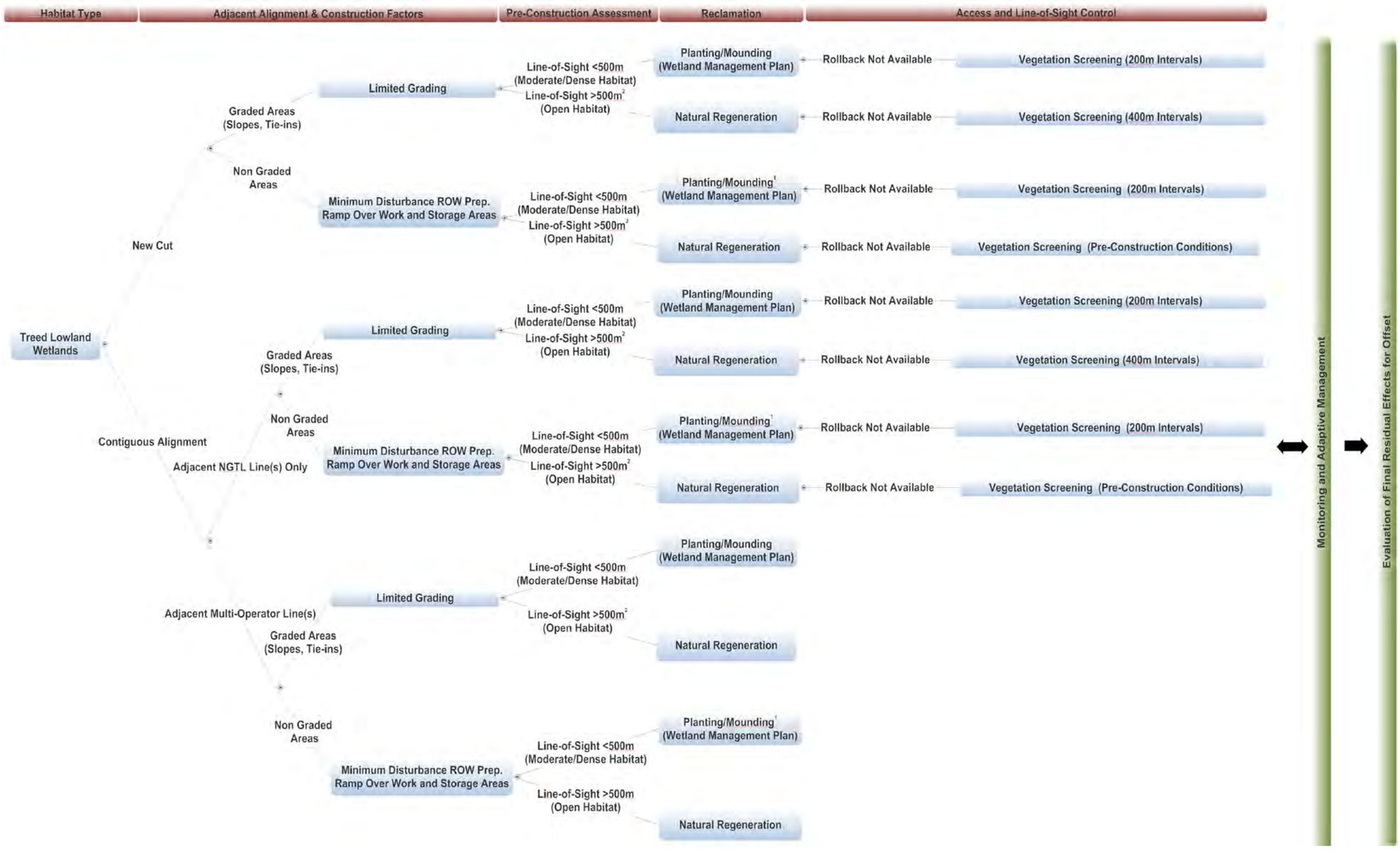
Evaluation criteria are the quantifiable restoration parameters that will be measured during monitoring to evaluate restoration effectiveness. Measurable targets are the criteria that will be used to determine whether the CHRP objectives have been achieved. Overall, the site conditions specific to the Project were a key factor in the development of the measurable targets (see Figures 2a, 2b and 2c), including the natural site characteristics, existing disturbance features and activities, regulatory requirements, and construction methods.

The need to maintain operational access, site conditions specific to the Project and natural variation (using Alberta Environment [AENV] 2001 as a guideline) are considered in the measurable targets provided in . The Reclamation Assessment Criteria for Pipelines (AENV 2001) recommends that equivalent land capability should take into account natural variability, which is the range of biophysical landscape conditions in an area, for example, slope, drainage, vegetation composition, and organic matter. This guideline specifies that equivalent land capability is achieved when the reclaimed ROW restoration targets (i.e., evaluation criteria) fall within 20% of natural variability in the surrounding environment (AENV 2001). This implies that when natural variation is considered, habitat restoration may be considered successful when a minimum of 80% of the restored area is re-vegetated (e.g., 100% survival minus 20% due to natural variability). Similarly, reforestation standards in Alberta require a minimum of 80% stocking of regeneration sites (AESRD 2013a). Therefore, the equivalent land capability criterion was incorporated into the measurable targets for upland forest restoration units for the Project.



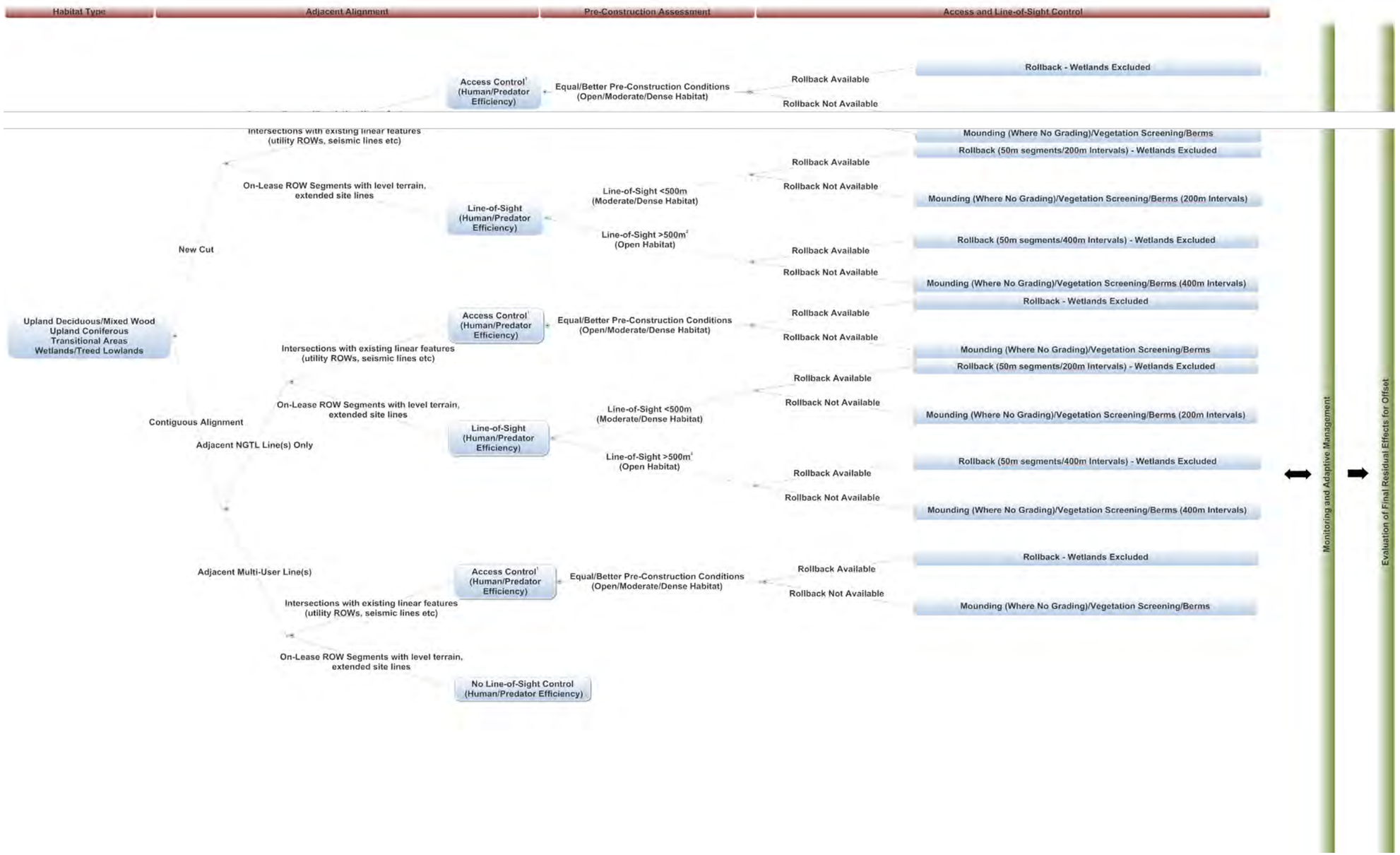
Note: (1) Habitat-specific planting to accelerate natural regeneration in areas of minimal disturbance ROW preparation with line-of-sight < 500 m will be considered from detailed habitat information as part of Condition 7. (2) In areas of new cut or contiguous alignment with NGTL lines only, where minimum disturbance ROW preparation and pre-construction line-of-sight extends > 500 m on-easement (i.e., open habitat), line-of-sight blocking will be placed at intervals that achieve pre-construction conditions as determined by Condition 7.

Figure 2a Chinchaga Lateral Loop No.3 – Caribou Habitat Restoration Site Selection and Mitigation Prioritization Decision Tree (Upland Mixedwood/ Upland Coniferous/ Transitional Habitat)



Note: (1) Habitat-specific planting to accelerate natural regeneration in areas of minimal disturbance ROW preparation with line-of-sight < 500 m will be considered from detailed habitat information as part of Condition 7. (2) In areas of new cut or contiguous alignment with NGTL lines only, where minimum disturbance ROW preparation and pre-construction line-of-sight extends > 500 m on-easement (i.e., open habitat), line-of-sight blocking will be placed at intervals that achieve pre-construction conditions as determined by Condition 7.

Figure 2b Chinchaga Lateral Loop No.3 – Caribou Habitat Restoration Site Selection and Mitigation Prioritization Decision Tree (Treed Lowlands and Wetlands)



Note: (1) Access control at intersecting existing linear features (i.e., utility ROW, seismic lines etc.) will not be implemented or inhibit traditional use.

Figure 2c Chinchaga Lateral Loop No.3 – Caribou Habitat Restoration Site Selection and Mitigation Prioritization Decision Tree (Line-of-Sight and Access Control)

Table 2 CHRP Objectives, Evaluation Criteria and Measurable Targets

CHRP Objective	Evaluation Criteria	Measurable Target
Native vegetation re-establishment	• Total density of planted seedlings and naturally regenerating seedlings (i.e., from seed ingress or suckering) • Height and percent cover of seedlings • Vigour of seedlings (evidence of chlorosis, pests/disease, browse, other damage) • Vegetation community composition (percent cover, species present, abundance): – conifer tree – deciduous tree – palatable shrub – non-palatable shrub – herb/graminoid – nonvascular (mosses and lichens) – introduced (non-native, weed, invasive)	Habitat restoration measurable targets are designed to demonstrate restoration success in terms of survival and sustained following completion of restoration along sections of available footprint[1]. **Upland Conifer, Deciduous, Mixedwood and Transitional** • Seedling density will vary by species with target range from 1600 to 2000 stems/ha (combined planted seedlings and/ regeneration) on sites that are not mounded. • Seedling density will vary by species with target range from 800 to 1400 stems/ha (combined planted seedlings and/or regeneration) on mounded sites, dependent on mound density. • Spatial distribution of seedlings (combined planted seedlings and/or natural regeneration) ≥80% of the restoration unit available for restoration). • ≥80% of the tree seedlings (planted and/or natural regeneration) demonstrate sustained growth trends since time of p increasing values for height and percent cover). **Treed Lowlands** • Natural vegetation is regenerating, including at least two characteristic species (vascular and/or nonvascular; e.g., C Sphagnum moss sp.) (classified as per Halsey et al. 2004). • As indicators of healthy vegetation community, no restricted weeds or invasive species such as cattails or reed grass. • ≥80% cover of native vegetation species in the footprint. • Where tree seedlings are planted (e.g., mounded sites): – seedling density of 400 to 1000 stems/ha (combined planted seedlings and/or natural regeneration), dependent – continuous spatial distribution of seedlings (combined planted seedlings and/or natural regeneration) ≥80% of the • ≥80% of the tree seedlings (planted and/or natural regeneration) demonstrate sustained growth trends since time of p increasing values for height and percent cover). **Shrub/Graminoid Lowlands** • Natural vegetation is regenerating, including at least two characteristic species (as per Halsey et al. 2004). • No restricted weeds. • ≥80% cover of native vegetation species in the footprint.

Table 2 CHRP Objectives, Evaluation Criteria and Measurable Targets

CHRP Objective	Evaluation Criteria	Measurable Target
Access control	Evidence and level of vehicular use along the Project ROW will be measured using criteria ratings, as follows: • Evidence of access: – Yes/No • Evidence of U-turns at access barriers: – Yes/No • Motorized access type: – all-terrain vehicle – truck – other • Access level metrics: – absent – low (tracks/trail evident but difficult to discern or appear to be infrequently used) – high (tracks/trails appear to be well-used; vegetation is trampled down; bare ground might be visible from frequent use)	Access control targets are designed to demonstrate human access is prevented and/or limited to low levels following completion of restoration activities in caribou range: • No evidence of motorized access via entry points where access control measures are installed on the Project ROW or • Success of habitat restoration targets, specifically sustained growth trends, is a good indicator that human access is not limiting habitat restoration.
Line-of-sight blocking	• Woody debris (log)/earth berms: – footprint width – length of berm (perpendicular to ROW) – length of berm with height ≥1.5 m – sight line model results • Vegetation screens: – spatial distribution (distance between live woody stems) – height of live woody stems – percent cover of live woody stems	Line-of-sight blocks are designed to block sight lines along sections of new alignment of the Project ROW following completion of restoration in caribou range. • Line-of-sight is limited to ≤500 m along the linear feature in upland forested areas. • Where log/earth berms are installed to break the line-of-sight, berms are in good condition and functional (in terms of blocking line-of-sight). • Where vegetation screening is used to break the line-of-sight: – seedling densities and growth trends meet the targets for habitat restoration – line-of-sight breaks are in good condition and functional (in terms of blocking line-of-sight)

NOTE:
[3] Available footprint is the area of the Project footprint that is not anticipated to be disturbed by future operation and maintenance activities during the life of the Project.

Table 2 CHRP Objectives, Evaluation Criteria and Measurable Targets

Objective	Monitoring Method	Evaluation Criteria	Measureable Targets	Adaptive Management
Habitat Restoration	Aerial Monitoring LiDAR Imagery 360 Photography Ground-Based Monitoring Establishment Surveys Performance Surveys	Total density of planted seedlings and naturally regenerating seedlings (i.e., from seed ingress or suckering) Height and percent cover of seedlings Vigour of seedlings (evidence of chlorosis, pests/disease, browse, other damage) Vegetation community composition (percent cover, species present, abundance): conifer tree deciduous tree palatable shrub non-palatable shrub herb/graminoid	Habitat restoration measurable targets are designed to demonstrate restoration success in terms of survival and sustained growth trends following completion of restoration. **Upland Conifer, Deciduous, Mixedwood and Transitional**: Seedling density will vary by species with target range from 1600 to 2000 stems/ha (combined planted seedlings and/or natural regeneration) on sites that are not mounded. Seedling density will vary by species with target range from 800 to 1400 stems/ha (combined planted seedlings and/or natural regeneration) on mounded sites, dependent on mound density. Spatial distribution of seedlings (combined planted seedlings and/or natural regeneration) ≥80% of the restoration unit (footprint available for restoration). ≥80% of the tree seedlings (planted and/or natural regeneration)	Adaptive management actions for habitat restoration are implemented at sites where the measurable targets have not been met and take into consideration site conditions and other ecological factors that may affect successful restoration. **Upland Conifer, Deciduous, Mixedwood and Transitional**: If seedlings (planted or natural regeneration) are damaged due to human access, assess and modify access control measures and plant seedlings to maintain desired seedling density targets. If seedlings (planted or natural regeneration) are damaged due to disease, plant seedlings to replace those that have died to maintain desired seedling density targets. If seedling growth/vigour (planted or natural regeneration) is impeded by competition from surrounding vegetation, such as grasses, implement spot spraying or manual vegetation control to reduce competition pressure and

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Objective	Monitoring Method	Evaluation Criteria	Measureable Targets	Adaptive Management
		nonvascular (mosses and lichens) introduced (non-native, weed, invasive)	demonstrate sustained growth trends since time of planting (i.e., increasing values for height and percent cover). **Treed Lowlands**: Natural vegetation is regenerating, including at least two characteristic species (vascular and/or nonvascular; e.g., Carex sp. and Sphagnum moss sp.) (classified as per Halsey et al. 2004). As indicators of healthy vegetation community, no restricted weeds or invasive species such as cattails or reed grass. ≥80% cover of native vegetation species in the project footprint. Where tree seedlings are planted (e.g., mounded sites): seedling density of 400 to 1000 stems/ha (combined planted seedlings and/or natural regeneration), dependent on mound density continuous spatial distribution of seedlings (combined planted seedlings and/or natural regeneration) ≥80% of the restoration unit ≥70% of the tree seedlings (planted and/or natural regeneration) demonstrate sustained growth trends since time of planting (i.e., increasing values for height and percent cover). **Shrub/Graminoid Lowlands**: Natural vegetation is regenerating, including at least two characteristic species (as per Halsey et al. 2004). No restricted weeds. ≥80% cover of native vegetation species in the project footprint.	plant seedlings to maintain desired seedling density targets. **Treed Lowlands**: If establishment and growth of planted seedlings is impeded by wet site conditions (e.g., flooding and ingress of invasive species such as cattails), modification of surface drainage patterns may be implemented to facilitate near-surface water flow. If natural regeneration of vegetation is impeded, plant alder seedlings to facilitate natural regeneration of shrubs. If noxious weed species occur on the Project ROW or on offset locations, implement spot spraying or manual control measures to manage weed populations. **Shrub/Graminoid Lowlands**: If natural regeneration is impeded by wet site conditions (e.g., flooding and ingress of invasive species such as cattails), modification of surface drainage patterns) may be implemented to facilitate near-surface water flow. If natural regeneration of vegetation is impeded, plant alder seedlings to facilitate natural regeneration of shrubs. If noxious weed species occur on the Project ROW or on offset locations, implement spot spraying or manual control measures, as required to manage weed populations.
Access Control	Aerial Monitoring LiDAR Imagery 360 Photography Ground-Based Monitoring Establishment Surveys Performance Surveys Remote Camera Monitoring	Evidence and level of vehicular use along the Project ROW and at offset locations will be measured using subjective criteria ratings, as follows: Evidence of access: Yes/No Evidence of U-turns at access barriers: Yes/No Motorized access type: all-terrain vehicle truck other Access level metrics: absent low (tracks/trail evident but difficult to discern or appear to be infrequently used) high (tracks/trails appear to be well-used; vegetation is trampled down; bare ground might be visible from frequent use)	Access control targets are designed to demonstrate human access is prevented and/or limited to low levels within five years following completion of restoration activities in caribou range: No evidence of motorized access via entry points where access control measures are installed on the Project ROW or in offset locations. Success of habitat restoration targets, specifically sustained growth trends, is a good indicator that human access is not inhibiting habitat restoration.	Adaptive management actions for access control will enhance or alter current access control measures to improve the effectiveness of these measures for limiting human use of areas undergoing restoration. The location, and source and type of access will be investigated, with enhanced access controls added where evidence of access is identified. This will be in the form of physical access barriers such as enhanced use of coarse woody debris, tree felling/tree bending (Cody 2013; Golder 2014), large rocks or fencing.
Line-of-Sight Breaks	Aerial Monitoring LiDAR Imagery 360 Photography Ground-Based Monitoring Establishment Surveys Performance Surveys Remote Camera Monitoring	Woody debris (log)/earth berms: footprint width length of berm (perpendicular to ROW) length of berm with height ≥1.5 m sight-line model results Vegetation screens: spatial distribution (distance between live woody stems)	Line-of-sight breaks are designed to block sight lines along sections of new alignment of the Project ROW and at offset locations within five years following completion of restoration in caribou range. Line-of-sight is limited to ≤500 m along the linear feature in upland forested areas. Where log/earth berms are installed to break the line-of-sight, berms are in good condition and functional (in terms of blocking line-of-sight). Where vegetation screening is used to break the line-of-sight:	Adaptive management actions for line-of-sight breaks will enhance the effectiveness of line-of–site measures and include: Where log/earth berms are installed, repairing berms to maintain height and length requirements (i.e., revegetating berm to prevent erosion). Implementing adaptive management actions associated with habitat restoration to create effective vegetation screens as line-of-sight breaks. For example, adding alder seedlings to a site to enhance rate of shrub growth for establishment of a line of site or use of tree-felling or tree-bending (Cody 2013, Golder 2014), across the ROW where there is suitable thick, adjacent

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Objective	Monitoring Method	Evaluation Criteria	Measureable Targets	Adaptive Management
		height of live woody stems percent cover of live woody stems	seedling densities and growth trends meet the targets for habitat restoration line-of-sight breaks are in good condition and functional (in terms of blocking line-of-sight)	forest cover of either non-merchantable or merchantable coniferous trees.

Additional guidelines were consulted when developing the measurable targets for the CHRP. Reclamation criteria and guidelines for forested areas in Alberta and reforestation standards in Alberta specific to the Project area (AENV 2010, 2011; AESRD 2013a) were used ~~as the basis for~~to set~~ting~~ measurable targets for tree seedling densities in upland forested and transitional restoration units. Target seedling densities in areas with mounding were adjusted to reflect the limited number of suitable planting sites that results from mounding.

The CHRP measurable targets applied to upland forest restoration units are not suitable for treed and shrubby lowland restoration units encountered within the Project footprint. The lowland restoration units typically have relatively slow rates of vegetation establishment and growth (i.e., wet sites can take longer than 50 years to recover; van Rensen et al. 2015), making tree seedling establishment and growth ~~in a 15 year time period~~ less certain. Rather, guidelines for wetland reclamation associated with oil sands mining (AENV 2008) may be used, but they focus on disturbance types that are not applicable to pipeline construction and operation. In addition, current research on reclamation of bogs and fens (i.e., the treed and shrubby lowland restoration units addressed in this CHRP) is in experimental stages and is not addressed in the current guidelines. The *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (AENV 2010) includes specifications for various indicators using an "end land use" approach that targets reclamation ~~to~~ of commercial forests, which conceptually provide other ecosystem functions, including wildlife habitat ~~(AENV 2010)~~. However, the application of these guidelines to the CHRP needs to be approached with caution, since they relate to a very different disturbance type (i.e., bitumen mining versus pipeline ROW) and are developed for different natural subregions and objectives. With these limitations in mind, it is recognized that the AENV guidelines for oil sands reclamation are developed for boreal forests with similar attributes to those on the Project and, therefore, the thresholds and indicators were used to guide the development of measurable targets for the CHRP. In particular, the measurable targets associated with treed and shrubby lowland restoration units incorporated the concept of plant community composition as an appropriate indicator to assess reclamation status and progress (AENV 2010).

Plant community composition as described in the *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (AENV 2010) and characteristics of healthy plant communities within lowlands (i.e., the number and abundance of characteristic species found in undisturbed native wetland plant communities and the number of restricted weeds; Cibrowski et al. 2012) were used to develop measurable targets for the lowland restoration units in this CHRP. AENV 2010 suggests a threshold of two characteristic species in wet poor sites, which was derived to be conservative (low) with respect to realistic reclamation success. Given the much lower disturbance level associated with pipeline construction and operation compared ~~to~~ with oil sands mining, two characteristic species within a 15 year monitoring period is likely a reasonable measurable target and therefore has been adopted for restoration of the lowland

restoration units (). Characteristic species may include vascular and non-vascular plants, provided they are species found in the adjacent undisturbed native plant community. They are not limited to the two tree species that will be planted (i.e., white spruce and black spruce), but also other native vegetation species that will naturally re-vegetate the ROW (see Section 6.1.1). The other measurable targets are the absence of restricted weeds to indicate vegetation community health and 80% vegetation cover by characteristic species.

The evaluation criteria and measurable targets are summarized in . As noted above, the site conditions specific to the Project were a key factor in the development of the measurable targets, including the natural site characteristics, existing disturbance features and activities, regulatory requirements, and construction methods.

The ability to achieve the CHRP measurable targets will be dependent, in part, on future development activities. NGTL recognizes that ~~the~~ habitat restoration ~~efforts applied to the~~implemented to reduce the Project's residual effects may be at risk of disturbance due to ongoing industrial activity in proximity to the project footprint. ~~NGTL will engage with third parties where proposed activity is in the area of habitat restoration measures, and, under the terms and conditions of its crossing agreement, NGTL will specify that avoidance of restoration measures is preferred wherever feasible and that if disturbance does occur, the third party is responsible and accountable to restore the NGTL footprint to pre-disturbance conditions, and is required to comply with all reasonable instructions of the TCPL Field Representative regarding the procedures to be followed during the work. NGTL will track these activities as a separate component of its follow-up program.~~

NGTL will include terms and conditions in new and existing crossing agreements with third parties specifying that avoidance of NGTL's CHRP and OMP measures is preferred. If disturbance does occur, the third party will be responsible and accountable for restoring measures to as close as practical to pre-disturbance conditions. The third party will be required to comply with all reasonable instructions of a NGTL Representative to complete the work.

Where regulatory (provincial or federal) approval is ~~given~~ granted for other projects/land use activities that destroy measures implemented by NGTL for the CHRP, the area of influence within the Project footprint will be excluded from the final determination of restoration success upon completion of the monitoring program. These locations will be tracked in monitoring reports filed after each monitoring year (see CHROMMP).

A repeated measures monitoring study design using the evaluation criteria will be developed to test whether the restored footprint meets the measurable targets. A summary of the monitoring and adaptive ~~mitigation~~ management plan is provided in Section 6.0. ~~Details will be provided under separate cover in a CHROMMP.~~ The approach to validate effects predictions and

restoration success is described in the revised Final CHRP and the detailed monitoring and adaptive management plan will be described in the CHROMMP.

2.2 RESTORATION UNITS AND MEASURES

Restoration units were developed in the Preliminary CHRP (8Appendix A) to describe the habitat characteristics within the Project footprint, which affect the habitat restoration measures that can be applied to each site. The restoration units are based on ecosite phases mapped along the Project footprint. However, the ecosite phases were derived from a vegetation community model based on Alberta Vegetation Inventory (AVI) data and there is a margin of error associated with ecosite phase mapping.

The restoration units identified in and on the alignment sheets in 8Appendix B ~~have been~~were derived from a combination of ~~the~~ ecosite phase mapping, field data, aerial imagery, satellite imagery and notes documented by Environmental Inspectors during construction. The rationale for selection of restoration measures is closely tied to the restoration units.

2.3 HABITAT RESTORATION/ NATIVE VEGETATION RE-ESTABLISHMENT

The objective of native vegetation re-establishment for the revised Final CHRP is to restore equivalent land capability of habitat along the ROW. Under this paradigm, the objective is to support and promote native vegetation establishment so that it has similar characteristics (e.g., composition) to native vegetation that existed ~~prior~~ before pipeline construction. This will be completed through natural re-vegetation (i.e., minimum disturbance areas) and tree planting along the ROW. Minimum disturbance construction is a promising approach for promoting native vegetation re-establishment (see Section 3.2.4) and was conducted along the ROW where it was safe to do so. Specifically, minimum disturbance construction was done where the terrain was flat. Soil stripping and grading is necessary on sidehills and steep slopes to ensure a safe work environment. Established reclamation and forestry reforestation practices will be applied to promote native vegetation re-establishment where tree planting is required (see Section 4.2.2).

2.4 ACCESS CONTROL

The creation of new access is a relatively minor issue for the Project because it parallels ~~an~~ existing ROW~~s (including two transmission lines)~~ for much of its length. Thus, little or no new access will be created as a result of the Project. Nevertheless, there is an opportunity for the Project to positively contribute to caribou habitat in the area by implementing access control along the Project ROW. Access control measures were implemented with the primary intention of blocking human use of the ROW. There is evidence that linear features enhance predator movement across landscapes (see Section 3 of Preliminary CHRP, Appendix A). However,

control of predator access and movement along wide linear features may require intensive rollback treatments to be effective, which can increase fire risk and may impede operational access for maintenance. Predator access control was not prescribed as part of the revised Final CHRP.~~However, access control for wildlife may require intensive blockages of the ROW (e.g., heavy use of rollback) to be successful (see Section 3.1). This level of access control was not implemented in the Final CHRP because of~~ there could be ~~risks of using heavy amounts of coarse woody debris (e.g., fire) and because the project parallels an existing open ROW for much of its length.~~

Access control measures were recommended at intersections of the Project ROW with existing perpendicular linear features (*e.g.*, roads, utility corridors, seismic lines, etc.) to reduce access between the ROW and existing linear features. Specifically, access control will be implemented during operation where existing seasonal or all-weather roads ~~cross~~ intersect the ROW at 19 separate sites (see Table 5 and Appendix B for locations). Access control measures include use of rollback (i.e., large logs) (Figure 3), site preparation such as mounding (Figure 4), fabricated line-of-sight screens, and minimum ~~-~~disturbance hand-cutting of vegetation (Figure 5). In addition, willow staking of riparian areas traversed by the ROW will create vegetation barriers.

~~Measures of human use may include subjective criteria, such as whether there is any evidence of human use, and if yes, the type (e.g., ATV, truck) and amount (i.e., low or high) of human use. For example, a site may be considered as low human use if tracks or trails are evident but difficult to discern or infrequently used, and high human use if tracks or trails appear to be well used, vegetation is trampled, and bare ground is visible. Measures of human use of the ROW will also consider the effects of unanticipated new dispositions that cross the ROW (e.g., roads and cutblocks).~~

Measures to evaluate human use include ground-based monitoring criteria such as evidence of vehicular access and/or U-turns, ~~-~~the type of vehicle access (e.g., ATV, truck) and the intensity of use (see Table 2). For example, an access controlled site may be considered successful where vehicular tracks or trails are evident but difficult to discern or infrequently used, or requiring adaptive management where tracks or trails appear to be highly used, vegetation is trampled, and bare ground is visible. Adaptive management measures will consider the location, source, and type of access to inform corrective action strategies.

Figure 3 **Example of Rollback Spread at a Road Intersection with a Pipeline ROW from the Air (left) and Ground (right)**

Figure 4 **Example of Mounding along a Pipeline ROW from the Air (left) and Ground (right)**

Figure 5 Example of Minimum Disturbance Construction, Hand-Cutting of Vegetation along a Pipeline ROW, at a Road Intersection

2.5 LINE-OF-SIGHT BLOCKING

Linear features create open habitats that are easier for humans and wildlife to see along and travel through than forest. Line-of-sight blocks along linear features are intended to reduce human use and possibly wildlife predator travel and visibility of their prey. This may mitigate increased predator hunting efficiency due to linear feature development, which might ultimately mitigate caribou mortality risk (see Section 3 of Preliminary CHRP ~~for full explanation~~).

Similar to access control, line-of-sight blocking is a ~~relatively minor issue~~challenge to implement ~~for the Project~~ because ~~it~~ the Project parallels an existing ROW, which does not have line-of-sight blocks. ~~Nevertheless, t~~To ~~minimize any new impacts from~~reduce Project residual effects ~~the Project and possibly alleviate previous impacts of other projects,~~ line-of-sight blocks will be

~~established~~ implemented along the Project ROW at locations where they are most likely to be successful.~~.~~

Line-of-sight blocks will be established at a minimum of 500 m intervals within 15 years along the Project ROW where no topographic or route features (e.g., dog-legs in the ROW) occur. There are no provincial guidelines in Alberta for line-of-sight management for linear features. Reclamation programs for previous developments in Alberta have targeted maximum sight lines of 400 m (Golder 2007, DES 2004). Operating practices for energy development in sensitive caribou range in BC (BC Ministry of Environment 2011) suggest implementing line-of-sight management every 500 m on linear features that do not share a ROW boundary with a road (see ~~also explanation in~~ Section 3.2.1).

Line-of-sight blocks include planting vegetation (e.g., tree planting or willow staking), fabricated site screens and minimal disturbance construction to preserve vegetation (Figure 3). Line-of-sight blocks will be implemented at locations with sight lines >500m, particularly where they intersected with existing road access. Trees~~s planting~~ will be planted ~~will be staggered~~ in an alternating pattern across the pipeline ~~centerline~~centreline along portions of the ROW (Figure 6). Specifically, trees will be planted across the ~~centerline~~centreline with open vegetation left at alternating sides of the ROW along some sections. This alternating vegetation pattern will create a line-of-sight break (Figure 6). ~~Details on exact configuration of seedling planting to achieve line-of-sight breaks depends~~Details on exact configuration of seedling planting to achieve line-of-sight breaks depend on as-built location of the pipe ~~centre line~~centreline and ~~whether the route is adjacent to another ROW~~adjacent linear disturbances. Figure 6a illustrates the potential planting configuration ~~if the pipeline is in the centre of the ROW~~at locations where there is no disturbance parallel to an NGTL ROW. Figure 6b illustrates the potential planting configuration ~~if the pipeline is at the edge of the ROW adjacent to~~where the adjacent disturbance is an existing NGTL ROW.
Figure 6c illustrates the potential planting configuration where the adjacent disturbance is an existing third-party ROW~~configuration if the pipeline is near the edge of ROW adjacent to an existing third-party ROW~~.

Topography, bends in the ROW, minimum disturbance construction to preserve vegetation and willow staking ~~are effective ways to~~ create immediate line-of-sight blocks (i.e., create visual barriers after restoration activities are implemented). However, short-term barriers were not necessarily implemented every 500 m along the ROW, as the objective is to create line-of-sight blocks at ~~a minimum~~least every 500 m along the ROW in the long term, after 15 years. Vegetation planting, including at staggered intervals across the pipeline ~~centerline~~centreline, will establish these blocks. Therefore, vegetation planting will create long-term line-of-sight blocks <500 m apart.

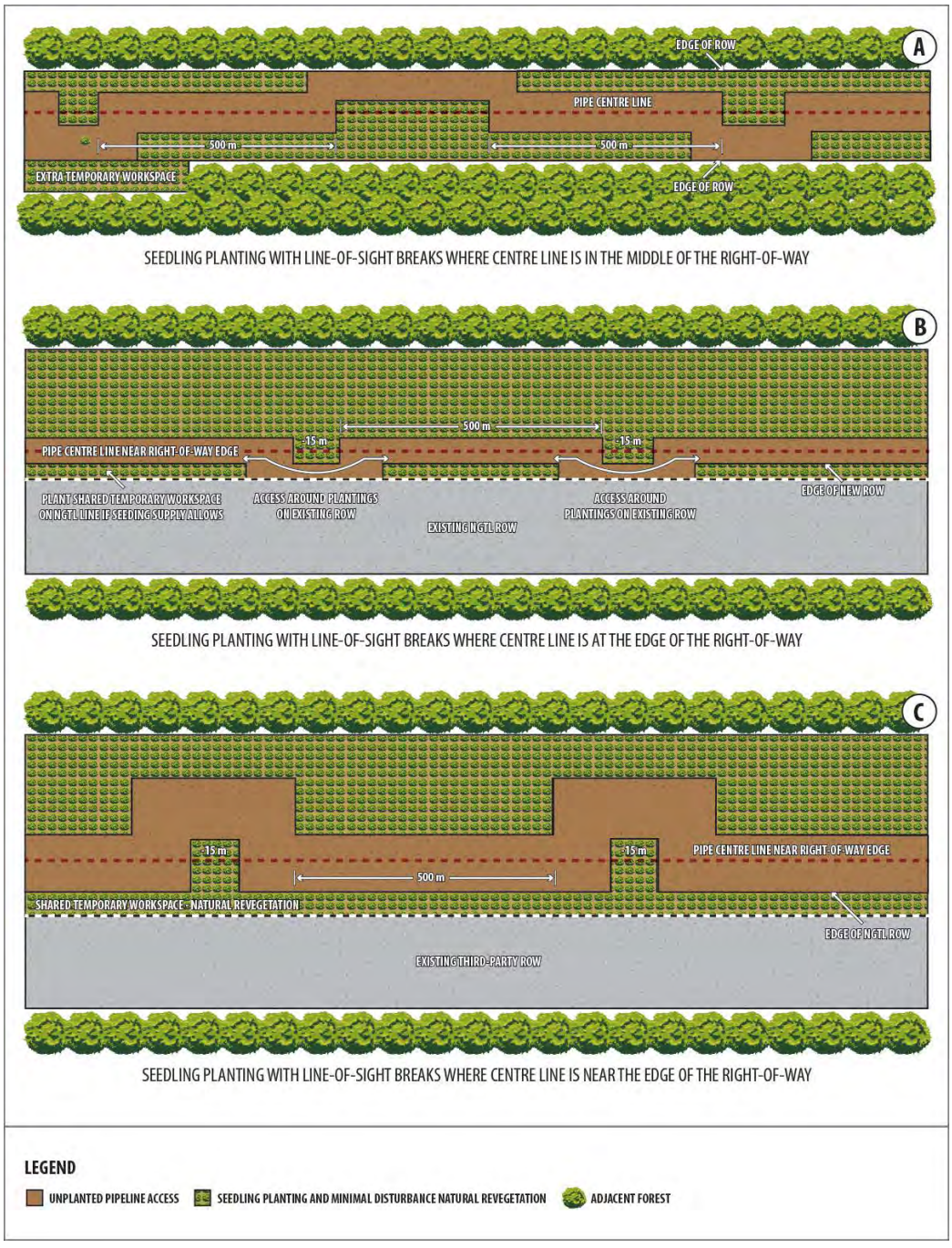

Figure 6 Seedling Planting with Line-of-Sight Breaks

2.6 ASSUMPTIONS AND LIMITATIONS

Habitat restoration assumes that caribou will be able to maintain adequate spatial separation from predators, i.e., pre-disturbance levels of mortality risk (Athabasca Landscape Team 2009). Restoration of the ROW is also expected to mitigate caribou avoidance of the ROW (i.e., within a zone of influence) (Oberg 2001). As such, habitat restoration is expected to mitigate the residual effects of the Project on caribou over the long-term (i.e., longer than 15~~0~~ years). Although there is uncertainty in the effectiveness of some measures prescribed to restore habitat, the assumption is made that habitat restoration will be effective in the long-term. In addition, monitoring and adaptive management will be completed to systematically evaluate program outcomes and address unsuccessful restoration measures by adjusting or supplementing how these measures are implemented.

Restoration of habitat within the ROW through implementation of the CHRP will not completely eliminate the ~~adverse~~ residual effects of the Project on caribou habitat. Maintenance of low vegetation heights over the pipeline centre~~re~~line is required to comply with operational standards and regulations for monitoring and safe operation. NGTL has updated its operational standards to allow for alternating plantings of woody vegetation over the pipeline centreline~~centre line~~, allowing for a narrow, meandering access line over the centreline ~~centre line~~ (Figure 6). The result is that the CHRP treatments applied within segments of the ~~Footprint~~ project footprint that are planted with tree seedlings are expected to achieve the targets set out for the CHRP and effectively eliminate ~~the~~ Project residual effect~~s of the Project~~ along those segments in the long-term. For quantification of residual habitat loss, it is assumed that there ~~is~~ are no residual effect~~s~~ on the segments of the Project footprint that are planted with trees.

Where the CHRP prescribes natural regeneration as the primary treatment for re-vegetation of the project footprint, NGTL conservatively assumes that the 10 m wide area over the pipeline centreline ~~centre line~~ will be periodically ~~mowed to~~ maintain~~ed to provide~~ access for operational purposes. This area will not achieve the measurable targets for the CHRP and is quantified as residual caribou habitat loss.

The lag time required to achieve habitat value equivalent to pre-construction conditions is an important consideration and discussed further in the OMP. Residual effects within restored segments of the project footprint will extend over the long-term, until vegetation community composition and structure has matured to a seral stage that is presumed to provide functional caribou habitat and restore pre-disturbance predator-prey dynamics.

2.7 SUMMARY

The three objectives of the revised Final CHRP are comple~~i~~mentary. Native vegetation re-establishment ultimately provides access control and line-of-sight blocking, ~~and access control and line-of-sight blocking may~~which might support vegetation re-establishment by reducing

vegetation trampling along the ROW. Nevertheless, an important consideration of caribou habitat restoration is that the scientific understanding of the relationship between linear access, native vegetation, access control, line-of-sight blocking and caribou mortality is correlative. Measuring the mechanistic relationship between habitat restoration and caribou mortality is outside of the scope of the revised Final CHRP. The evaluation criteria described here focuses on measuring the direct effects of restoration to infer any indirect effect on caribou mortality risk. That is, if restoration is successful, than it is inferred that there will be ~~little~~ few or no negative residual effects of the Project on caribou mortality risk. The three restoration objectives are ~~complimentary~~ complementary to promote successful and rapid restoration of caribou habitat.

3 UPDATES FROM THE PRELIMINARY CHRP

This section discusses specific updates or modifications to the Preliminary CHRP that ~~have been~~were incorporated into the Final CHRP (submitted November 2014). This ~~includes~~included an updated literature review (Section 3.1) and documentation of how NEB comments on the Preliminary CHRP ~~have been~~were incorporated into the Final CHRP, including if and how they influenced decision making criteria (Section 3.2). Further comments were received from the NEB on the Final CHRP, and revisions were made to the Final CHRP and are provided in the revised Final CHRP (i.e., this document). Details of the NEB comments on the Final CHRP and how they are addressed in revised Final CHRP are provided in Section 1.0.

3.1 UPDATED LITERATURE REVIEW

~~The~~ A literature review was conducted~~updated and completed~~ in June 2014 an additional literature has since been incorporated to ensure that NGTL considered the most recent published knowledge of caribou habitat restoration in the Final CHRP and revised Final CHRP. Restoration of disturbed habitat has become one of the key components for caribou conservation, and has been identified in the federal boreal caribou recovery strategy (Environment Canada 2012) and in Alberta boreal caribou recovery planning efforts (~~Government of Alberta~~ GoA 2011). The literature review was conducted using a systematic approach and standard research techniques including the use of in-house reference material and querying online scholarly databases using keywords and phrases. The literature review for the ~~F~~final CHRP included a search of the following databases:

- Google
- Google Scholar
- BioOne
- Web of Science
- Cumulative Environmental Management Association (CEMA) database
- Oil Sands Research and Information Network (OSRIN) database

The following combinations of search terms were included in the literature review:

- Caribou habitat restoration
- Boreal forest restoration
- Linear feature restoration in boreal forest

In addition to the literature search, Stantec attended the 15th North American Caribou Workshop, where seven papers related to habitat restoration for caribou were presented

(Reid 2014; Bentham and Coupal 2014; Keim et al. 2014; Saxena et al. 2014; Dickie et al. 2014; Finnegan et al. 2014; Cody et al. 2014). Key messages from those presentations that are relevant to the revised Final CHRP are summarized here.

~~The majority~~Most of the new information obtained in the recent literature review ~~was~~ is related to use of rollback and monitoring wildlife use of restored linear features. Key references related to use of rollback include the updated ~~Government of Alberta (~~GoA~~)~~ Enhanced Approval Process (GoA 2013), specifically related to industrial operation in caribou range and the rollback management guides provided by Pyper and Vinge (2012) and Vinge and Pyper (2012). Vinge and Pyper (2012) highlight the advantages of using rollback to enhance re-vegetation of disturbed area. Specifically, they summarize the benefits of using whole logs to create microsites and use of rollback along as much of the ROW as possible to control access, both of which can enhance the speed and success of vegetation re-establishment. They recommend using rollback volumes of 60 to 100 m^3/ha in upland areas and 30 to 50 m^3/ha in lowland areas. They also provide a visual guide (Pyper and Vinge 2012) to help operators achieve these targets. The advantages ~~or~~ of rollback are reflected by the GoA, as they recommend using rollback at least 40% of the ROW length ~~ROW~~, as long as sections of rollback do not exceed 250 m ~~in length~~ long and are separated by 25 m to minimize fire risk (GoA 2013).

Results of research on wildlife species ~~use of~~ using linear features, including pipelines, and response to restoration treatments is emerging. Black bears (*Ursus americanus*) have recently been found to use seismic lines ~~>~~ more than 2 m wide more than forest interior, suggesting they may use linear features to increase their ability to capture prey, including caribou (Tigner et al. 2014). Wolves have been found to use linear features 1.25 to ~~two~~ 2 times more than expected and move 1.3 to 3.3 times faster on linear features than non-linear habitats in the oil sands region of Alberta (Dickie et al. 2014). Similarly, wolves in northeastern BC were found to be 1.5 ~~and three~~ times more likely to move to seismic lines and 3 times more likely to move to roads~~, respectively,~~ than other habitats, and travelled 4.2 times faster on roads than other habitats (DeMars et al. 2014). 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 to these species. Some very preliminary results of intensive linear feature blockages suggest that this type of mitigation can be effective at reducing wildlife use of linear features. Application of high densities of salvage logs (i.e., rollback) at linear feature intersections reduces human use of linear features by 100%, wolf use of linear features by 90%, and deer use of linear features by 50% (Keim et al. 2014). However, a limitation of this recommendation is that it requires very large amounts of woody debris, which may not be available, may pose a fire risk and may impede natural vegetation growth (see consultation with AESRD in Section 7.0). Therefore, it is not recommended in the revised Final CHRP.

~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE ~~CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015~~REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

Updates from the Preliminary CHRP
April 30, 2015

Winter tree planting and mechanically bending live trees into the ROW are emerging mitigation options ~~that are~~ currently being implemented in the oil sands region of Alberta (Reid 2014; Cody et al. 2014). Tree bending may be particularly promising as it promotes natural re-vegetation by increasing cone deposition onto the ROW and creating microsites through shading and dropped dead woody debris. However, these mitigation measures are only initially being evaluated and their utility remains unknown. Furthermore, they were applied on narrower seismic lines rather than pipeline ROWs. Therefore, they are not proposed in the revised Final CHRP, but may be considered in the future as part of adaptive management if the restoration plans proposed in the revised Final CHRP are unsuccessful.

Caribou habitat restoration is receiving increasing research attention and it is anticipated that methods to restore habitat will continue to tested and modified in the near future. NGTL will continue to incorporate this new information as part of post-construction monitoring and adaptive management, and in development of the CHROMMP, as well as subsequent CHRPs to be completed for other projects.

3.2 RESPONSE TO NEB COMMENTS ON THE PRELIMINARY CHRP

Feedback obtained from the NEB on the Preliminary CHRP was filed and ~~has been~~was incorporated in the Final CHRP. The updates are summarized in a revision log (**Error! Reference source not found.**) ~~and where necessary, more detail is provided below~~. Additional feedback was obtained from the NEB on the Final CHRP and has been incorporated into the revised Final CHRP (this document). Details of this revision are described in Section 1.0.

Updates from the Preliminary CHRP
April 30, 2015

Table 3 Revision Log of Changes to Restoration Measures from the Preliminary CHRP

Issue/Comment	Amendment/Action	Reference – revised Final CHRP
NEB comment to reconcile 50 m line-of-site in literature with 500 m line-of-site used in the decision tree.	Provided explanation for 500 m line-of-sight threshold in decision trees (Section 2.3): " There are no provincial guidelines in Alberta for line-of-sight management for linear features. Reclamation programs for previous developments in Alberta have targeted maximum sight lines of 400 m (Golder 2007, DES 2004). Operating practices for energy development in sensitive caribou range in BC (BC Ministry of Environment 2011) suggest implementing line-of-sight management every 500 m on linear features that do not share a ROW boundary with a road."	Section 3.2.1
NEB comment: Clarify whether the proposed 5 year monitoring period is just a preliminary minimum period that would feed into a CHROMMP.	Section 3.2.2 now provides details that 15 years is a preliminary monitoring period and that during the 15 years adaptive management will be implemented to determine whether additional restoration treatments will be implemented, or whether the residual effects will be offset. If restoration treatments are on trajectory to achieve targets after 15 years they will be deemed successful (i.e., no residual effects).	Section 3.2.2
NEB comment: Where do the quantifiable targets come from (e.g., 70% survival rate)?	Target has been increased to 80% success rate (see Section 3.2.3) for the following reasons: Consistent with NWML and Leismer to Kettle River plans. These plans provide rationale that equivalent land capability is achieved when the reclaimed fall within 20% of 'control values' (AENV 2001), where 'control' is considered 100% survival in surrounding landscape. They indicate reforestation standards in Alberta require a minimum of 80% stocking of regeneration sites (AESRD 2013a). Provides a consistent target for evaluating success across projects.	Section 3.2.3

Updates from the Preliminary CHRP
April 30, 2015

Issue/Comment	Amendment/Action	Reference – revised Final CHRP
NEB comment: "Are uncertainties already calculated in the quantifiable targets? Or how will time lags and uncertainties be carried forward to the OMP?"	Section 3.2.3 provides a description of how restoration targets will be used. Specifically, it states that post-construction monitoring will be used to evaluate if the restoration treatments are on a trajectory to achieving the targets, and if not, further restoration treatments or offsets will be implemented. These will be described in detail in the OMP and CHROMMP.	Section 3.2.3
NEB question: "How do restoration units compare to habitat types?	"Restoration units" were identified from "habitat types" that were determined using ecosite phase data.	All sections
NEB question: "Will any ongoing management/planned succession practices be used in those areas that will undergo natural regeneration? Or would natural regeneration be an entirely hands off approach?"	Section 3.2.4 addresses this section by describing that natural regeneration will essentially be hands off.	Section 3.2.4
NEB comment: "Further clarification around how opportunities and constraints determine the choice of restoration method…" is needed.	Sections 2.1 to 2.5 describe the opportunities and constraints for the restoration methods.	Sections 2.1 to 2.5
NEB question whether any new literature sources were viewed since one year ago. NEB comment to provide a discussion of how NGTL will continue to incorporate new research ideas into the CHRP over time, the date of the last literature search and to have a clear reproducible methodology for future literature reviews.	Section 3.0 summarizes all updates to the Preliminary CHRP. Section 3.1 describes results of the updated literature review, how and when it was completed and how new information was incorporated.	Section 3.0 and 3.1.
NEB comment: How do restoration targets link to OMP, for example if 70% restoration target is met will 30% be offset?	We now clarify in Section 2.1 that measures ≤ 20% of targets will not be offset, but targets > 20% and that can't be mitigated in adaptive management will be offset.	Section 2.1
NEB comment: Evaluation criteria, performance measures and targets do not always match-up and often use different measures entirely.	This refers to Table 4 in the Preliminary CHRP. The Table (now) has been re-organized so that each CHRP objective is aligned with its restoration targets and measures. Objectives align with the	Section 2.1,

Updates from the Preliminary CHRP
April 30, 2015

Issue/Comment	Amendment/Action	Reference – revised Final CHRP
	appropriate mitigation type, by habitat type.	
NEB comment: The link between caribou habitat, caribou mortality risk, restoration targets and evaluation and performance criteria are unclear.	Section 3.1 now explains that the linkage between caribou mortality and restoration is correlative; therefore the focus is on measuring the direct effects of restoration measures on habitat to infer a reduced effect on caribou mortality risk.	Section 3.1
NEB comment: A concordance table is needed in the Final CHRP to track how NGTL addressed the NEB comments on the Preliminary CHRP. NEB certificate ~~condition~~ Condition 10 requirement to document "any updates" to the Preliminary CHRP "that includes the rationale for any changes to decision making criteria."	Section 3.0 summarizes all updates to the Preliminary CHRP and provides a concordance table (**Error! Reference source not found.**) where each NEB comment is a separate row and a description of where and how the comment was addressed is provided.	Section 3.0, **Error! Reference source not found.**
NEB certificate condition 10 requirement to provide "a complete table of caribou habitat restoration sites, including but not limited to location, spatial area, description of habitat quality, site-specific restoration activities and challenges;	**Error! Reference source not found.** in Section 4.3 provides this information.	Section 4.3, **Error! Reference source not found.**
NEB certificate condition 10 requirement to provide "maps or Environmental Alignment Sheets showing the locations of the sites."	8Appendix B includes the restoration sites alignment sheet ~~of restoration sites~~.	8Appendix B
NEB certificate condition 10 requirement to "a quantitative and qualitative assessment of the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the ~~aerial~~ areal extent of the resulting residual effects to be offset, which also includes indirect disturbance."	Sections 5.0 and 5.2.1. and Table 6 ~~quantifies~~ quantify the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the ~~aerial~~ areal extent of the resulting residual effects to be offset, including indirect disturbance.	Section 5.0, 5.2.1 Table 6.
NEB certificate C~~c~~ondition 10 requirement to	Section 5.0 and Table 7 summarizes consultation with Environment	Section 5.0, Table 7

Issue/Comment	Amendment/Action	Reference – revised Final CHRP
provide "Evidence and summary of consultation with Environment Canada and provincial authorities regarding the Final CHRP."	Canada and provincial authorities.	

3.2.1 Line-of-sight Blocks

Clarification was requested regarding the use of a 500 m line-of-sight break in the Preliminary CHRP when in the literature review it was stated that "line-of-sight measured on the re-vegetating seismic lines was typically less than 50 m after 20 years" (Stantec 2013). An important clarification about this statement is needed, as it refers to line-of-sight measured 20 years after restoration, when vegetation was already established. The Preliminary CHRP recommended a 500 m line-of-sight break as an initial mitigation until vegetation became established. A 500 m line-of-sight break is consistent with linear feature restoration guidelines in Alberta and BC (see Section 2.3). Native vegetation re-establishment is a higher mitigation priority than line-of-sight breaks because vegetation will ultimately create visual and access barriers along the entire ROW. Once vegetation is re-established it is anticipated that line-of-sight breaks ~~on~~ in the Project ROW will be shorter and ~~occur within what is~~ more typical of re-vegetated seismic lines (i.e., less than 50 m). The 500 m line-of-sight break decision tree from the Preliminary CHRP was therefore applied to the revised Final CHRP.

3.2.2 Monitoring Period

A five year post-restoration monitoring period was recommended in the Preliminary CHRP, but later changed to a 15 year monitoring ~~length~~ period ~~was later requested~~. Additional monitoring was recommended in the CHRP (See Section 6.0).

3.2.3 Restoration Targets

Restoration targets have been revised based on the recent literature review (2014). ~~Furthermore, t~~The rationale for some of the targets discussed in the Preliminary CHRP is clarified ~~. Finally,~~ and specific targets have been developed as part of the revised Final CHRP (Section 2.1) that was not discussed in the Preliminary CHRP.

Sustained vegetation growth in 70% of restoration sites was proposed in the Preliminary CHRP. However, this target was not consistent with AESRD recommendations, which proposed that 80% of restoration sites should be re-vegetated to be considered ~~a~~ successful restoration. AESRD provided detailed rationale for this target, including Alberta reforestation standards (AESRD 2013a) and the Alberta Reclamation Assessment Criteria for Pipelines (AENV 2001) and therefore this target was adopted in the revised Final CHRP. Using a consistent target across NGTL projects allows for a 'meta-analysis' of restoration success (i.e., analysis of results from multiple projects). This approach enhances adaptive management by providing similar data across projects to evaluate restoration treatments within the context of local environmental conditions.

More specific restoration targets have been provided in . These include a specific planting density target for seedlings, levels of human use and line-of-sight distances. A planting density of

1,600 to 2,400 stems/ha has been proposed as a restoration target in upland areas, and 800~~-~~ to 2,000 stems/ha in lowland and mounded areas. Again, this provides a ~~consistent~~ target consistent with forestry standards across Canada (Golder 2014; TERA 2014).

Maintaining a 'low' level or no human use along the ROW is another target. This will be measured qualitatively by looking for evidence of human use at restoration sites.

The restoration targets identified here are supported by regulatory restoration guidelines. The purpose of monitoring is to determine if habitat restoration locations achieve their respective targets in the short term (less than 15 years) and long term (more than 15 years) term. If yes, ~~than~~ restoration would be ~~deemed~~ considered successful. If no, ~~then~~ additional mitigation and adaptive management actions will be implemented, which is discussed in the CHROMMP.

3.2.4 Natural Re-vegetation

Natural re-vegetation will occur at some locations along the ROW (see Table 5 and Appendix B), particularly where minimum disturbance practices were implemented or in wet lowland areas with little soil, as indicated by poor tree growth in neighboring sites. Based on the literature review in the Preliminary CHRP (Stantec 2013), ~~there is a lack of evaluation of~~ because restoration treatments are not well evaluated, ~~and therefore~~ the success of natural re-vegetation versus other treatment types is unknown. ~~Here i~~It is predicted here that natural re-vegetation of minimally disturbed sites should be successful, as long as human use is kept to a minimum. Monitoring for ~~fifteen~~ 15 years post-construction is a key aspect of the revised Final CHRP and will be used to evaluate if this prediction is correct.

Natural re-vegetation is a "hands-off" approach to restoration where the primary objective is to avoid disturbing vegetation and soil. Surface disturbance (e.g., compaction or removal of soil) can slow or prevent the recovery of native vegetation on industrial developments. For example, Osko and Glasgow (2010) measured a few hundred stems per hectare (stems/ha) of aspen on highly disturbed (i.e., stripped-soil) wellsites compared ~~to~~ with 10,000 to 15,000 stems/ha of aspen on minimum disturbance construction wellsites, indicating minimum disturbance resulted in two orders of magnitude higher vegetation biomass recovery. Similarly, seismic lines cleared by a bulldozer and left to restore on their own may take as long as 112 years to reach 95% recovery to woody vegetation (Lee and Boutin 2006).

Minimum disturbance was conducted as part of the CHRP where it was safe for equipment to operate without soil stripping and grading (i.e., flat terrain) by minimizing surface disturbance and soil stripping during construction. Surface disturbance will also be minimized post-construction through limiting all-terrain vehicle (ATV) travel on the site (i.e., access control).

4 CARIBOU HABITAT RESTORATION SITE PRESCRIPTIONS

This section includes a detailed table of proposed habitat restoration sites, including the location, habitat, and site-specific restoration activities for each site, as well as a restoration schedule. This is supplemented by alignment sheets with the location of each of these proposed habitat restoration sites (8Appendix B). Together these provide a detailed restoration plan along the Project route.

4.1 SCHEDULE

Restoration measures implemented during the construction and rough clean-up phase (winter 2013/2014) included the following:

- Minimum disturbance construction that will facilitate natural regeneration
- Bio-engineering (e.g., geotextile soil wraps or "coir lifts") of watercourse banks and riparian areas
- Retention and spreading of woody debris for erosion control, improved microsite conditions (i.e., to enhance seedling survival) and access control (note: woody debris was retained on-site in some locations and will be spread during final clean-up)
- Retention of vegetation across portions of the project footprint at select road crossings to break line-of-sight (i.e., visual screens)

The locations of these measures are shown on the Environmental Alignment Sheets (8Appendix B). Going forward, the proposed habitat restoration schedule is listed below and in **Error! Reference source not found.**. The schedule includes the following:

- Fall 2014: nursery seedling procurement
- Winter 2015: final clean-up and restoration measures, including recontouring surface soils, installing drainage and erosion control measures, additional bio-engineering at watercourse banks and riparian areas (e.g., geotextile erosion control), spreading mulch in areas where depth is too thick, spreading woody debris and mounding for access control and creation of microsites
- Summer/fall 2015: seedling planting; willow cutting collection and staking
- Summer/fall 2016: contingency plan for additional planting/staking and/or mounding at select locations, in the event that unforeseen circumstances prevent completion of CHRP measures during 2015

The scheduling of the habitat restoration work ~~has~~ considered that seasonal access constraints (i.e., frozen conditions and adequate snow) are required to accommodate vehicle and

machinery travel along the ROW, as well as to protect areas of minimum disturbance during clean-up activities, comply with sensitive and/or restricted activity periods for caribou and other wildlife, and provide adequate lead time for the production of nursery seedlings. An "early-in/early-out" approach ~~will be~~was taken for final clean-up work in winter 2015 and~~, with a goal of completing~~ final clean-up was completed before the February 15 recommended timing restriction within caribou ranges in Alberta (GOA 2013).

Scheduling of monitoring will be detailed in the CHROMMP. The implementation of CHRP measures will be documented and sample plots will be established to form the basis of monitoring. Monitoring will commence in the first growing season following completion of habitat restoration measures (i.e., Q3 2015) and will continue for 15 years (i.e., 2030). Implementation of adaptive management protocols, if warranted, will depend on the monitoring schedule as well as the seasonal, wildlife sensitivity and logistical considerations described above.

Table 4 Schedule of Habitat Restoration Measures 2014-2015

Activity	2014		2015			
	Q3	Q4	Q1	Q2	Q3	Q4
			February 15 ↓		July 15 ↓	
Field Assessments and Planning						
Seedling Procurement						
Nursery Seedlings Grown						
Final Clean-up and Winter Restoration						
Collect Willow Cuttings						
Bio-Engineering (Willow Staking)						
Plant Seedlings						

4.2 STANDARDS AND SPECIFICATIONS

There are no existing specifications for the design and implementation of caribou habitat restoration. As a result, relevant standards and guidelines for forestry (AESRD 2013a), reclamation of pipelines, wellsites and associated facilities (AENV 2001, 2011), reclamation of oil sands development (AENV 2008, 2010; AESRD 2013b) and results of caribou habitat restoration

research were used to develop specifications for the CHRP. In addition, information obtained from the literature review provided in the Preliminary CHRP and updated in the revised Final CHRP was considered.

Given the limited quantitative information available regarding monitoring and success of restoration, and the uncertainty associated with the effectiveness of various restoration measures for different ecosites in different parts of Alberta, the specifications identify acceptable ranges for the implementation of restoration measures. The following specifications will be applied to the restoration measures.

4.2.1 Minimum Disturbance Construction

NGTL implemented minimum surface disturbance construction techniques to facilitate natural re-vegetation (8Appendix B; **Error! Reference source not found.**). Minimum disturbance construction techniques included limiting grading and soil salvage on flat terrain, hand-cutting or mowing of vegetation (Figure 5), and snow padding over vegetation. Hand-cutting/snow padding was implemented at intersections with other linear features to facilitate rapid vegetation recovery ~~of vegetation~~ to create access and line-of-sight barriers.

4.2.2 Conifer Tree Planting

Tree planting densities are based on western Canadian forestry recommendations, which typically range from 1,500- 2,500 stems/ha (MacDonald et al. 2012). Specific to oil and gas developments, the ~~Government of Alberta~~GoA *Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands* (AENV 2011) recommends that upland sites should be planted with merchantable species at 2,000 stems/ha. Similarly, the guidelines for forest reclamation in the oil sands region (AENV 2010) specify planting densities of conifer (pine and white spruce) seedlings in dry, moist poor or moist rich site types of 1,400-2,000 stems/ha and planting densities of black spruce at 1,400-2,800 stems/ha in wet poor sites.

The objective of ~~the~~ the revised Final CHRP is to plant 1,600-2,400 stems/ha with the goal of establishing 2,000 stems/ha in upland sites. Upland sites will be planted with either white spruce or lodgepole pine (8Appendix B; **Error! Reference source not found.**). Lowland and mounded sites will be planted with black spruce (8Appendix B; **Error! Reference source not found.**).

4.2.3 Alternating Tree Planting Across the ROW

To comply with Canadian Standards Association (CSA) CSA-Z662-11, the pipeline must be accessible for emergency and operational purposes. However, to create line-of-sight breaks, tree planting will cross the cent~~e~~re of the ROW at alternating sections along the ROW (Figure 6).

Alternating tree planting sections of the ROW will occur at least every 500 m along the ROW where tree planting is recommended to maintain line-of-sight breaks.

4.2.4 Mounding

Mounding (excavations approximately 0.3 m to 0.75 m deep) will be implemented at applicable lowland sites and transition sites between upland and lowland sites. It will be targeted ~~at~~ in wet to moderately wet areas with sufficient mineral soil to support tree growth, particularly at intersections with other linear features with these conditions for access control (8Appendix B; **Error! Reference source not found.**). Mounding will not be done anywhere on the ROW within 5 m of the pipeline to comply with the ~~Canadian Standards Association (~~CSA~~)~~ *Oil and Gas Pipeline Systems Standard Z662-11*, which restricts ground disturbance by heavy machinery within 5 m of the pipeline (CSA 2011). Black spruce will be planted two per mound to achieve tree planting densities of at 800-2,000 stems stems/ha with the goal of establishing 1,400 stems/ha.

4.2.5 Willow Staking

Native willow from nearby locations with high densities of willow will be cut into stakes and planted along restored riparian areas. Willow staking will contribute to stabilization of the banks of waterbodies traversed by the pipeline, as well as to creating line-of-sight and access barriers along the ROW (8Appendix B; **Error! Reference source not found.**).

4.2.6 Rollback

Rollback (i.e., logs) will be used primarily to control access, and secondarily to provide microsites for re-vegetation along the ROW. Availability of large woody debris is limited. Furthermore, forestry companies and AESRD are concerned with the additional risk of fire due to placing concentrated amounts of woody debris on the ROW. Therefore, rollback will be targeted to sites where the ROW intersects other linear features (8Appendix B; **Error! Reference source not found.**). Rollback will be placed in > 50 m long sections to a maximum of 250 m, if sufficient material is available and will be placed where the ROW narrows to maximize the length of rollback. Rollback will be placed by stacking layers of logs spaced a few mete~~r~~res apart on top of each other at a perpendicular angle (Figure 2). Thus, it will create a barrier approximately 1 m high with spacing that allows for trees to be planted among the logs. Trees planted among rollback will be planted at a density of 1,600-2,400 stems/ha with the goal of establishing 2,000 stems/ha.

4.3 RATIONALE FOR SITE SELECTION AND RESTORATION MEASURES

Restoration sites were ~~selection~~ selected ~~was done~~ based on local site conditions and using the decision trees developed in the Preliminary CHRP (Figure 2a, 2b and 2c). Local site conditions were determined based on a post-construction site visit completed in September 2014. The

decision tree was developed based on a literature review completed in the Preliminary CHRP that was updated in Section 3.0. Final clean-up and restoration of the Project ROW will be completed in spring/summer of 2015. Monitoring will commence the following year~~,~~ in fall 201~~5~~6.

Table 5 List of Caribou Habitat Restoration Sites along the Chinchaga Lateral Loop No. 3

Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/ Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
0.000 to 0.004	NE 26-094-02	Upland Deciduous/ Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
0.004 to 0.079	NE 26-094-02 to SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
0.079 to 0.212	SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (1112 seedlings).	-	-	✓	In progress
0.212 to 0.221	SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier from the existing road and promote rapid vegetation recovery.	✓	-	-	Complete
0.221 to 0.251	SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
0.251 to 0.259	SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier from the existing road and promote rapid vegetation recovery.	✓	-	-	Complete
0.259 to 0.331	SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (606 seedlings).	-	-	✓	In progress
0.331 to 0.688	SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (1,728 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
0.688 to 0.753	SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (376 seedlings).	-	-	✓	In progress
0.753 to 0.828	SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
0.828 to 0.846	SE 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (606 seedlings).	-	-	✓	In progress
0.846 to 0.913	SE 35-094-02 to NW 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (578 seedlings).	-	✓	✓	In progress
0.913 to 0.973	NW 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (540 seedlings).	-	-	✓	In progress
0.973 to 1.028	NW 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/ Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
1.028 to 1.090	NW 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (460 seedlings).	-	-	✓	In progress
1.090 to 1.169	NW 35-094-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (346 seedlings).	-	✓	✓	In progress
1.169 to 1.514	NW 35-094-02	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (1,728 seedlings).	-	-	✓	In progress
1.514 to 1.682	NW 35-094-02	Upland Deciduous/ Mixedwood Transitional Treed Lowland Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (732 seedlings). Terrain creates line-of-sight barrier.	-	-	✓	In progress
1.682 to 2.164	NW 35-094-02 to NE 34-094-02	Upland Deciduous/ Mixedwood Transitional Treed Lowland Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (2,316 seedlings).	-	-	✓	In progress
2.164 to 2.554	NE 34-094-02 to SE 03-095-02	Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
2.554 to 2.852	SE 03-095-02	Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (1,308 seedlings).	-	-	✓	In progress
2.852 to 3.093	SE 03-095-02	Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
3.093 to 3.346	SE 03-095-02 to SW 03-095-02	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (1,594 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
3.346 to 3.382	SW 03-095-02	Upland Deciduous/ Mixedwood Disturbed Land Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
3.382 to 5.006	SW 03-095-02 to SE 09-095-02	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (7,490 seedlings).	-	-	✓	In progress
5.006 to 5.015	SE 09-095-02	Disturbed Land	Line-of-Sight Barrier	Fabricated visual screen.	A visual screen will be fabricated across the width of the ROW. The screen will be ≥ 2 m high and consist of biodegradable materials. Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
5.015 to 5.089	SE 09-095-02	Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (652 seedlings).	-	-	✓	In progress
5.089 to 5.110	SE 09-095-02	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/ A	N/ A	N/ A	N/ A

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/ Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
5.110 to 5.165	SE 09-095-02	Disturbed Land Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (436 seedlings).	-	-	✓	In progress
5.165 to 5.173	SE 09-095-02	Disturbed Land	Line-of-Sight Barrier	Fabricated visual screen.	Intersection with existing road. A visual screen will be fabricated across the width of the ROW. The screen will be ≥ 2 m high and consist of biodegradable materials.	-	-	✓	In progress
5.173 to 5.367	SE 09-095-02 to SW 09-095-02	Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (850 seedlings).	-	-	✓	In progress
5.367 to 5.465	SW 09-095-02	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (432 seedlings).	-	✓	✓	In progress
5.465 to 6.300	SW 09-095-02 to SE 08-095-02	Upland Deciduous/ Mixedwood Transitional Wetland – Treed Swamp Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (4,264 seedlings). Terrain creates line-of-sight barrier.	-	-	✓	In progress
6.300 to 6.714	SE 08-095-02 to NE 08-095-02	Transitional Wetland – Treed Swamp Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
6.714 to 8.015	NE 08-095-02 to NW 08-095-02	Upland Deciduous/ Mixedwood Transitional Wetland – Treed Swamp Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (6,404 seedlings).	-	-	✓	In progress
8.015 to 8.072	NW 08-095-02	Upland Deciduous/ Mixedwood Transitional	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
8.072 to 8.212	NW 08-095-02 to NE 07-095-02	Upland Deciduous/ Mixedwood Transitional	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (620 seedlings). Terrain creates line-of-sight barrier.	-	-	✓	In progress
8.212 to 8.311	NE 07-095-02	Upland Deciduous/ Mixedwood Transitional	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
8.311 to 8.388	NE 07-095-02 to SE 18-095-02	Upland Deciduous/ Mixedwood Transitional	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (334 seedlings). Terrain creates line-of-sight barrier.	-	-	✓	In progress
8.388 to 8.792	SE 18-095-02	Upland Deciduous/ Mixedwood Transitional	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,996 seedlings).	-	-	✓	In progress
8.792 to 8.913	SE 18-095-02	Upland Deciduous/ Mixedwood	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (690 seedlings).	-	-	✓	In progress

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						C	FC	R-NF	
8.913 to 9.062	SE 18-095-02 to SW 18-095-02	Upland Deciduous/ Mixedwood	Habitat restoration/ native vegetation Line-of-Sight Barrier	Minimal Disturbance	Flat terrain. Limited grading and soil salvage. Bend in ROW creates line-of-sight barrier.	✓	-	-	Complete
9.062 to 9.601	SW 18-095-02	Upland Deciduous/ Mixedwood	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (2,792 seedlings).	-	-	✓	In progress
9.601 to 9.660	SW 18-095-02	Transitional Wetland – Treed Bog Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
9.660 to 9.795	SW 18-095-02	Upland Deciduous/ Mixedwood Transitional Wetland – Treed Bog	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (636 seedlings).	-	-	✓	In progress
9.795 to 9.908	SW 18-095-02 to NW 18-095-02	Upland Deciduous/ Mixedwood Transitional Wetland – Shrubby Bog	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
9.908 to 10.218	NW 18-095-02 to NE 13-095-03	Upland Deciduous/ Mixedwood	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (1,520 seedlings).	-	-	✓	In progress
10.218 to 10.343	NE 13-095-03	Upland Deciduous/ Mixedwood	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (550 seedlings).	-	✓	✓	In progress
10.343 to 10.461	NE 13-095-03	Upland Deciduous/ Mixedwood	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (928 seedlings).	-	-	✓	In progress
10.461 to 10.471	NE 13-095-03	Upland Deciduous/ Mixedwood	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier from the existing road and promote rapid vegetation recovery.	✓	-	-	Complete
10.471 to 10.496	NE 13-095-03	Upland Deciduous/ Mixedwood	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/ A	N/ A	N/ A	N/ A
10.496 to 10.506	NE 13-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier from the existing road and promote rapid vegetation recovery.	✓	-	-	Complete
10.506 to 10.564	NE 13-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (802 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
10.564 to 10.594	NE 13-095-03	Upland Deciduous/ Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/ A	N/ A	N/ A	N/ A
10.594 to 10.660	NE 13-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (516 seedlings).	-	-	✓	In progress

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/ Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
10.660 to 10.792	NE 13-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600 -2,400 trees/ha (578 seedlings).	-	✓	✓	In progress
10.792 to 11.028	NE 13-095-03 to SE 24-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,360 seedlings).	-	-	✓	In progress
11.028 to 11.154	SE 24-095-03	Wetland – Treed Bog	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
11.154 to 11.220	SE 24-095-03 to SW 24-095-03	Upland Deciduous/ Mixedwood Wetland – Treed Bog	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (310 seedlings).	-	-	✓	In progress
11.220 to 11.341	SW 24-095-03	Upland Deciduous/ Mixedwood Wetland – Treed Bog	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
11.341 to 12.290	SW 24-095-03 to SE 23-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (4,842 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
12.290 to 12.396	SE 23-095-03 to NE 23-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
12.396 to 12.536	NE 23-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (614 seedlings).	-	-	✓	In progress
12.536 to 13.534	NE 23-095-03 to NW 23-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (5,008 seedlings).	-	-	✓	In progress
13.534 to 13.621	NW 23-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (5,384 seedlings).	-	✓	✓	In progress
13.621 to 13.948	NW 23-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,332 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
13.948 to 13.977	NW 23-095-03	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
13.977 to 14.046	NW 23-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (682 seedlings).	-	-	✓	In progress

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14.046 to 14.215	NW 23-095-03 to NE 22-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,064 seedlings).	-	✓	✓	In progress
14.215 to 14.394	NE 22-095-03 to SE 27-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (966 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
14.394 to 14.425	SE 27-095-03	Upland Deciduous/ Mixedwood Riparian Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
14.425 to 15.036	SE 27-095-03 to SW 27-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,666 seedlings).	-	-	✓	In progress
15.036 to 15.608	SW 27-095-03	Upland Deciduous/ Mixedwood Wetland – Shrubby Bog Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,734 seedlings).	-	-	✓	In progress
15.608 to 15.889	SW 27-095-03 to NW 27-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,542 seedlings).	-	-	✓	In progress
15.889 to 15.971	NW 27-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (360 seedlings).	-	✓	✓	In progress
15.971 to 16.046	NW 27-095-03 to NE 28-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (654 seedlings).	-	-	✓	In progress
16.046 to 16.054	NE 28-095-03	Upland Deciduous/ Mixedwood Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
16.054 to 16.153	NE 28-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (620 seedlings).	-	-	✓	In progress
16.153 to 16.234	NE 28-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (366 seedlings).	-	✓	✓	In progress
16.234 to 16.864	NE 28-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (3,346 seedlings).	-	-	✓	In progress

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16.864 to 16.876	NE 28-095-03	Wetland – Shrubby Fen Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
16.876 to 17.003	NE 28-095-03 to NW 28-095-03	Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
17.003 to 17.013	NW 28-095-03	Wetland – Shrubby Fen Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
17.013 to 17.034	NW 28-095-03	Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Minimal Disturbance	This is a rare plant location, therefore limited grading and soil salvage was completed and the area will be avoided to ensure the plant is not impacted.	✓	-	-	Complete
17.034 to 17.230	NW 28-095-03	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (1,144 seedlings).	-	-	✓	In progress
17.230 to 17.317	NW 28-095-03 to SW 33-095-03	Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
17.317 to 17.435	SW 33-095-03	Transitional Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (520 seedlings).	-	-	✓	In progress
17.435 to 17.621	SW 33-095-03	Transitional Wetland – Shrubby Fen	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
17.621 to 18.106	SW 33-095-03 to SE 32-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (2,396 seedlings).	-	-	✓	In progress
18.106 to 18.143	SE 32-095-03	Riparian Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
18.143 to 18.870	SE 32-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (3,706 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
18.870 to 18.995	SE 32-095-03 to NW 32-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
18.995 to 19.269	NW 32-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (1,204 seedlings).	-	-	✓	In progress
19.269 to 19.321	NW 32-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Next to open wellsite. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier between the wellsite and the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (548 seedlings).	-	✓	✓	In progress

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19.321 to 19.645	NW 32-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,408 seedlings).	-	-	✓	In progress
19.645 to 19.674	NW 32-095-03	Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
19.674 to 19.888	NW 32-095-03 to NE 31-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,160 seedlings).	-	-	✓	In progress
19.888 to 19.972	NE 31-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (366 seedlings).	-	✓	✓	In progress
19.972 to 20.051	NE 31-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (670 seedlings).	-	-	✓	In progress
20.051 to 20.077	NE 31-095-03	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
20.077 to 20.169	NE 31-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (802 seedlings).	-	-	✓	In progress
20.169 to 20.399	NE 31-095-03	Upland Deciduous/ Mixedwood Transitional Wetland – Treed Fen Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant white spruce.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,016 seedlings).	-	✓	✓	In progress
20.399 to 20.631	NE 31-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,466 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
20.631 to 20.650	NE 31-095-03	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
20.650 to 20.817	NE 31-095-03 to NW 31-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,184 seedlings).	-	-	✓	In progress
20.817 to 20.900	NW 31-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
20.900 to 21.075	NW 31-095-03	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (788 seedlings).	-	-	✓	In progress

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21.075 to 21.603	NW 31-095-03 to SE 01-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (4,158 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
21.603 to 21.620	SE 01-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/ A	N/ A	N/ A	N/ A
21.620 to 21.788	SE 01-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (1,520 seedlings).	-	-	✓	In progress
21.788 to 21.817	SE 01-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
21.817 to 22.144	SE 01-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (2,196 seedlings).	-	-	✓	In progress
22.144 to 22.225	SE 01-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant lodgepole pine.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. Lodgepole pine will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (352 seedlings).	-	✓	✓	In progress
22.225 to 22.342	SE 01-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (796 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
22.342 to 22.927	SE 01-096-04 to SW 01-096-04	Upland Deciduous/ Mixedwood Transitional Wetland – Treed Fen Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
22.927 to 23.004	SW 01-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant white spruce.	White spruce will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (346 seedlings).	-	-	✓	In progress
23.004 to 23.421	SW 01-096-04 to SE 02-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
23.421 to 24.109	SE 02-096-04 to NE 02-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ ha with a range of 1,600-2,400 trees/ ha (3,310 seedlings).	-	-	✓	In progress
24.109 to 24.418	NE 02-096-04 to NW 02-096-04	Upland Deciduous/ Mixedwood Transitional Wetland – Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete

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24.418 to 24.820	NW 02-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,762 seedlings).	-	-	✓	In progress
24.820 to 24.918	NW 02-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant lodgepole pine.	Intersection with existing road. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier from the road to the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (432 seedlings).	-	✓	✓	In progress
24.918 to 24.980	NW 02-096-04 to SW 11-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (516 seedlings).	-	-	✓	In progress
24.980 to 25.013	SW 11-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
25.013 to 25.177	SW 11-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,182 seedlings).	-	-	✓	In progress
25.177 to 25.208	SW 11-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
25.208 to 25.244	SW 11-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (312 seedlings).	-	-	✓	In progress
25.244 to 25.291	SW 11-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
25.291 to 25.330	SW 11-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (388 seedlings).	-	-	✓	In progress
25.330 to 25.440	SW 11-096-04 to SE 10-096-04	Transitional Disturbed Land	Habitat restoration/ native vegetation Access control	Mounding. Plant black spruce.	Intersection with existing road. Mounding will be excavated to approximately 0.3 m to 0.75 m deep. Black spruce will be planted two per mound to a target density of 1,400 trees/ha with a range of 800-2,000 trees/ha (339 seedlings).	-	✓	✓	In progress
25.440 to 25.607	SE 10-096-04	Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Minimal Disturbance	Flat terrain. Limited grading and soil salvage. Bend in ROW creates line-of-sight barrier.	✓	-	-	Complete
25.607 to 25.629	SE 10-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing.	-	✓	-	In progress
25.629 to 25.918	SE 10-096-04	Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
25.918 to 25.940	SE 10-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A

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25.940 to 26.385	SE 10-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Minimal Disturbance	Limited grading and soil salvage. Bend in ROW creates line-of-sight barrier.	✓	-	-	Complete
26.385 to 26.492	SE 10-096-04 to NW 10-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (476 seedlings).	-	-	✓	In progress
26.492 to 26.594	NW 10-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
26.594 to 27.640	NW 10-096-04 to NE 09-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (4,788 seedlings).	-	-	✓	In progress
27.640 to 28.069	NE 09-096-04 to SE 16-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,196 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
28.069 to 29.284	SE 16-096-04 to SE 17-096-04	Upland Deciduous/ Mixedwood Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (6,828 seedlings).	-	-	✓	In progress
29.284 to 29.836	SE 17-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
29.836 to 30.121	SE 17-096-04 to SW 17-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,818 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
30.121 to 30.144	SW 17-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Rare plant location; avoid during restoration. Terrain creates line-of-sight barrier.	-	✓	-	In progress
30.144 to 30.489	SW 17-096-04 to NW 17-096-04	Upland Deciduous/ Mixedwood Transitional Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (2,482 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress
30.489 to 30.587	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Access control	Rollback. Plant lodgepole pine.	Next to open wellsite. Rollback deciduous tree logs across the ROW to a height of ≥ 1m to create a physical barrier between the wellsite and the ROW. Rollback will be stacked perpendicular with spaces between logs to allow for tree planting. Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (424 seedlings).	-	✓	✓	In progress
30.587 to 30.664	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (570 seedlings). Bend in ROW creates line-of-sight barrier.	-	-	✓	In progress

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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/ Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
30.664 to 30.756	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
30.756 to 30.778	NW 17-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
30.778 to 30.828	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Minimal Disturbance	Flat terrain. Limited grading and soil salvage.	✓	-	-	Complete
30.828 to 30.847	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
30.847 to 31.066	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Minimal Disturbance	Flat terrain. Limited grading and soil salvage. Bend in ROW creates line-of-sight barrier.	✓	-	-	Complete
31.066 to 31.288	NW 17-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (1,680 seedlings).	-	-	✓	In progress
31.288 to 31.306	NW 17-096-04 to NE 18-096-04	Riparian	Habitat restoration/ native vegetation Line-of-Sight Barrier	Willow staking.	Plant willow stakes within the banks of the restored watercourse crossing. Terrain creates line-of-sight barrier.	-	✓	-	In progress
31.306 to 31.358	NE 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (490 seedlings).	-	-	✓	In progress
31.358 to 31.378	NE 18-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
31.378 to 31.442	NE 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Access control Line-of-Sight Barrier	Mounding. Plant black spruce.	Intersection with existing road. Mounding will be excavated to approximately 0.3 m to 0.75 m deep. Black spruce will be planted two per mound to a target density of 1,400 trees/ha with a range of 800-2,000 trees/ha (419 seedlings). Bend in ROW creates line-of-sight barrier.	-	✓	✓	In progress
31.442 to 31.477	NE 18-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
31.477 to 32.451	NE 18-096-04 to NW 18-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
32.451 to 32.528	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Access control	Mounding. Plant black spruce.	Intersection with existing road. Mounding will be excavated to approximately 0.3 m to 0.75 m deep. Black spruce will be planted two per mound to a target density of 1,400 trees/ha with a range of 800-2,000 trees/ha (238 seedlings).	-	✓	✓	In progress
32.528 to 32.613	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (670 seedlings).	-	-	✓	In progress

~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)~~~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015~~REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

Caribou Habitat Restoration Site Prescriptions
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Kilometer Post (Start - End)	Legal Location (W6M)	Restoration Unit/ Habitat Type	Objectives	Restoration Measures[1]	Details[2]	Implementation Schedule[3]			Status
						C	FC	R-NF	
32.613 to 32.618	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier and promote rapid vegetation recovery.	✓	-	-	Complete
32.618 to 32.646	NW 18-096-04	Disturbed Land	None – Foreign Disposition	None	This is a foreign disposition so no restoration is permitted.	N/A	N/A	N/A	N/A
32.646 to 32.652	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Line-of-Sight Barrier	Hand cut vegetation.	Intersection with existing road. Vegetation was hand cut along the edge of the intersecting road to maintain a visual barrier and promote rapid vegetation recovery.	✓	-	-	Complete
32.652 to 32.704	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant black spruce.	Black spruce will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (414 seedlings).	-	-	✓	In progress
32.704 to 32.777	NW 18-096-04	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation Access control	Mounding. Plant black spruce.	Intersection with existing road. Mounding will be excavated to approximately 0.3 m to 0.75 m deep. Black spruce will be planted two per mound to a target density of 1,400 trees/ha with a range of 800-2,000 trees/ha (225 seedlings).	-	✓	✓	In progress
32.777 to 33.225	NW 18-096-04 to NE 13-096-05	Transitional Wetland – Treed and Shrubby Fen Disturbed Land	Habitat restoration/ native vegetation	Plant lodgepole pine.	Lodgepole pine will be planted to a target density of 2,000 trees/ha with a range of 1,600-2,400 trees/ha (3,712 seedlings).	-	-	✓	In progress

NOTES:

1 Standard measures inherent to the Project design (e.g., bends in ROW, shared workspace and parallel routing) and site characteristics (e.g., topographic variation that breaks line-of-sight) that may contribute to habitat restoration or reduced effects on caribou are excluded.

2 Tree species are denoted as follows:
lodgepole pine = Pl
white spruce = Sw
black spruce = Sb

3 The implementation schedule for restoration measures is as follows:
C = Construction (winter 2013/2014) – applies to minimum disturbance construction measures (promotes natural regeneration in deciduous areas).
FC = Final Clean-Up and Initial Restoration (winter 2015) – applies to final clean-up, erosion control, bio-engineering riparian areas (e.g., soil stabilization) and site preparation (e.g., mounding).
R-NF = Restoration in Non-Frozen Conditions (summer/fall 2015) – applies to tree planting and shrub staking/planting in bio-engineering locations.

5 PREDICTED RESIDUAL EFFECTS

5.1 ASSUMPTIONS AND CONSIDERATIONS

The restoration of disturbed habitat is expected to result in increased use of the reclaimed area by caribou as natural habitat characteristics re-establish (Oberg 2001). Additionally, restoration of disturbed habitat is assumed to allow caribou to regain spatial separation from predators and other prey (e.g., moose, deer), and in doing so return to natural levels of mortality risk (Athabasca Landscape Team 2009). While habitat restoration cannot immediately eliminate the residual effects of the Project on caribou habitat, over the long term, the residual effects will decline to zero. Addressing direct residual effects on caribou habitat, will also address indirect residual effects on caribou habitat. While there is uncertainty surrounding the effectiveness of implemented restoration measures to restore caribou habitat, it is assumed that restoration efforts will be effective over the long-term. CHRP treatments that are applied within segments of the project footprint are expected to achieve the targets set out in the CHRP, and effectively eliminate Project residual effects in those segments in the long term.

Habitat restoration will not completely eliminate the adverse effects on caribou habitat relating to the Project. A ten meter wide area along the entire ROW ~~centerline~~centreline will not be restored, as this area must be left open ~~by law~~ for the maintenance and safety reasons described in Section 4.~~0~~2.3. Although actual access required for maintenance and safety purposes will likely range from 6 to 10 m, NGTL is conservatively assuming that where the CHRP prescribes natural regeneration as the method for re-vegetation of the project footprint, a 10~~-~~-m~~-~~wide area over the pipeline ~~centre line~~centreline will be mowed periodically to maintain access. This area is assumed to not achieve the measurable targets for the CHRP and therefore is quantified as residual caribou habitat loss.

Residual effects of the Project on caribou habitat are calculated here based on the assumption that restoration prescriptions described in Section 4.0 are implemented successfully and will achieve the goal of restoring caribou habitat in the long term ~~(>~~ (longer than 1~~5~~0 years). Monitoring of restoration treatments to assess actual restoration success, adaptive management to address unsuccessful restoration and habitat compensation offsets will be addressed in greater detail in the CHROMMP.

5.2 QUANTIFICATION OF DISTURBANCE

The area of the Project footprint, including the ROW and temporary workspace, was used to quantify the Project's 'direct' disturbance footprint (**Error! Reference source not found.**), i.e., habitat that was physically removed to construct the pipeline ROW. For the revised Final CHRP,

as-built surveys were used to accurately calculate the total direct disturbance resulting from the Project footprint within caribou range. Where the Project footprint crosses or overlaps roads, the area of the overlap is excluded from the Project footprint. Areas of the Project footprint that cross existing pipeline corridors (e.g., 'foreign' pipeline crossings) have been designated for natural re-vegetation. NGTL did not acquire permission from adjacent disposition holders to apply CHRP measures within foreign dispositions. These corridor crossings are included in the quantification of the Project's direct footprint, but are excluded from the quantification of residual habitat loss because the appropriate measures will be implemented to ensure that the area reclaims to preconstruction conditions (i.e., there is no loss of caribou habitat as a result of the Project). Where Project construction used shared temporary workspace on adjacent pipeline rights-of-way, the area of the shared or overlapping footprint is included in the Project's direct disturbance footprint, since the Project has affected regenerating vegetation on those existing disturbance features. Where the shared workspace is on an NGTL disposition, the recommended CHRP measures will be applied on the entire Project footprint, including the shared workspace on the adjacent disposition. Shared workspace on foreign dispositions will be allowed to naturally regenerate. This area of natural regeneration is not anticipated to affect the probability of achieving CHRP targets, therefore, is not quantified as a residual habitat loss.

Consistent with the method applied to the Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada (Environment Canada 2011, 2012), undisturbed caribou habitat is defined as habitat ~~which~~ that has not burned in the past 40 years, and is not within 500 m of anthropogenic disturbance. Habitat ~~which~~ that has been directly disturbed by fire or anthropogenic features, and habitat within 500 m of anthropogenic disturbances, is considered to be disturbed habitat. Incremental indirect disturbance (**Error! Reference source not found.**) ~~are~~ includes areas within 500 m of the direct project footprint that were undisturbed prior to construction (i.e., outside of 500 m from existing footprint or within an area burned within the last 40 years). Existing footprint ~~are~~ includes all human landscape features (e.g., roads, pipelines and cutblocks) visible on satellite imagery at a 1:50,000 scale.

The direct disturbance footprint of the Project is 121.0 ha (**Error! Reference source not found.**). The area of restored project footprint is 87.8 ha and the area of residual project disturbance is 33.2 ha. Incremental indirect disturbance is 1.3 ha.

Table 6 Quantification of Direct and Indirect Project Disturbance of Caribou Habitat

	Area (ha)			
	Direct Project Disturbance	**Restored Project Footprint**	**Residual Direct Project Disturbance**	**Incremental Indirect Disturbance**
Length of Pipeline Segment	121.0	87.8	33.2	1.3

5.2.1 Duration of Spatial Disturbance

The duration of the spatial disturbance of residual effects resulting from the Project was estimated using available studies and expert opinion (e.g., CLMA and FPAC 2007; ALT 2009). In northeastern Alberta, an area was considered reclaimed for caribou when caribou no longer exhibited reduced use in the area of a land use feature (Athabasca Landscape Team 2009). Caribou in restored habitat are also assumed to experience natural levels of predator encounter rates (Athabasca Landscape Team 2009). Oberg (2001) determined the recovery of conventional seismic lines to functioning caribou habitat in west-central Alberta occurred within 20 years. Golder (2009) determined that recovery of seismic lines to an average height of 2 m through natural regeneration occurred within 20 to 25 years. The duration of residual effects resulting from direct and indirect habitat alteration and loss is expected to be medium-term (i.e., 10 ~~to 30~~ years). Uncertainties regarding the duration of residual effects will be addressed in the OMP.

5.3 ASSESSMENT OF RESIDUAL EFFECTS

Predation by wolves is considered to be the main factor limiting caribou populations (Bergerud 1988, James 1999, James and Stuart-Smith 2000, Seip 1992, Stuart-Smith et al. 1997) and increased predation by wolves and possibly by other predators is facilitated by underlying landscape changes through apparent competition (Holt 1977). Although the proximate cause of caribou decline is predation, the ultimate cause of caribou decline is linked to a change in habitat and linear feature density (Boutin et al. 2012). Although the effect mechanisms are complex, the negative effects of increasing linear feature density includes changes in caribou distribution and movement and an increased vulnerability to predators (Oberg 2001; Dyer et al. 2002; Latham et al. 2011; Whittington et al. 2011).

The Chinchaga caribou population is not self-sustaining (Environment Canada 2012) due to a complex interaction of factors, all of which are ultimately related to changes in caribou habitat. Increases in primary prey and, therefore, wolves have led to otherwise suitable caribou habitat becoming unsuitable due to higher predation pressure.

Offset measures may be warranted to reduce the residual effects of the Project on the Chinchaga caribou range to acceptable levels. The residual effects of the Project quantified in Table 6 may be modified in the calculation of residual effects in the OMP and CHROMMP to factor in the uncertainty associated with the effectiveness of the CHRP measures, as well as the time lag or duration of ~~the~~ residual effect~~s~~. The result is an offset ratio greater than ~~one~~ 1 to ~~one~~ 1.

6 MONITORING AND ADAPTIVE MANAGEMENT

NGTL has created a CHROMMP to monitor the effectiveness of planned habitat restoration measures described in the revised Final CHRP. Adaptive management, i.e., the systematic process of monitoring and assessing outcomes and modifying restoration measures if necessary, will be implemented by adjusting and/or supplementing restoration measures, where warranted, to achieve the objectives of the CHRP. Given that science is still emerging on caribou habitat restoration methods and effectiveness, adaptive management principles will be an important means of addressing uncertainty.

Monitoring will be completed for up to 15 years, beginning in summer Q3 2016. At each monitoring interval (described in section 6.1.1 and 6.1.2), effectiveness measures will be evaluated and compared ~~to~~ with restoration targets. If measures indicate that restoration has achieved or is on a trajectory to achieving targets, then no further mitigation will be completed. However, if measures indicate that targets are unlikely to be achieved after 15 years, ~~then~~ an adjustment to mitigation will be needed and additional monitoring ~~(></~~(longer than 15 years) will be conducted. This could include implementation of ~~an~~ existing mitigation (e.g., ~~those described in s~~see Section 4.2) or ~~a~~ new mitigation that is proving to be successful. For example, NGTL is engaged in linear feature restoration research with the Regional Industry Caribou Collaboration in northeastern Alberta so that lessons learned from this research can be applied to the Project. At ~~year~~ Year 10, if monitoring results suggest that restoration was successful, then NGTL may request from the NEB an exemption from monitoring in ~~year~~ Year 15. In addition, if monitoring results suggest that mitigation measures~~s~~ are meeting their targets, NGTL may request a variance from the NEB to discontinue monitoring at these locations or to conduct less intensive monitoring (e.g., less frequently). Monitoring results, as well as any necessary adaptive management actions, will be reported to the NEB, Environment Canada and AESRD in Q1 following each monitoring interval. Habitat restoration measures that require adaptive management at the conclusion of the 15 year monitoring program will require additional ground-based monitoring until they are successful. If adaptive management actions fail, a revised monitoring program and timeframe will be developed to address unsuccessful measures and their ~~respective~~ locations

The following sections of the CHRP include brief descriptions of the restoration targets and how they will be measured. Specific details on the monitoring program methods, frequency, timing and locations are included in the CHROMMP submitted in 2015. The CHROMMP describes a comprehensive monitoring program for three NGTL pipeline projects (Northwest Mainline, Leismer and Chinchaga) and a designated offset area in northeastern Alberta (~~the~~ Dillon River Wildland Park).

6.1 TARGETS AND PERFORMANCE MEASURES

Monitoring is divided into habitat restoration and access control programs. Habitat restoration monitoring includes measures of vegetation regrowth. Access control monitoring includes measures of human and wildlife use of the restored ROW.

6.1.1 Habitat Restoration Measures and Targets

Habitat restoration monitoring will be completed in the short term~~,~~ at intervals of 1, 3 and 5 years, and in the long term~~,~~ at intervals of 10 and 15 years. It will include both aerial and ground-based sampling protocols. Habitat restoration targets consist of three broad restoration unit types, including treed upland/transitional, treed lowlands and shrub/graminoid lowlands. Within each type, vegetation will be monitored following Alberta Regeneration Standards (AESRD 2013b; ASRD 2000), including monitoring stocking amount (percent), density (stems/ha) and early growth of regenerated trees.

Aerial monitoring consists of collecting 360° geo-referenced photography and high resolution light detection and ranging (LiDAR) imagery. High-resolution 360° geo-referenced photography provides a ~~full~~ complete visual record of the entire ROW and thus will be used to assist in identifying areas that may require restoration adjustment (e.g., lack of vegetation regeneration). In addition, it can be used to verify use of the ROW by motorized vehicles for access control monitoring (see Section 6.1.2). LiDAR imagery provides data on vegetation height, percent ground cover and stem density along the entire ROW that can also be compared ~~to~~ with ground-based monitoring plots. A total of 330 LiDAR sample plots (10 plots/km) will be completed along the ROW.

Ground-based monitoring will be conducted to measure habitat restoration performance and verify aerial monitoring data. It will be conducted at randomly placed sample plots within each restoration unit.

Restoration measures from aerial and ground-based surveys include: vegetation height, stem density (stem/ha), ground cover (%) and sight-line (m). In addition, ground-based monitoring will provide detailed information on species composition and percent cover of trees, palatable and non-palatable shrubs, forbs, grasses, nonvascular plants and non-native, invasive or weed species. Evidence of human and wildlife use of the ROW, soils and line-of-sight measurements using Robel poles will also be recorded.

6.1.2 Access Control and Line-of-Sight

Access control and line-of-sight blocking effectiveness will primarily be monitored using remote, motion-triggered cameras, in addition to aerial and ground-based measures described in

section 6.1.1. Access control and line-of-sight monitoring will be completed every year for up to 15 years, across multiple seasons.

Remote cameras will be deployed at the beginning of Q3 of each monitoring year at randomly selected access control and line-of-sight block locations along the ROW. In addition, cameras will be deployed ~~on~~ in randomly selected locations of the ROW where access control and line-of-sight block measures were not implemented. This will provide a comparison of human and wildlife use between mitigated and unmitigated ROWs (see CHROMMP). Photographs of wildlife will be evaluated by individual species and groups of species, including predators (e.g., wolf, grizzly bear, black bear, cougar, lynx and coyote) and prey (e.g., deer, moose, elk and caribou) to provide count-based statistics.

6.2 ADAPTIVE MANAGEMENT

The adaptive management process has been updated in the revised Final CHRP. It now includes a 15 year monitoring and adaptive management period instead of a 5 year period. It is also has been closely aligned with the CHROMMP.

Adaptive management will be implemented when measures indicate that restoration targets are not being met. Adaptive management actions will address the root cause of lack of performance and will be determined in consultation with regulators and in consideration of caribou recovery guidelines or policies available at that time (i.e., Action Plan and Range Plan). Adaptive management to achieve habitat restoration targets will be completed as recommended by a Registered Forestry Professional. Adaptive management for access control measures and line-of-sight blocking will consist of repair or realignment of mitigation measures as recommended by a reclamation specialist and provincial guidelines. The extent of additional monitoring required for adaptive management actions will be site specific.

Habitat restoration thresholds that will trigger adaptive management actions in upland restoration units include:

- Seedling density (planted seedlings and/or natural regeneration) <1600 stems/ha
- Spatial distribution of seedlings (planted seedlings and/or natural regeneration) <80% of the restoration unit/ha, or
- <80% seedlings (planted seedlings and/or natural regeneration) do not demonstrate sustained growth trends since time of planting (i.e., increasing values for height and percent cover)

Access control thresholds that will trigger adaptive management actions include:

- Evidence of motorized access (removal or destruction of barriers)

- Human use of the ROW is high, or
- Evidence of vegetation disturbance by humans in areas immediately adjacent to access controls

Line-of-sight thresholds that will trigger adaptive management actions include:

- Line-of-sight is >500 m along linear features in upland forested areas
- Physical barriers are not functional or are in poor condition
- Vegetation barriers do not demonstrate sustained growth trends since time of planting, or
- Human use of the ROW is high

7 CONSULTATION

Table 7 provides records of consultation ~~completed~~ for the CHRP, including records of consultation ~~that were conducted~~ for other NGTL projects in caribou range that were relevant to the Project. Consultation for the Project will continue with Environment Canada and AESRD regarding the revised Final CHRP and during implementation of the CHRP, and development of the offset and monitoring plans. The revised Final CHRP ~~will be~~was sent to AESRD and ~~E~~Environment Canada in April 2015 and further consultation ~~will be~~is tracked in Table 7.

In general, consultation with Environment Canada included clarification of if and how habitat disturbance was quantified using the method applied in the Recovery Strategy, consideration of the time lag associated with restoration and addressing a mechanism for demonstrating effectiveness of restoration measures. Feedback from provincial regulators (AESRD) included a request to use an ecosite phase approach to determining restoration treatments, concerns with the retention of woody debris for various reasons (e.g., fire hazard, forest pests and merchantable timber sent to market), as well as recommendations to include woody debris as an important measure for controlling human access on the ROW. AESRD recommended that establishing trees and human access control should be prioritized over predator travel (e.g., line-of-sight and woody debris is ineffective for modifying predator movement/efficiency). Similar to comments from Environment Canada, provincial regulators suggested that, in general, the CHRP successfully identifies many useful tools and locations for restoration activities. Monitoring restoration measures to determine what is working and what requires adaptive mitigation is a key consideration.

Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Federal Agencies			
Environment Canada Department of Fisheries and Oceans Department of Transportation		April 2, 2012 Meeting and teleconference	• Discussion on alignment of environmental assessment with the current recovery strategy for caribou. NGTL committed to prepare CHRP and offset measures plan (OMP) for the Project. • Environment Canada indicated that they would be interested in participating in future discussions relating to how Project effects on caribou will be mitigated, and specifically are interested in reviewing and offering advice on reclamation, restoration, and offsetting plans. Environment Canada is bound to uphold the Federal Caribou Recovery Strategy.
Environment Canada	June Yoo Rifkin Andrew Robinson Paul Gregoire Stephen Virc Victoria Shable Hugo Gherbavaz Francois Blouin-Maurice Melissa Vance Cheryl Ann Johnson	October 9, 2012 Meeting and teleconference	• Discussion on the final federal recovery strategy for boreal caribou, including implications for the Project. NGTL discussed the status of the preliminary CHRP and provided an updated draft to Environment Canada for comment. Environment Canada also requested that NGTL work with them in the development of the OMP.
Environment Canada	Paul Gregoire	January 17, 2013 Conference Call	• Discussion on the CPP, CHRP and OMP. NGTL provided a history of the development of the caribou documents, from pre-construction through operations. The documents will be the toolbox for what will be done. • Preliminary CHRP explains how measures were arrived at and what could be done; Final CHRP allows for evaluation of detailed construction activities and quantification of measureable parameters to refine objectives (i.e., where, what, when, how). • Conduct a preliminary caribou habitat assessment that is robust, defensible and quantitative; Preliminary CHRP will not have the quantitative results, but they will be in the Final CHRP and in a separate report under Condition 7. • Environment Canada informed NGTL of its Conservation Allowances policy; also, that the recovery strategy lays out advice and approach for recovery. Environment Canada ~~EC~~ wants NGTL to focus on critical habitat, and on the guidance from the Province. • Environment Canada~~EC~~ informed NGTL that they are not in a position to decide or inform whether critical habitat is/will be restored/offset. Environment Canada ~~EC~~ cannot support destruction of critical habitat, wants to know what is going on, and wants NGTL to consult with the Province. • NGTL (via Rob Staniland) provided an overview of the OMP, including initial thoughts on calculation of residual effects, measures to reduce residual effects, and ways to gauge effectiveness of mitigation • CHRP will focus on planting and restoration, but also on access and line-of-sight blocking. • NGTL indicated they were expecting feedback on NWML and Leismer from the NEB on the CHRPs for those projects.
Environment Canada	Paul Gregoire	January 23, 2013 Email received	• Environment Canada recommended addressing time delay in context of the ability of restoration to benefit caribou (time sensitive, given current population trends). Given the Threatened status of caribou, greater accountability and due diligence must be reflected accordingly. A mechanism to demonstrate the effectiveness of restoration is warranted. • Comments are addressed in the CHRP. Time to achieve restoration is addressed in Section 5.1. Monitoring and adaptive management (i.e., mechanism to demonstrate effectiveness of restoration) are described in Section 6.0 and will be elaborated on in the ~~Caribou Habitat Restoration and Offset Measures Monitoring Plan~~CHROMMP to be filed with the NEB.
Environment Canada	Paul Gregoire	April 12, 2013 Email sent to EC April 26, 2013 Email sent to EC	• Stantec emailed Mr. Gregoire on April 12 and provided a copy of the draft protocols for the ground based caribou habitat assessment to satisfy Condition 7 of Certificate GC-121. • A follow-up email was sent by Stantec to Mr. Gregoire on April 26 to ask whether Environment Canada would be providing feedback and if a date for this could be anticipated. • No feedback was received
Environment Canada	Paul Gregoire	April 17, 2013 Email sent to EC	• NGTL emailed Mr. Gregoire on April 2 and provided a copy of the draft Preliminary CHRP. • Mr. Gregoire indicated he found the report comprehensive, but wanted to hear from AESRD, especially with respect to Table 4 (Measureable Objective/ Project Implementation).

Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Federal Agencies (cont'd)			
Environment Canada	Paul Gregoire	December 6, 2013 Email sent	• In response to the Draft Final CHRP for the NGTL Northwest Mainline Expansion (NWML) and Leismer to Kettle River Crossover (Leismer) pipeline projects, Environment Canada provided written comments on the definition of critical habitat under the Federal Species at Risk Act and how it is to be defined within a range, and discussed future Project review documentation needs around boreal caribou critical habitat. Environment Canada also outlined mitigation principles and the application of these principals in the hierarchical sequence of Avoidance, Mitigation and Compensation for any residual environmental effects that cannot be avoided or sufficiently minimized and will not result in the destruction of critical habitat and/or jeopardize the survival or recovery of the species. Environment Canada identified that for the Project-specific cases of the NGTL Northwest Mainline Expansion and Leismer to Kettle River Crossover pipeline projects, that the application, approval and construction of the projects occurred during a period of transition between the Draft Recovery Strategy for Boreal Caribou (released August 26, 2011) and the final Recovery Strategy (October 5, 2012). The Draft Recovery Strategy did not identify the Project areas as critical habitat, whereas the Final Recovery Strategy identified the area as likely critical habitat. • Environment Canada reviewed the Draft Final CHRP for NWM L and Leismer and overall agrees with the approaches. Environment Canada notes that NGTL will continue consultations with AESRD on the finer details. The biggest challenge identified by Environment Canada is in the successful timely implementation of restoration and offset measures.
Environment Canada	Paul Gregoire	March 27, 2015 Email sent	• Sent revised Final CHRP for Chinchaga for review and comment.
Environment Canada	Paul Gregoire	April 21, 2015 Email received	• Noted that: – a large portion of the project parallels a large power line ROW, hence making restoration more challenging. – monitoring will be extended to 15 years. – access management will focus on areas where ROW's intersect the project. – Alberta Fish and Wildlife has been consulted – the proponent acknowledges that offsetting will be a ratio greater than 1:1 – the proponent's commitment to adaptive management. – a variety of appropriate methods to be used in restoration, line of sight and access control. • • Noted there is of risk of other projects undoing some of the restoration and recommend that the Province of Alberta track restoration areas and manage future development accordingly (the proponent, if aware, should advise the Province when it is notified of potential conflicts). • Suggests the use of more Alder over willows where appropriate (and other less palatable species). • Suggest that although there is a 15 year timeframe for effectiveness of mitigation, any measures that offer potential benefits in the short term should be vigorously pursued and monitored for efficacy, e.g., access management, some line of sight, as the caribou's predicament is time sensitive. • Overall, agreed with the approach of the report and did not otherwise identify any major concerns.
Provincial Agencies			
AESRD	Don Williams Dave Moyles Norm Van Vliet Gerry Matthews Marcus Ruehl Ryan Minchau	December 8, 2011 Meeting and teleconference	• Discussion regarding use and limitations of rollback for access management.
AESRD	Dave Moyles	June 13, 2012 Telephone	• Discussion between Mr. Moyles (AESRD) and Albert Lees (Stantec) regarding boreal caribou along the Chinchaga section. Mr. Moyles suggested that NGTL seek a coordinated approach to caribou protection planning across projects. • Mr. Moyles also indicated that he could provide telemetry data for the Chinchaga herd.
AESRD	Dave Hervieux	November 16, 2012 Telephone	• A telephone discussion was held between Dana Charlton (NGTL) and Mr. Hervieux on November 16 regarding CHRP and offset measures.

Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Provincial Agencies (cont'd)			
AESRD	Dave Hervieux	December 17, 2012 Phone call	• AESRD expects it will be the owner for the caribou Range Plans, as called for under the Federal Recovery Plan and the Alberta Caribou Policy. The Range Plans will be components of broader Action Plans. Range Plans will focus on habitat; Action Plans will extend from habitat to other elements, such as population management. Range Plans will work to move caribou range from the current state to that which facilitates the persistence of caribou, by means including conservation and phased development. AESRD intends to develop the Range and Action Plans in communication with key industry partners (e.g., industry working groups). • There are several pilot projects underway, or soon to be underway, by oil and gas production companies to do restoration work on linear and polygonal features (i.e., old industrial features that are not their holdings). The objective of the habitat restoration is to establish tree growth of equivalent capacity to adjacent lands. • NGTL is advised to strive to enable regrowth on substantial portions of the Project footprint (length and width) to that equivalent to the adjacent forest. Mr. Hervieux indicated that regrowth of herbaceous and deciduous species is not beneficial for caribou and noted that there should be consideration given to how this would be managed. Mr. Hervieux indicated that he feels that caribou are not forage-limited and there is no science to support line-of-sight measures affecting predator travel. However, line-of-sight breaks and rollback are effective measures to block human access and use, and rollback is helpful for re-vegetation. Overall comments regarding habitat restoration: – Habitat restoration measures are good. – Controlling/blocking human access is valuable. – Line-of-sight breaks can be advantageous to some extent; a good restoration project will, in time, address line-of-sight. – The role of companies is to monitor the success of restoration planting, to assess what worked, what needs to be corrected or done differently. – Even with extensive planting, there would be negative effects on caribou. • Habitat for many years until trees mature.
AESRD	Don Williams	February 25, 2013 Telephone	• Discussion between Jim Cochrane (NGTL) and Mr. Williams regarding use of timber for rollback.
AESRD	Dave Moyles	April 2, 2013 Email sent to AESRD April 15, 2013 Email sent to AESRD April 29, 2013 Email received by NGTL	• Christine Nicholls (NGTL) emailed Mr. Moyles on April 2 and provided a copy of the draft Preliminary CHRP. • Ms. Nicholls followed up on April 15. • Mr. Moyles emailed Ms. Nicholls (NGTL) on April 29 with comments on the preliminary CHRP. Mr. Moyles main concern was the use of natural regeneration on the Project ROW and the lack of access management outlined in the plan. • AESRD advised that on a broad scale, upland forested areas (pine-dominated and mixedwood) that are close to treed muskegs are important habitat. Caribou in the Chinchaga range move into these upland forests particularly during winters of early, deep snow (i.e., snow depths approaching a metre by early December). "Wet" white spruce (AVI classification) is also used by caribou throughout the year. During the rut in fall, caribou in the Chinchaga range frequent open wetlands composed of willows and sedges. The openness of this habitat is ideal for bull caribou "showing off" their attributes. • AESRD expressed concern with natural regeneration of deciduous-dominated vegetation communities and use of willow and poplar cuttings, both of which provide good habitat for moose and deer. AESRD recommended NGTL to consider restoration measures to restore upland areas to conifer-dominated stands by planting conifers. • The staffed access check point on the Chinchaga Trunk Road was not operated during the past winter and AESRD has not been advised of any plans that this check point would be operated in the future. There is relatively heavy traffic along the Chinchaga Trunk Road. The existing gate on the road, previously known as the Wintershal road (east of the Cranberry Section), was put in place after a small group of caribou were shot. The potential for unauthorized traffic to do damage is real. • Comments are addressed in the CHRP. Restoration of both upland and lowland habitats, avoidance of reclaiming habitats to shrub-dominant communities with palatable browse for moose and deer, and encouraging regeneration of conifer stands, where appropriate, were incorporated into the habitat restoration prescription.
AESRD	Dave Hervieux	April 2, 2013 Email sent to AESRD April 15, 2013 Email sent to AESRD	• Ms. Nicholls emailed Mr. Hervieux on April 2 and provided a copy of the draft Preliminary CHRP. • Ms. Nicholls followed up on April 15. • NGTL will continue dialogue to seek input from Mr. Hervieux during the preparation of the ~~F~~Final CHRP.

Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Provincial Agencies (cont'd)			
AESRD	Dave Moyles Don Williams	April 12, 2013 Email sent to AESRD April 26, 2013 Email received by Stantec June 6, 2013 Email sent to AESRD	• Michael Preston (Stantec) emailed Mr. Moyles on April 12 and provided a copy of the draft protocols for the pre-construction caribou habitat assessment to satisfy Condition 7 of Certificate GC-121. • Mr. Moyles emailed Mr. Preston on April 26. His main comments are below: – Mr. Moyles indicated that description of critical attributes of caribou habitat should be expanded based AESRD knowledge of the Chinchaga herd range. A description of habitat types important to caribou was provided based on AESRD knowledge of the range. – Mr. Moyles stated that the construction and operation of the Chinchaga Section would have impacts extending further than 30 m from the ROW and that habitat data could be collected 500 to 1000 m outside the Project footprint. – Mr. Moyles asked if the proposed effort of 60 to 80 survey sites was finalized and if the sites had been chosen. • On June 6 Lisa May (NGTL) emailed a letter from Mr. Preston to Mr. Moyles responding to Mr. Moyles comments of the draft protocols. Mr. Preston's key response points are below: – All of the habitats described by Mr. Moyles would be considered as part of the ecosite identification component of the habitat assessment. Mr. Preston agreed that these habitats are important to caribou, and that they are a component of Table 1 of the federal recovery strategy. – Mr. Preston indicated that an assessment of Project effects had been completed at both local and regional scales and that the pre-construction caribou habitat assessment was designed to help develop the ~~f~~Final CHRP and OMP specific to the ROW. – The final number and location of sites was yet to be determined. Plots would be established in appropriate locations subject to habitat variability and replication.
AESRD	Dave Moyles Don Williams Austin Babb	June 26, 2013 Meeting	• Mr. Moyles confirmed he agreed with the "like for like" restoration approach of planning restoration to match the existing landscape of upland and lowland/wetland vegetation. • Mr. Moyles confirmed he like the mounding approach for line of sight barriers especially in lowland/black spruce areas. • Range plans haven't been started for the Chinchaga Herd. He doesn't want to commit to any "special areas" of concern or priority for Offset Measures because of shifts in behavior that may not be reflected in the development of the plan as well as yearly weather and snow conditions. • Mr. Moyles would like to be consulted and possibly work with TransCanada PipeLines Limited ~~TCPL~~ to explore more site specific locations for Offsets. • Mr. Williams wasn't sure how the Offsets Measures strategy and the existing land disposition system will work together but he would open the conversation when TransCanada PipeLines Limited ~~TCPL~~ has more specific locations in mind.
AESRD	Dave Moyles	June 13, 2013 Phone call	• AESRD requested a coordinated approach to caribou protection planning across NGTL's projects. • NGTL has collaborated with federal and provincial regulators in various jurisdictions, promoted a cooperative group of project and consulting staff to achieve consistency between projects and made an effort to coordinate and combine project meetings with regulators.
AESRD	Dave Moyles	June 21, 2013 Field visit	• Aerial overflight of the NWML Timberwolf and Cranberry Sections to review work completed to date and to discuss potential restoration measures to be implemented. AESRD noted that access is not an issue specifically on the Timberwolf Section and acknowledged the challenges of restoration. Mr. Moyles suggested that different treatments could be applied in an effort to learn what is most effective. • Comments are addressed in the CHRP. The habitat restoration prescription considered locations where access control is a priority. The prescribed measures were developed to include various restoration treatments. Combined with monitoring the implementation of the CHRP is expected to contribute important information regarding effectiveness of habitat restoration in boreal habitats.
AESRD	Dave Moyles	June 26, 2013 Field visit	• AESRD indicated the like-for-like restoration approach is preferred, whereby restoration planning aims to match the existing landscape of upland and lowland/wetland vegetation. Mounding for (access) barriers in lowland/black spruce areas is an accepted approach by AESRD. • AESRD has not yet started Range Plans and cannot commit to any special areas of concern or priority for restoration measures at that time. • Comments are addressed in the CHRP. like-for-like habitat restoration is incorporated into the goals, objectives and restoration prescription

Table 7 Summary of Consultation with Federal and Provincial Authorities

Agency	Name	Date and Method	Details
Provincial Agencies (cont'd)			
AESRD	Dave Moyles, Don Williams, Alan Carson, Austin Babb	August 29, 2013 Conference call	• Project status, objectives and timelines of the NWML CHRP were briefly reviewed. Discussion points focused on the use of woody debris, controlling invasive species and grasses from adjacent rights-of-way, mounding, shrub staking, line-of-sight breaks and revegetation. • Rollback is useful for access control. Forest Officer has seen the log berms on the Cranberry Section; since they are isolated features, they are likely not enough to create a continuous ladder or fire hazard. It is comparable to the brush piles that forest harvest operators leave in cutblocks without issue. Refer to Tim Vinge's work related to mounding densities and rollback. Contact Marty O'Byrne for information on planting densities and target survival. In general, 1,200-1,600 stems/ha is common in forest industry for planting densities, depending on the species and site. Avoid the hinge of the mound pile for planting (variable with site conditions and species). • From wildlife management perspective, recommend that focus should be on avoiding attraction of wildlife to the ~~right-of-way~~ROW. There have been issues with seeded barley along the Chinchaga Trunk Road attracting bears and ungulates. Herbicide application is a viable option to control graminoid species competing with seedlings; to be used with caution and in consideration of sensitivities (proximity to water, etc.). • Ramp-over areas in black spruce lowlands are a good measure. Recommend protecting in winter clean-up and not planting anything to extend them (unlikely success of tree seedlings; do not introduce willow). Natural regeneration as a revegetation method in the lowland areas makes sense. Targeting regeneration of natural vegetation (% cover) as opposed to tree stem density is logical. No noxious weeds is a good target. • Like-for-like restoration is ideal. Where willows are present, willow staking is a viable option. Do not plant willows in areas where they don't currently grow. Willow staking in bio-engineered riparian banks should be done in a manner that will not compromise the effectiveness of erosion control measures (e.g., soil wraps). • Open sight-lines are the nature of the vegetation communities in the lowland areas. Concern with line-of-sight is relevant to the upland forest areas. Access control and line-of-sight measures should be implemented where they make sense; control measures are not warranted where they will be ineffective (e.g., adjacent to roads) for the sole purpose of breaking the line-of-sight every 500 m. • AESRD encourages trying different measures and monitoring to see what is effective. • Comments are incorporated into the goals, objectives, targets, restoration prescription and monitoring plan.
AESRD	Dave Moyles	March 27, 2015 Email sent	• Sent revised Final CHRP for Chinchaga for review and comment. • Email response form Mr. Moyles on April 7, 2015 indicating that the CHRP was received and comments would be provided. • Comments will be incorporated when provided.

~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)~~FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE ~~CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015~~REVISED FINAL CARIBOU HABITAT RESTORATION PLAN FOR THE CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) MAY 2015

Consultation
April 30, 2015

Regards,

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APPENDIX A PRELIMINARY CARIBOU HABITAT RESTORATION PLAN FOR THE NOVA GAS TRANSMISSION LTD. CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION)

APPENDIX B CHINCHAGA LATERAL LOOP NO. 3 (CHINCHAGA SECTION) PROJECT – ENVIRONMENTAL ALIGNMENT SHEETS