Bipole III Transmission Project
Biophysical Monitoring Plan

Pursuant to Bipole III Transmission Project *Environment Act* licence condition #18

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Prepared for:

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ACRONYMS

ATK	Aboriginal Traditional Knowledge
BMP	Biophysical Monitoring Plan
CEC	Clean Environment Commission
CEAA	Canadian Environmental Assessment Act 2012
CMR	Capture-Mark-Recapture
CWD	Chronic Wasting Disease
EIS	Environmental Impact Statement
EPIMS	Environmental Protection Information Management System
EPP	Environmental Protection Program
ESS	Environmentally Sensitive Site
GPS	Global Positioning Unit
GHA	Game Hunting Area
HVdc	High Voltage DC
HR	Home Range
Ha	Hectare
IR	Infrared
LSA	Local Study Area
MBCA	Migratory Birds Convention Act
MBCDC	Manitoba Conservation Data Centre
MCWS	Manitoba Conservation and Water Stewardship

MESEA	Manitoba Endangered Species and Ecosystems Act
MH	Manitoba Hydro
MMF	Manitoba Metis federation
MWQSOG	Manitoba Water Quality Standards, Objectives, and Guidelines
NDVI	Normalized Difference Vegetation Index
ROW	Right-of-way
RSF	Resource Selection Function
SAR	Species at Risk
SARA	Species at Risk Act
SOCC	Species of Conservation Concern
SSEA	Site Selection and Environmental Assessment
TSS	Total Suspended Solids
VEC	Valued Environmental Component
ZOI	Zone of Influence

1.0 INTRODUCTION

1.1 BACKGROUND

Part of Manitoba Hydro's commitment to environmental protection includes the development of a comprehensive Environmental Protection Program (EPP) for the Bipole III Transmission Project (the 'Project').Map 1 illustrates the Project area and its major components. One aspect of this program is monitoring and follow up for biophysical environmental components identified in the Bipole III Transmission Project Environmental Impact Statement (EIS) and technical reports. All construction activities on the Bipole III Transmission Project were completed on July 1st, 2018.

Manitoba Hydro collected vast amounts of baseline data as part of the EIS development, however, as a result of environmental issues raised through regulatory review and the Clean Environment Commission hearings further baseline data was identified. Manitoba Hydro has continued to gather and collect further baseline data for moose, caribou, plant communities of importance to Aboriginal People, as this plan was under development and prior to construction.

This document provides the Biophysical Monitoring Plan (BMP), which outlines the various monitoring activities that will occur during the phases of Project development (i.e., pre-construction, construction and post construction).

The Biophysical Monitoring Plan is intended to describe how and provide assurance to regulators, environmental organizations, Aboriginal communities and the general public that potential environmental effects caused by the Project will be monitored, evaluated and reported on in a responsible and accountable manner.

Manitoba Hydro has accumulated a wealth of knowledge and lessons learned from previous monitoring programs. The successes of those programs have been leveraged in the development of this plan. Previous weaknesses have been adapted and improved upon to further enhance this plan's approach, methods and key environmental monitoring activities.

As this Biophysical Monitoring Plan requires and generates large amounts of data, an Environmental Protection Information Management System (EPIMS) was developed to manage, store and facilitate the transfer of Environmental Protection Program data and information amongst the Project team. EPIMS will facilitate the transferring of knowledge and experiences encountered on a daily basis during construction activities from Environmental Inspectors and Community Monitors to the Specialists that are responsible for monitoring project effects. As well monitoring results and mitigation measure adaptations will be communicated back to construction staff and contractors. EPIMS is an essential tool, that manages vast amounts of data and information that will be generated through the implementation of this plan, allowing for

Manitoba Hydro to adapt from its experiences on this project and apply that knowledge to future developments.

2.0 PURPOSE AND OBJECTIVES

2.1 PURPOSE

The Bipole III Transmission Project Environmental Impact Statement (EIS), Clean Environment Commission recommendations and *Environment Act* Licence conditions identified several key environmental components that require follow-up monitoring. These include:

- Groundwater
- Aquatics
- Soils and Terrain
- Terrestrial Ecosystems and Vegetation
- Reptiles, Amphibians and Invertebrates
- Birds
- Mammals

The purpose of this Biophysical Monitoring Plan is to outline the potential effects as identified in the Bipole III Transmission Project Environmental Impact Statement and the key activities that will be conducted to as part of the monitoring and follow-up component of the Environmental Protection Program. The intended goal of this plan is to provide details on monitoring activities and how monitoring results will be used to trigger actions that lead to adaptive management decisions to further minimize the effects of the Project on the environment.

2.2 OBJECTIVES

The objectives of this monitoring plan are to:

- Confirm the nature and magnitude of predicted environmental effects as stated in the EIS;
- Assess effectiveness of mitigation measures implemented;
- Identify unexpected environmental effects of the project, if they occur;
- Identify mitigation measures to address unanticipated environmental effects, if required;
- Confirm compliance with regulatory requirements including approval terms and conditions; and
- Provide baseline information to evaluate long-term changes or trends.

Manitoba Hydro is committed to developing a Biophysical Monitoring Plan that incorporates input from stakeholders such as government agencies, public, First Nations and Metis. Biophysical monitoring information will be shared for learning and improvement through regular reporting to regulators and community presentations

2.3 SCOPE OF WORK

The scope of this Biophysical Monitoring Plan will include physical and biological components of the environment. Community and Socio-economic components are addressed in the Socio-Economic Monitoring Plan. Monitoring of cultural components can be found in this Biophysical Monitoring Plan, the Socio-Economic Monitoring Plan and the Cultural and Heritage Resource Protection Plan.

2.4 MANAGEMENT AND COORDINATION

Manitoba Hydro has committed dedicated staff for the implementation of this plan, funding of community environmental monitors, along with retaining highly qualified consultant specialists in appropriate disciplines. EPIMS will play a major role in managing field works, data and communications amongst the monitoring team.

2.5 PUBLIC COMMUNICATIONS AND ENGAGEMENT

In addition to extensive public engagement efforts that have occurred to date throughout the development of the Project, Manitoba Hydro welcomes all members of the public to contact the corporation with questions or comments throughout the construction process. Manitoba Hydro's Bipole III Transmission Project website site (http://www.hydro.mb.ca/projects/bipoleIII) will be maintained and updated regularly throughout the project. As noted on the Project website, additional information is always available to the public upon request via a toll-free phone number, dedicated project e-mail address or by mail.

2.6 ABORIGINAL ENGAGEMENT & TRADITIONAL KNOWLEDGE

Manitoba Hydro made commitments in the Environmental Impact Statement (EIS) and during the Clean Environment Commission Hearings to provide updates, encourage ongoing communication with Aboriginal communities and hold discussions regarding culturally appropriate and site-specific mitigation measures that have been identified as concerns with First Nations, NACCs and the Manitoba Metis Federation (MMF). Numerous Environmental Protection Program meetings and workshops have been held over the past few years and more are planned in the future. Meeting notes are compiled, reviewed by Manitoba Hydro and the community and a final version posted on the Manitoba Hydro website.

The goals of these EPP meetings and workshops are to:

- Ensure that there is a consistent approach in the consideration of Aboriginal community concerns in the development of mitigation measures and the identification of sensitive sites;
- Address community concerns and satisfy commitments identified in the EIS and through the Site Selection and Environmental Assessment (SSEA) process;
- Ensure that communities with previously identified concerns have the opportunity to participate in the process and communicate how these concerns are being addressed; and
- Provide communities the opportunity to suggest alternate mitigation measures that Manitoba Hydro may not have previously considered; where Manitoba Hydro is not able to accommodate these alternate suggestions, ensure communities understand why.

Environmental Monitors and Comunity Liasons

Manitoba Hydro also committed to engaging community-based expertise in the construction of the Bipole III Transmission Project. Manitoba Hydro is funding qualified and interested individuals from specific communities to work as Environmental Monitors and Community Liaisons. Environmental Monitors will be provided training by Manitoba Hydro staff and Specialists on environmental inspection and monitoring activities, with a pre-job start training session and on the job training. Community Liaisons will work alongside Manitoba Hydro staff and their contractors with the objectives to keep both the community and Manitoba Hydro informed about the progress and effects of the project while continuing to build a lasting and trusting relationship. Each Community Liaison will communicate project progress to the community and community interests to Manitoba Hydro.

As part of Manitoba Hydro's commitment to conduct cultural effects monitoring for the Project, plant communities of importance to Aboriginal people will be monitored, and access, furbearer and trap line monitoring will occur. Reasoning behind these monitoring components is to help Manitoba Hydro and the local communities better understand the impacts transmission facilities have on blueberries, medicinal plants, access for resource use, furbearer behaviour and trapper success.

3.0 MONITORING REQUIREMENTS

3.1 OVERVIEW

As defined under the *Canadian Environmental Assessment Act* (CEAA), monitoring and follow up is required to verify the accuracy of the environmental assessment of a project and determine the effectiveness of measures taken to mitigate potential adverse environmental effects (CEAA 2011). Through monitoring and follow up, Environmental Impact Statement (EIS) outcomes are realized, communicated to stakeholders and managed through refinement and improvement of mitigation strategies.

The Environmental Protection Program includes two main types of monitoring: environmental monitoring and compliance monitoring.

- Environmental monitoring – periodic or continuous surveillance or testing, according to a predetermined schedule, of one or more environmental indicators to establish/enhance knowledge of baseline conditions or to verify the accuracy of an environmental assessment and the effectiveness of mitigation measures.
- Compliance monitoring – observation or testing conducted to verify whether a practice or procedure meets the applicable requirements prescribed by legislation, licence conditions, and/or Environmental Protection Plans.

This Biophysical Monitoring Plan as well as the Socio-Economic Monitoring Plan addresses the above environmental monitoring component. The Compliance Program involves the use of dedicated Environmental Inspectors and Site Environmental Officers to observe and verify the implementation of the environmental protection plans. Information generated from these programs will be used within an adaptive management approach to improve both mitigation measure effectiveness and monitoring program design.

A number of environmental components were identified in the EIS and technical reports as well and Clean Environment Commission Report, *Environmental Act* Licence and First Nations and Metis engagement activities that require monitoring and follow up. For each environmental component, one or more environmental indicators were selected to focus monitoring and follow up efforts. General information on how these environmental indicators will be measured is covered in Section 4.

Environmental indicators were selected to represent the nine broad environmental components in the table below if the component had one or more of the following attributes:

- Scientific/regulatory importance (rare/endangered or protected status);
- Cultural importance (important to communities or society as a whole);
- Environmental importance; and

- Vulnerable and sensitive to change.

Table 3-1 provides a list of environmental components and their respective environmental indicators/parameters including the rationale for their inclusion in this plan.

Table 3-1 Environmental Components Requiring Follow-up Monitoring

Environmental Component	Environmental Indicator	Parameter	Rationale[1]
Groundwater	Water level and quality (construction camp, converter station)	Water level, water chemistry, petroleum hydrocarbons and other parameters	Environmental importance; public health
Aquatics	Water quality	Total suspended solids and turbidity	Environmental importance; MWQSOGs; protection of aquatic life
	Fish habitat	Riparian buffers, ground cover, erosion	Environmental importance; protection of aquatic life; Regulatory importance
Soils and Terrain	Permafrost	Thermal temperature of surface	Environmental importance;
	Soil productivity	Crop performance	Valued by agricultural producers as a primary source of income
Terrestrial Ecosystems and Vegetation	Wetlands	Areas and locations of wetlands affected by the Project	Environmental importance; protection of aquatic life; no-net loss
	Terrestrial vegetation	Species occurrence	Environmental importance; ecosystem change
	Species of conservation concern	Species occurrence	Regulatory importance - MESEA; SARA; MBCDC
	Native grassland /prairie	Size (area)	Environmentally important; potential to support species of

Table 3-1 Environmental Components Requiring Follow-up Monitoring

Environmental Component	Environmental Indicator	Parameter	Rationale[1]
			conservation concern
	Plants/communities important to Aboriginal people	Species occurrence	Cultural importance
	Invasive and non-native species	Species occurrence	Environmental importance
Reptiles	Northern prairie skink habitat	Skink presence, habitat buffers	Regulatory importance – SARA, MESEA
	Red-sided garter snake dens	Persistence of garter snake dens/hibernacula	Vulnerable and sensitive to change
Birds	Bird wire collision mortality	Abundance/Mortality	Regulatory importance - MBCA; Manitoba *Wildlife Act*
	Active bird nests	Presence	Regulatory importance – MBCA
	Colonial bird nesting sites	Colonial bird abundance, disturbance	Regulatory importance - Manitoba *Wildlife Act*
	Sharp-tailed grouse Leks	Lek abundance, disturbance, mortality	Vulnerable and sensitive to change
	Bird species of conservation concern	Presence/Absence Abundance	Regulatory importance - MESEA; SARA; MB CDC
	Birds of prey	Habitat use, mortality	Environmental importance
Mammals	Moose	Habitat use, population, distribution, mortality	Environmental and social importance
	Caribou	Habitat use, population, distribution, mortality, recruitment, movement	Regulatory importance – SARA,MESEA
	Deer	Project related changes in distribution and/or *P. tenuis* presence	Environmental importance
	Elk	Distribution, mortality and occurance	Environmental and social importance

Table 3-1 Environmental Components Requiring Follow-up Monitoring

Environmental Component	Environmental Indicator	Parameter	Rationale[1]
		proximate to RoW	
	Grey Wolf	Presence/absence (project-related change in occurrence and distribution) relative to ~~o~~ ROW~~,~~ caribou/moose mortalities	Environmental importance; interaction with Boreal Woodland Caribou
	Black Bear	Presence/absence (project-related change in occurrence/distribution) relative to ROW, caribou/moose mortalities	Environmental importance; interaction with Boreal Woodland Caribou
	Furbearers	Species availability, project-related changes in trapping harvest by registered trapline and construction segment	Environmental and social importance
Access	Humans	Presence and magnitude of use of ROW by humans	Environmental, cultural and societal importance

[1] Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG); *Manitoba Endangered Species and Ecosystems Act* (MESEA); *Species at Risk Act* (SARA); Manitoba Conservation Data Centre (MBCDC); *Migratory Bird Convention Act* (MBCA)

4.0 ENVIRONMENTAL COMPONENT MONITORING

This section describes the environmental components and indicators that will be monitored, including: key monitoring activities, task descriptions, duration, frequency and timing of activities, Environmental Monitor input, Manitoba Hydro commitments and specialist and Manitoba Conservation and Water Stewardship (MCWS) roles. Manitoba Hydro has developed the plan to address concerns expressed by stakeholders, local communities, First Nations and Metis, regulators and the Clean Environment Commission.

Where applicable, Decision Trigger(s)/Threshold(s) for Action have been identified for each environmental component. These decision triggers or thresholds dadfor action are mechanisms to promote adaptive management that cause Manitoba Hydro and its Specialists to stop and further evaluate the monitoring results and, if required, adapt mitigation measures or monitoring activities. Decisions triggers/thresholds cannot be identified for all situations, there are too many parameters and variables and scientific research required. Species and population responses to disturbance are also variable as a function of habitat configuration and species distribution. It is for these reasons why many government agencies, including Manitoba, have not yet published definitive thresholds for action for different wildlife management scenarios. The development of mitigative actions in response to decision triggers and thresholds being met, will be done in conjunction with MCWS, as some of those actions are not something Manitoba Hydro has the authority or ability to enact. Development of adaptive monitoring activities as they are created will be done in consultation with MCWS.

Sustainability indicators and thresholds for applicable environmental components will be informed by the ongoing Regional Cumulative Effects Assessment process currently underway jointly between Manitoba Hydro and Manitoba Conservation and Water Stewardship as per Clean Environmental Commission recommendation 13.2.

4.1 GROUNDWATER

To ensure potable water is being provided at the construction camp and Converter Station, regular potability testing will be undertaken with results compared to the most current Canadian Guidelines for Drinking Water Quality. Long term monitoring of water quality and quantity will ensure any changes at the camp that may be related to the influence of Nelson River water be addressed by the water treatment process.

Water quality will be monitored to address possible changes to aquifer water quality and possible surface water intrusion from the Nelson River to the aquifer during long term (e.g., multi-year) pumping in the water treatment process stream; particularly during high river staging (e.g., winter ice staging) events.

Objective(s):

- *The objective is to monitor wells and water treatment facilities for potable drinking water quality standards*

Applicable Project Component(s): *Keewatinohk Converter Station and Camp*

Monitoring Activities

Table 4-1 Groundwater

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Aquifer water quality and quantity at construction camp and converter station	Construction /Post construction	Drinking Water Analysis	Water level, water chemistry, petroleum hydrocarbons and other parameters	Construction camp and Converter Station	Duration of camp	6 months, Every 2 weeks	Year-round	Ammonia, Total organic Carbon, Coliform, Ecoli

Methods and Reporting

Manitoba Hydro is committed to:

- *Collect water samples and submit to accredited lab for water quality analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Water samples that are not within acceptable Drinking Water Quality Guidelines.*

4.2 AQUATICS

4.2.1 Water Quality

Construction at and adjacent to water courses has the potential to affect water quality by increasing total suspended solids (TSS) as a result of erosion and sedimentation. Stream crossing best management practices have been developed both provincially and federally and adherence to these guidelines minimizes or eliminates the potential for effects to surface water quality from overhead lines, temporary crossings or works adjacent to water courses. Where works include instream construction under wetted conditions and/or post rainfall events during spring earthworks prior to revegetation the potential for effects to surface water quality occur.

The construction of the northern ground electrode and the Keewatinohk Converter Station will require construction activities within watercourses. Construction of the northern ground electrode will require excavation of a trench through and a small unnamed tributary to place the ground electrode ring beneath the stream. Development of the Keewatinohk Converter Station will require infilling of a section of a small unnamed stream. Both activities have the potential to result in increased TSS and where construction occurs under wetted conditions and/or post rainfall events during spring earthworks prior to revegetation monitoring of TSS will be undertaken.

Objective(s):

- The objective is to monitor TSS levels and provide feedback to construction staff facilitating adaptive management to maintain TSS as close to background as possible.

Applicable Project Component(s): *Keewatinohk Converter Station Area, Northern Ground Electrode.*

Monitoring Activities

Table 4-2 Water Quality

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Water quality (TSS) at affected streams	Construction phase	Upstream/Downstream water quality monitoring.	TSS and Turbidity	Aquatics ESS	During instream construction and Spring Run-off	Hourly during construction/ Daily following rain events in spring	During instream construction/post rain events in spring	TSS and Turbidity

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of mitigation performance at ESS sites within project footprint or access routes.*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Design and conduct specific survey methods that sample water quality at sites where instream works are planned;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on water quality discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *The short-term guideline for the protection of aquatic life for TSS is 25 mg/L or 10% above background (MWQSOG 2011).*

4.2.2 Fish Habitat

The Project will require overhead line crossings of 360 water courses. The right-of-way of the overhead lines is adjacent to the riparian areas of an additional 58 water courses. In addition to these crossings, construction access routes will require 125 stream crossings. Other project components not requiring stream crossings lie within close proximity to watercourses including the Keewatinohk Converter Station adjacent to Goose Creek and a number of borrow sites in proximity to watercourses.

A potential effect of the Project to fish habitat is the loss of riparian vegetation (vegetation along the water's edge) during construction. Riparian vegetation functions as fish habitat by providing bank stability, food and nutrient inputs (e.g., leaf litter and insect drop), and shading. The loss of riparian vegetation can result in increased sediment in water due to decreased bank stability, increased water temperature and decreased cover for fish. Increased suspended sediments can decrease light penetration resulting in decreased photosynthesis. Sedimentation of streams can bury or create unsuitable habitats for aquatic invertebrates that are eaten by fish, infill spawning habitats and reduce the spawning and feeding success of fish.

Post-construction monitoring at stream crossings and encroachment areas (borrow areas and Keewatinohk Converter Station) will be conducted to ensure that the prescribed riparian buffers have been established and that crossing sites have been adequately rehabilitated where required.

Objective(s):

- *To verify the implementation and effectiveness of mitigation prescribed for areas adjacent to watercourses including: riparian buffers, erosion control, and temporary stream crossings.*

Applicable Project Component(s): *Keewatinohk Converter Station Area, N1, N2, N3, N4, C1, C2, S1, S2, AC Collectors and Construction Power*

Monitoring Activities

Table 4-3 Fish Habitat

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Stream crossing assessment	Post construction	Stream Crossing Survey	Riparian buffers, ground cover, erosion	Aquatics ESS	2018,2019	Annual	Spring or Summer	Riparian buffer width (m), Vegetative cover (% cover : % bare ground), Bank stability and erosion (%), Re-vegetation where soil was disturbed (% ground cover : % bare ground)
Waterbody encroachments	Post construction	Riparian Buffer Survey	Riparian buffer, ground cover	Aquatics ESS outside ROW and near Keewatinohk and borrow pits	2018,2019	Annual	Spring or Summer	Riparian buffer width (m), Vegetative cover (% cover : % bare ground), Re-vegetation where soil was disturbed (% ground cover : % bare ground)

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*

- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Report immediately to MCWS any unanticipated project effects on stream crossing and encroachment areas discovered through monitoring activities and consult on any remediation plans; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of mitigation performance at ESS sites within project footprint or access routes.*
- *Record observations with photo and waypoint and store in EPIMS*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of stream crossing and encroachment areas requiring site survey and assessment of ROW effects;*
- *Review Environmental Inspector and Monitor daily reports for the performance and implementation of prescribed mitigation measures at each stream crossing site and encroachment area;*
- *Design and conduct specific survey methods that sample aquatics ESS sites and at sites where documentation by environmental inspectors is insufficient or site conditions warrant follow-up to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on stream crossing and encroachment areas discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Bank stability and erosion – equal to pre-construction stability, if not equal prescribe site specific rehabilitation measures as required.*

4.3 SOILS AND TERRAIN

4.3.1 Permafrost

Permafrost Degradation

Permafrost degradation refers to decreases in the lateral/areal or vertical extent (depth) of permafrost soils. Activities that compact or remove the seasonally-thawed active soil layer (i.e., the soil that insulates the underlying permafrost) such as moving vehicles and equipment and clearing or removing vegetation can result in a loss of permafrost. Other activities, such as concentrating natural drainage, can also contribute to a loss of permafrost. Areas of continuous, discontinuous and isolated patches of permafrost are susceptible to degradation. Indirect effects of permafrost degradation and loss include adverse effects to infrastructure engineering, alteration to drainage patterns and increases in greenhouse gas releases to the atmosphere.

Objective(s): *The objective of the permafrost monitoring program is to monitor areas of increased risk of rapid permafrost degradation to determine the effects of project construction on permafrost degradation.*

Applicable Project Component(s): *N1, N2, N3, AC Collectors and Construction Power Line*

Monitoring Activities

Table 4-4 Permafrost

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Permafrost thaw	Construction phase	Monitoring ROW for increased risk of rapid permafrost melt	Thermal temperature of surface form Landsat-8 TIRS (Thermal Infrared Sensor)	Applicable Project Component Footprint	2016,2017,2018	Semi-monthly	Spring to Fall	ROW surface temperature

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of ROW areas of increased risk to rapid permafrost melt requiring assessment of ROW effects;*
- *Acquire Landsat-8 imagery and compute ROW Normalized Difference Vegetation Index (NDVI) analysis for the ROW and buffer area to be used as the undisturbed control area;*
- *Review Environmental Inspector and Monitor daily reports for the performance and implementation of prescribed mitigation measures;*
- *Design and conduct specific survey methods that sample permafrost at sites where documentation by environmental inspectors is insufficient or site conditions warrant follow-up to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on permafrost discovered through monitoring activities;*

- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Excessive water pooling along ROW as a result of melt*
- *Differentiation of ROW surface temperatures compared to surrounding area that may indicate rapid melt of permafrost*

4.3.2 Soil Productivity

In Agro-Manitoba, primarily in the southern portion of the Local Study Area, the productivity of soils for arable agriculture is valued by agricultural producers as a primary source of income. Agricultural production is also of general benefit to society.

Soil productivity, as quantified by the agricultural capability of soils in rural Manitoba, could be affected primarily due to the use of heavy equipment and vehicles, disturbance of surface materials during grading, excavation of foundations, and removal of vegetation. Construction activities may adversely affect soil capability and productivity through physical, chemical and biological impacts to the soil. These direct effects on soil properties are typically manifested in and can be assessed using vegetation productivity. Therefore, vegetation and agricultural crop performance can often be used as an effective proxy for soil productivity. Therefore, these vegetative indicators can be used as an effective screening tool to assess the effectiveness of prescribed mitigation in the maintenance and reclamation of soil productivity following construction activities.

Objective(s): *The objective of the monitoring program is to monitor crop performance as a key indicator of soil productivity for a period of two years following construction in agricultural portions of the project rights-of-way.*

Applicable Project Component(s): *N4, C1, C2, S1, S2*

Monitoring Activities:

Table 4-5 Soil Productivity

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Soil productivity	Pre-construction phase	Map crop productivity along ROW, access roads, and other temporary project footprints , plus a non-disturbed buffer area	Crop performance	Portions of project footprints of sections N4, C1, C2, S1 and S2 within areas of agricultural land use	One-time	Semi-annually	Summer	NDVI (Tier 1 and Tier 2)
	Construction phase	Map crop productivity along ROW, access roads, and other temporary project footprints, plus a non-disturbed buffer area	Crop performance	Portions of project footprints of sections N4, C1, C2, S1 and S2 within areas of agricultural land use	2016,2017	Semi-annually	Summer	NDVI (Tier 1 and Tier 2)
	Post-construction phase	Map crop productivity along ROW, access roads, and other temporary project footprints, plus a non-disturbed buffer area	Crop performance	Portions of project footprints of sections N4, C1, C2, S1 and S2 within areas of agricultural land use	2018,2019, 2020,2021 or until suitable knowledge acquired	Semi-annually	Summer	NDVI (Tier 1 and 2) Field assessments TBD (Tier 3)

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*

- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of compaction and/or rutting within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential soil productivity sampling sites and assessment of ROW effects;*
- *Acquire Landsat-8 imagery and compute NDVI analysis for the ROW and buffer area to be used as the undisturbed control area;*
- *Acquire Worlview-2 imagery and compute NDVI for select areas of the ROW and buffer;*
- *Review Environmental Inspector and Monitor daily reports for identification of potential sampling sites;*
- *Design and conduct specific survey methods that sample soil productivity through crop performance to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on soil productivity discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis (specific farm production infomation will not be shared); and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Crop Performance values on ROW are significantly below surrounding crop*

4.4 TERRESTRIAL ECOSYSTEMS AND VEGETATION

4.4.1 Wetlands

Bog, fen and marsh wetlands were identified along the transmission line right-of-way and cover approximately 1,456 hectares (ha). Only bog and fen wetlands were identified for other Project components. Main effects include the potential disruption, alteration or loss of wetlands from Project activities for the transmission line right-of-way and other project components. Project activities may also affect species of concern that may be present in these areas, cause soil compaction or change water flow which may affect plant populations.

Environmentally sensitive areas identified along the transmission line right-of-way include patterned fen wetlands. Approximately 535 ha of patterned fen wetlands occur within the transmission line right-of-way. Main effects to these environmentally sensitive sites include potential site disturbance or loss of plants from construction, maintenance and decommissioning activities.

Objective(s):

- *Document the composition and abundance of wetland vegetation at selected sites; and*
- *Verify the implementation and effectiveness of wetland protection measures.*

Applicable Project Component(s): ***N1,N2,*** *N3, N4,C1,C2*

Monitoring Activities:

Table 4-6 Wetlands

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Vegetation ground surveys	Construction	Ground surveys to identify wetland changes not discernible from habitat mapping and to monitor wetland protection measures	Areas and locations of wetlands affected by the Project	Applicable Project Component Footprint and wetland ESS	During construction	Annual	Summer	Area affected (ha); species composition and abundance
	Post-construction	Ground surveys to identify wetland changes not discernible from habitat mapping	Areas and locations of wetlands affected by the Project	Applicable Project Component Footprint and wetland ESS	2018,2019	Annual	Summer	Area affected (ha); species composition and abundance

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Map cleared project footprint;*

- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of mitigation performance at Environmentally Sensitive Sites (ESS) within project footprint or access routes.*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential wetland sampling sites and assessment of ROW effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of potential wetland sampling sites;*
- *Design and conduct specific survey methods that sample vegetation composition and abundance to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on wetlands discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis o; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Actual disturbance footprint will be compared to the expected disturbance footprint*

4.4.2 Terrestrial Vegetation

The Bipole III Transmission Project will result in the loss of native forest vegetation during clearing and construction activities. It is estimated that 3,355 ha of upland forest vegetation will be affected by the clearing of the 500 kV transmission line right-of-way. Removal and long-term loss of forest cover as a result of right of way clearing as well as potential damage to adjacent forest vegetation during clearing and construction has been identified as an effect of transmission line development.

Many environment effect predictions incorporate effects on the terrestrial vegetation. For these reasons, terrestrial vegetation monitoring provides an effective means for identifying anticipated and unexpected effects on the terrestrial environment.

Objectives

- *Document the composition and abundance of vegetation;*
- *Confirm actual Project effects on vegetation; and*
- *Verify the implementation and effectiveness of protection measures.*

Applicable Project Component(s): *N1,N2,N3,N4,C1,C2 and AC Collectors and Construction Power.*

Monitoring Activities:

Table 4-7 Terrestrial Vegetation

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Terrestrial vegetation surveys	Construction	Ground surveys to identify terrestrial changes not discernible from habitat mapping and to monitor protection measures	Species occurrence	Project Footprint	During construction	Annual	Summer	Species composition and abundance
	Post-construction	Ground surveys to identify terrestrial changes not discernible from habitat mapping	Species occurrence	Project Footprint	2018,2019	Annual	Summer	Species composition and abundance

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential terrestrial vegetation sampling sites and assessment of ROW effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of potential terrestrial vegetation sampling sites;*
- *Design and conduct specific survey methods that sample vegetation composition and abundance to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on terrestrial vegetation discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis*.

Decision Trigger(s)/Threshold(s) for Action

- *Actual disturbance footprint will be compared to the expected disturbance footprint*

4.4.3 Species of Conservation Concern

Species of conservation concern include species of plants that are protected under *The Endangered Species Act* (Manitoba), the federal *Species at Risk Act* or are listed by the Manitoba Conservation Data Centre (MBCDC). These species generally exist in low numbers, play a role in helping to preserve species diversity (e.g., songbirds, invertebrates), and/or have limited distributions.

Fifteen locations for plant species of conservation concern were previously known to occur along the transmission right-of-way and project components (MBCDC records). Field assessments in 2010 identified species of concern along the transmission line right-of-way local study area (26 locations) and project components (three locations). In 2012, pre-construction botanical surveys conducted for the northern project components identified 42 locations for species of concern.

Construction activities that can negatively affect plant species of conservation concern include the use of heavy equipment (crushing plants) and clearing and grubbing (removal of roots) of vegetation. Another potential effect is herbicide use (during maintenance activities) which not only inhibits the growth of undesirable species, but can also negatively affect desirable species.

Objective(s):

- *Document species of conservation concern during pre-construction;*
- *Document presence of species of conservation concern during construction; and*
- *Verify the implementation and effectiveness of protection measures.*

Applicable Project Component(s): *All components.*

Monitoring Activities:

Table 4-8 Species of Conservation Concern

Key Monitoring Activity	Phase	Task Description	Parameter	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Rare plant surveys	Pre-construction	Ground surveys in areas that may support plant species of conservation concern	Species occurrence	Various sites within Project footprint	One-time	Once	Summer	Presence/absence
	Construction/Post Construction	Ground surveys to identify changes not discernible from habitat mapping and to monitor protection measures	Species occurrence	ESS sites	During construction and 2018	Annual	Summer	Presence/absence

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of rare plants and mitigation performance at ESS sites within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential rare plant habitat sampling sites and assessment of ROW effects;*
- *Conduct pre-clearing rare plant surveys for project components not previously surveyed;*
- *Review Environmental Inspector and Monitor daily reports for identification of potential rare plant sampling sites;*
- *Design and conduct specific survey methods that sample known rare plant sites for presence/absence to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on rare plants discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of species of concern to inform ongoing analyses related to biophysical monitoring (e.g. population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Species of Conservation concern no longer within ESS*

4.4.4 Native Grassland/Prairie

There is potential for native grassland/prairie areas located in the southern portion of the Project within the HVdc transmission line right-of-way to be disrupted by construction activities (e.g. heavy equipment use and grubbing activities).

Approximately 755 ha of the grassland cover type (considered agricultural pastureland) has the potential to be affected by construction activities, while less than 10 ha of dry upland prairie, which are part of grasslands and have been identified as environmentally sensitive sites may be affected. Another potential effect of the loss of native grassland/prairie areas is the loss of species of conservation concern, such as those listed by SARA, MBESA, or the MBCDC as very rare to uncommon within the HVdc transmission line right-of-way.

Sparse treed areas, that in some locations span the entire width of the HVdc transmission line right-of-way, were found in dry upland prairie areas during field assessments. Construction activities can result in the clearing of these treed areas. Native grasslands may also potentially be disrupted during HVdc maintenance activities within the transmission line right-of-way, if any rehabilitation is required within these areas native seed will be utilized.

Objective(s):

- *Document the composition and abundance of vegetation;*
- *Confirm actual Project effects on vegetation; and*
- *Verify the implementation and effectiveness of protection measures.*

Applicable Project Component(s): *C1, C2 and S1*

Monitoring Activities

Table 4-9 Native Grassland/Prairie

Key Monitoring Activity	Phase	Task Description	Parameter	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Native grassland/prairie monitoring	Pre-construction	Ground surveys to collect baseline data	NA	Prairie ESS	One-time	Once	Summer	Species composition and abundance
	Construction /Post-construction	Ground surveys to identify changes not discernible from habitat mapping and to monitor protection measures	Prairie area change	Prairie ESS	During construction and 2018,2019,2020	Annual	Summer	Area affected (ha); species composition and abundance

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of mitigation performance at ESS sites within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential native grassland/prairie sampling sites and assessment of ROW effects;*
- *Conduct pre-clearing vegetation surveys for baseline composition, abundance and structure within native grassland/prairie;*
- *Review Environmental Inspector and Monitor daily reports for identification of potential native grassland/prairie sampling sites;*
- *Design and conduct specific survey methods that sample known native grassland/prairie sites for composition and abundance to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on native grassland/prairie discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Area of native grassland/prairie disturbed is greater than 10ha as predicted in EIS*

4.4.5 Plants/Communities Important to Aboriginal People

A number of plants and plant communities have been identified as being particularly important to Aboriginal people (e.g., Assiniboine River, blueberry sites near Cowan). These areas are valued for their provision of resources used by Aboriginals including gathering of food and medicines and harvesting plants and trees.

Clearing and construction of transmission line rights-of-way as well as the creation of new access roads/trails for the Project can allow increased access by non-community members to sensitive areas that have been identified by local Aboriginal communities and can result in the potential loss of important vegetation resources found at these sites.

Although non-Aboriginal people also have long-established traditional uses related to botanical resources, several locations along the preferred route have been identified that support plants that are used by Aboriginal people, including areas for berry picking, medicine gathering, and harvesting plants and trees for cultural purposes. The harvesting and profiting from non-timber resources by non-community members is a concern for Aboriginal people. Add blueberry reference to cultural effects

Objective(s):

- *Document the composition and abundance of vegetation;*
- *Confirm actual Project effects on vegetation; and*
- *Verify the implementation and effectiveness of protection measures.*

Applicable Project Component(s): *N4,C1 and S1*

Monitoring Activities:

Table 4-10 Plants/Communities Important to Aboriginal People

Key Monitoring Activity	Phase	Task Description	Parameter	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Monitoring plant communities important to Aboriginal peoples	Pre-construction	Ground surveys to collect baseline data	NA	Vegetation ESS	One -time	Once	Summer	Species composition and abundance
	Construction	Ground surveys to identify changes not discernible from habitat mapping and to monitor protection measures	Species occurrence	Vegetation ESS	During construction	Annual	Summer	Species composition and abundance
	Post-construction	Ground surveys to identify changes not discernible from habitat mapping	Species occurrence	Vegetation ESS	2018,2019	Annual	Summer	Species composition and abundance

Methods and Reporting

Manitoba Hydro will:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*

- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of plant communities important to Aboriginal communities and mitigation performance at ESS sites within project footprint or access routes.*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of sampling sites for plant communities important to Aboriginal People and assessment of ROW effects;*
- *Conduct pre-clearing vegetation surveys for baseline composition, abundance and structure within plant communities important to Aboriginal People;*
- *Review Environmental Inspector and Monitor daily reports for identification of potential plant communities important to Aboriginal People sampling sites;*
- *Design and conduct specific survey methods that sample known plant communities important to Aboriginal People for composition and abundance to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on plant communities important to Aboriginal People discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Aboriginal Communities will be asked to:

- *Provide historical and current data of plant communities important to Aboriginal communities to inform ongoing analyses related to biophysical monitoring; and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Measurable significant decrease of plant abundance within ESS*

4.4.6 Invasive and Non-Native Species

The abundance of non-native or invasive plant species may increase as a result of the Project. Non-native species are plants that grow outside of their normal range while invasive species are plants that out-compete native species when introduced outside of their natural setting.

Construction equipment and vehicles can introduce non-native plants such as purple loosestrife, which is an aggressive herbaceous wetland perennial. During the field assessments in 2010, 27 non-native species were observed throughout the Project Study Area; five of these were invasive plants.

Non-native species are problematic for one or a number of the following reasons: introduced plants are capable of growing under a wide range of climatic and soil conditions; they produce abundant seeds that are easily disseminated, long lived and can remain dormant through the winter season; they can continue to persist even after the removal of vegetative portions of the plant; and they often have vigorous growth, produce seeds under conditions adverse for other plants, and can therefore outcompete native species.

Objectives

- *Document the composition and abundance of vegetation at pre-determined sites;*
- *Document the degree of non-native and invasive plant introduction and spread; and*
- *Recommend appropriate control and eradication programs, if there is introduction and/or spread.*

Applicable Project Component(s): All Components

Monitoring Activities:

Table 4-11 Invasive and Non-Native Species

Key Monitoring Activity	Phase	Task Description	Parameter	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Invasive and non-native species monitoring	Construction	Ground surveys to identify changes not discernible from habitat mapping and to monitor protection measures	Species occurrence	Project footprint	During construction	Annual	Summer	Species composition and abundance
	Post-construction	Ground surveys to identify changes not discernible from habitat mapping	Species occurrence	Project footprint	2018,2019	Annual	Summer	Species composition and abundance

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of invasive plants within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Create a Rehabilitation and Vegetation Management Plan;*
- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of invasive and non-native species sampling sites and assessment of ROW effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of potential invasive and non-native species sampling sites;*
- *Design and conduct specific survey methods that sample invasive and non-native species sites for composition and abundance to verify accuracy of EIS predictions and effectiveness of mitigation and control measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on invasive and non-native species discovered through monitoring activities;*
- *Prescribe vegetation management options for invasive species control where required;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Establishment and spread of invasive species along ROW.*

4.4.7 Rehabilitation

Rehabilitation mitigates adverse Project effects, controls erosion, controls invasive plant spread, restores wildlife habitat and improves aesthetics. Terrestrial habitat will be rehabilitated in areas not required for Project operation and some areas that are required for Project operation. Monitoring is required to verify the implementation and effectiveness of rehabilitation measures, the locations and nature of which are presently unknown, but may include staging areas, construction camps and borrow sites.

Objectives

- *Verify the implementation and effectiveness of rehabilitation efforts guided by the Vegetation Management and Rehabilitation Plan; and*
- *Confirm initial revegetation efforts are adequate.*

Project Component: *All components.*

Monitoring Activities:

Table 4-12 Rehabilitation

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Rehabilitation	Post-construction	Ground surveys will be used to identify the degree of implementation and the effectiveness of rehabilitation efforts	Areas affected by the Project requiring rehabilitation	Rehabilitation Area	2018,2019	Annual	Summer	Area (ha) meeting rehabilitation targets

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *Work with Specialist during field visits to assess rehabilitation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Create a Rehabilitation and Vegetation Management Plan;*
- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential rehabilitation sites and assessment of ROW effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of potential rehabilitation sites;*
- *Design and conduct specific survey methods that sample rehabilitation sites to verify rehabilitation targets;*
- *Report immediately to Manitoba Hydro any areas requiring rehabilitation or areas not meeting rehabilitation targets discovered through monitoring activities;*

- *Analyze, evaluate and report on monitoring findings including rehabilitation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the rehabilitation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Area prescribed rehabilitation not meeting site specific rehabilitation targets*

4.5 REPTILES

4.5.1 Northern Prairie Skink

The northern prairie skink (*Plestiodon septentrionalis)* is listed as endangered under the federal *Species at Risk Act* and the *Manitoba Endangered Species and Ecosystems Act.* The known distribution of the northern prairie skink lies in close proximity to but does not overlap the Project Footprint. Suitable habitat for the species occurs within and adjacent to the Project Footprint but skinks were not observed during environmental assessment studies.

The northern prairie skink inhabits mixed-grassed prairies associated with sandy soils. The alteration or loss of this uncommon habitat type may cause changes in the distribution, movement and overall abundance of the species. Re-growth of vegetation following disturbance may increase encroachment of invasive plant species such as leafy spurge, a plant known for invading ridges of suitable skink habitat and displacing individuals (COSEWIC 2004).

Pre-construction skink monitoring will be conducted to identify sensitive habitats, species presence and nest burrows with appropriate mitigation measures (i.e., setbacks) recommended. Follow-up monitoring will be conducted to document compliance with prescribed setbacks and the effectiveness of mitigation. Suitable skink habitat, within 200m of tower placement sites will be surveyed for skinks by placing 30X60cm plywood coverboards within suitable habitats at a density of approximately 1 coverboard/100 square metres. Coverboards will be examined weekly during peak breeding activity in the spring and/or during possible juvenile movements and summering peak activity in August. Where skinks are observed, alternate tower placement adjustments will be recommended so as to best preserve individuals and important habitat.

Objective(s):

- *To identify the presence of skinks and sensitive habitats located near proposed infrastructure and determine appropriate mitigation measures to minimize or avoid disturbance; and*
- *To verify the implementation and effectiveness of prescribed mitigation.*

Applicable Project Component: S1

Monitoring Activities:

Table 4-13 Northern Prairie Skink

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Northern prairie skink	Pre-construction phase	Reptile ESS Validation and Survey	Skink and skink burrow presence	Suitable skink habitat within 200 m of proposed infrastructure locations.	One -time	Once	Spring/Summer	Presence/absence of skinks
	Post-construction	Compliance and mitigation effectiveness monitoring	Habitat buffers Setbacks from burrows	Skink ESS	Not required as no ESS developed	Annual	Spring/Summer	Setback distance (m) Presence/absence of skink where observed

Methods and Reporting:

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*

- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of northern prairie skink and mitigation performance at ESS sites within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of northern prairie skink sampling sites and assessment of ROW effects;*
- *Conduct pre-construction surveys during peak breeding activity in spring and/or possible juvenile movements and summering peak activity in August, to identify important skink habitats, including nests;*
- *Based on pre-construction survey results, provide recommendations for tower placement adjustments and/or mitigation measures to limit or avoid disturbance to skinks;*
- *Review Environmental Inspector and Monitor daily reports for identification of northern prairie skink sampling sites;*
- *Design and conduct specific survey methods that sample northern prairie skink presence/absence to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on northern prairie skink discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of northern prairie skink populations to inform ongoing analyses related to biophysical monitoring (e.g. observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Pre-construction presence of skinks and burrows near proposed infrastructure*
- *Tower foundation siting within minimum 200 m of skink habitat*

4.5.2 Red-sided Garter Snake

Potential habitat for the red-sided garter snake (*Thamnophis sirtalis parietalis)* occurs within and adjacent to the Project Footprint. The red-sided garter snake overwinters in hibernacula or dens which are located in specific substrates, including limestone bedrock. Hibernacula that overlap with proposed infrastructure, such as transmission line towers could be disturbed or permanently destroyed.

Project-related effects to the red-sided garter snake (hibernacula), are limited to the Project right-of-way, as suitable habitat was not identified near electrode sites or converter stations. Right-of-way construction and transmission line tower installation at or near suitable garter snake habitat may negatively impact garter snake populations.

During operation, buffers associated with vegetation maintenance can protect garter snakes from sensory disturbance and physical harm caused by traffic and machinery-related activity, protect hibernacula and maintain the integrity of surrounding habitat. In general, clearing of the right-of-way may be beneficial for garter snake populations during migrations and movement between feeding and hibernation sites.

Pre-construction monitoring will be conducted to identify snake hibernacula near proposed infrastructure and appropriate mitigation measures (i.e., setbacks) to reduce or avoid disturbance. Follow-up monitoring will be conducted to document compliance with prescribed setbacks and the effectiveness of mitigation.

Objective(s):

- *To identify red-sided garter snake hibernaculum sites located near proposed infrastructure and determine appropriate mitigation measures to minimize or avoid disturbance; and*
- *To verify the implementation and effectiveness of mitigation measures.*

Applicable Project Component(s): N2, N3, N4, C1

Monitoring Activities:

Table 4-14 Red-sided Garter Snake

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Red-sided garter snake hibernacula	Pre-construction	Reptile ESS Validation and Survey	Presence of garter snake hibernacula	Suitable Red-sided garter snake hibernacula habitat within 200 m of proposed infrastructure locations.	One-time	Once	Spring or Fall	Presence/absence of hibernacula
	Post-construction	Compliance and mitigation effectiveness monitoring	Setbacks from hibernacula Continued use of hibernacula by garter snakes	Red-sided garter snake ESS	Not required as no ESS developed	Annual	Spring/Summer	Setback distance (m) Presence/absence of garter snakes in hibernacula

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of potential snake hibernacula and mitigation performance at ESS sites within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of red-sided garter snake sampling sites and assessment of ROW effects;*
- *Conduct pre-construction surveys for red-sided garter snake hibernacula;*
- *Based on pre-construction survey results, provide recommendations for tower placement adjustments and/or mitigation measures to limit or avoid disturbance;*
- *Review Environmental Inspector and Monitor daily reports for identification of red-sided garter snake sampling sites;*
- *Design and conduct specific survey methods that sample red-sided garter snake presence/absence to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on red-sided garter snake discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of red-sided garter snake hibernacula to inform ongoing analyses related to biophysical monitoring (e.g. population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Pre-construction presence of hibernacula near proposed infrastructure*
- *Tower foundation siting – within minimum 200 m of hibernacula*
- *Access trail – within minimum 100 m of hibernacula*

4.6 BIRDS

Manitoba Hydro is committed to responsible environmental stewardship, which aims to minimize the environmental effects of the Project components on bird species (Manitoba Hydro 2011). This requires a substantial effort as, of the approximately 400 bird species found in Manitoba, 371 have been identified as having ranges within the Project Study Area with 218 being seasonal breeders. Many of these species have precise breeding habitat requirements and require specialized habitats at other times of the year such as during migration. Fourteen of these 218 species are listed under *Manitoba Endangered Species and Ecosystems Act* (MESEA) or the federal *Species at Risk Act* (SARA).

4.6.1 Bird – Wire Collision Mortality Monitoring

The presence of power lines in proximity to areas of high bird activity may lead to bird – wire collisions which may result in the injury and death of birds. Manitoba Hydro has committed to installing bird diverters along transmission line sections which transect areas of high bird activity. Pre-construction surveys will serve to identify ESS for birds and gauge the level of bird activity at these sites at biological important times such as during migration and the rearing of offspring. Construction phase and post-construction phase studies will aim to quantify mortality to birds caused by the Bipole III Transmission Line and direct adaptive mitigation strategies to reduce or prevent mortality events.

Objective(s):

- *Identify the bird ESS at which to string bird diverters;*
- *Monitor avian mortality caused by transmission line infrastructure using a Control-Impact study design; and*
- *Determine the effectiveness of mitigation measures and, if appropriate, propose revisions to the existing plans or develop new mitigation options should high levels of avian mortality occur as a result of the transmission line.*

Applicable Project Component: All Components

Monitoring Activities:

Table 4-15 Bird – Wire Collision Mortality

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Bird – Wire collision mortality monitoring	Pre-construction phase	Bird ESS validation and survey	Abundance	Where suitable waterfowl migration stopover and breeding habitat overlap with Project components (e.g., towers, wires).	1 year	Two spring and two fall visits	April 1 – October 31	Presence/Absence Abundance Bird Flights Paths
	Post Construction	Bird ESS disturbance monitoring	Mortality	Selected transmission line sections with and without bird diverters.	2018,2019	Two spring and two fall visits	April 1 – October 31	Mortality Presence/Absence

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*

- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of high bird activity areas within project footprint;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential high use bird areas;*
- *Conduct pre-conductor stringing avian flight activity surveys at bird Environmentally Sensitive Sites;*
- *Based on pre-construction survey results, provide recommendations for bird diverter installation;*
- *Review Environmental Inspector and Monitor daily reports for identification of bird-wire collision sampling sites;*
- *Design and conduct specific survey methods that sample bird presence/absence, abundance, mortality and flight paths to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on birds discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Bird mortality statistics are above expected based on pre-construction abundance/flightpath surveys*

4.6.2 Active Bird Nests

Land clearing during the breeding bird period (April 1 – July 31) has the potential to destroy migratory bird nests and harm fledging birds, which contravenes both the *Migratory Bird Convention Act* (MBCA) and the *Manitoba Wildlife Act*. To prevent harm to birds or their nests, nest searches will be conducted prior to clearing in areas where summer clearing is planned (e.g., April 1 - July 31). Should active nests be located, buffer zones of appropriate sizes will be established to prevent disturbance and will be retained until young leave the nest.

Objective(s):

- *Identify active bird nests in Project areas scheduled to be cleared during the April 1 to July 31 period; and*
- *Determine the effectiveness of mitigation measures and, if appropriate, propose revisions to the existing plans or develop new mitigation options should unexpected impacts to birds occur as a result of clearing-related activities.*

Applicable Project Component: Keewatinohk Converter Station Area, C2,S1, S2

Monitoring Activities:

Table 4-16 Active Bird Nests

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Active bird nests	Pre-construction phase	Bird ESS validation and survey	Presence	Pre-project nest searches are required in areas where summer clearing (April 1 - July 31) is anticipated (e.g., in the southern portion of the Project footprint)	One-time	Once	April 1 - July 31	Presence/ Absence

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of active bird nests and mitigation performance at ESS sites within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential high use bird areas;*
- *Conduct pre-clearing non-invasive nest surveys when clearing areas within timing windows;*
- *Based on pre-clearing survey results flag buffer zones around active bird nests;*
- *Review Environmental Inspector and Monitor daily reports for identification of active bird nest sites;*

- *Report immediately to Manitoba Hydro any unanticipated project effects on birds discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Decision Trigger(s)/Threshold(s) for Action

- *Nest discovered within ROW when construction overlaps with Wildlife Reduced Risk Timing Windows*

4.6.3 Colonial Bird Nesting Sites

Colonial birds are protected under the *Manitoba Wildlife Act and Migratory Birds Convention Act*. They are sensitive to disturbance during the courting, nesting and brood-rearing periods. Construction activities could result in the loss of colonial bird nesting habitat and/or result in nest abandonment and a decrease in reproductive success by colonies breeding within or adjacent to Project construction areas.

Objective(s):

- *Characterize bird flight activity of birds at nesting colonies located in proximity to the transmission line where construction activities will overlap with nesting and breeding activities and*
- *Determine the effectiveness of mitigation measures using a Before-After Control-Impact (BACI) study design and, if appropriate, propose revisions to the existing plans or develop new mitigation options should unexpected impacts to colonial nesting birds occur as a result of the transmission line.*

Applicable Project Component(s): C2, S1, S2

Monitoring Activities:

Table 4-17 Colonial Bird Nesting Sites

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Colonial bird nesting sites	Pre-construction phase	Bird ESS validation and flight path survey	Colonial bird abundance	Within 1km of Applicable Project Component Footprints	One-time	Once	June 1- July 31	Presence/ Absence Abundance Behavior
	Construction phase	Bird nest disturbance and flight path monitoring	Disturbance	Bird ESS within 1 km of Applicable Project Components if construction activities overlap nesting and breeding periods	During construction	Two annual surveys	April 1 - July 31	Presence/Absence Abundance Behaviour
	Post-construction phase	Bird nest disturbance and flight path monitoring	Disturbance	Monitoring of predator nests (raptors) on towers near breeding colonies	Not required as no colonies found within 1km	Two annual surveys	April 1 - July 31	Presence/Absence Abundance Behaviour

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Share results of key monitoring activities with interested local stakeholders , First Nations and Metis; and*
- *Participate as a stakeholder in committees or working groups whose purpose is for the ongoing conservation of wildlife.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of colonial bird nests/rookeries and mitigation performance at ESS sites within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential Colonial bird nesting sites;*
- *Conduct pre-clearing aerial surveys for Colonial bird nesting sites;*
- *Based on pre-construction survey results, provide recommendations for bird diverter installation;*
- *Review Environmental Inspector and Monitor daily reports for identification of colonial bird nesting sites;*
- *Design and conduct specific survey methods that sample bird presence/absence, abundance, mortality and behaviour to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on Colonial bird nesting sites discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of colonial bird populations to inform ongoing analyses related to biophysical monitoring (e.g. Population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Colonial bird nesting sites near project footprint have significant reduction in abundance compared to pre-construction baseline and control nesting sites away from the project.*

4.6.4 Sharp-tailed Grouse Lekking Sites

Sharp-tailed Grouse (*Tympanuchus phasianellus*) are particularly vulnerable to bird - wire strikes and to increased rates of predation if birds of prey (raptors) use transmission line towers as perches when hunting or for nesting.

Objective(s):

- *Identify the presence of lekking sites along the transmission line;*
- *Monitor predation of grouse near lekking sites in proximity to the transmission line compared to that at control sites; and*
- *Determine the effectiveness of mitigation measures and, if appropriate, propose revisions to the existing plans or develop new mitigation options should unexpected impacts to Sharp-tailed Grouse occur as a result of the transmission line.*

Applicable Project Component(s): N4,C1, C2,S1,S2

Monitoring Activities:

Table 4-18 Sharp-tailed Grouse Lekking Sites

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Sharp-tailed grouse lekking sites	Post -Clearing	Bird ESS survey and validation	Lek abundance	Where suitable breeding habitat overlaps with Project components (e.g., towers)	One-time	Once	April 1 - May 31	Presence/Absence Abundance
	Construction phase	Bird ESS disturbance monitoring	Disturbance	Monitor disturbance effects if leks are found within 500 m of right-of-way (ROW) where construction activities overlap lekking activity	During construction	Annual	April 1 - May 31	Presence/Absence Abundance
	Post-construction phase	Bird ESS disturbance monitoring	Mortality	Monitor, effects of any nearby raptor nests located on towers	2018,2019	Annual	April 1 - May 31	Presence/Absence Abundance

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Share results of key monitoring activities with interested local stakeholders , First Nations and Metis; and*
- *Participate as a stakeholder in committees or working groups whose purpose is for the ongoing conservation of wildlife.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of lekking sites and mitigation performance at ESS sites within project footprint;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential lekking sites;*
- *Conduct pre-clearing surveys for lekking sites within 500 metres of ROW;*
- *Utilize MCWS Lek Survey Protocol or compatible protocol;*
- *Review Environmental Inspector and Monitor daily reports for identification of lekking sites;*
- *Design and conduct specific survey methods that sample bird presence/absence, abundance, mortality and behaviour to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on lekking sites discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of sharp-tailed grouse lekking sites to inform ongoing analyses related to biophysical monitoring (e.g. harvest data, population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Lekking sites near project footprint have significant reduction in abundance compared to pre-construction baseline and control lekking sites away from the project.*

4.6.5 Bird Species of Conservation Concern

Species of conservation concern include species of that are protected under MESEA, SARA or are listed as rare by the MBCDC. These species generally exist in low numbers and are sensitive to changes in habitat. As described under SARA (subsection 79(2)), monitoring of potential adverse effects on SARA-listed wildlife species is required (SARA 2011).

Objectives

- *Identify the location of bird species of conservation concern within or in close proximity to the Project footprint with the purpose of establishing a Control-Impact monitoring program for known individuals and/or groups;.*
- *Monitor species of conservation concern in close proximity to the transmission line and compare annual site fidelity and abundance to nearby control sites; and*
- *Determine the effectiveness of mitigation measures and, if appropriate, propose revisions to the existing plans or develop new mitigation options should unexpected impacts to birds occur as a result of construction or operation activities.*

Applicable Project Component(s): N4,C1, C2, S1, S2

Monitoring Activities:

Table 4-19 Bird Species of Conservation Concern

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Bird species of conservation concern	Pre-construction phase	Point Counts	Presence/Absence Abundance	Applicable Project Component Footprint	One-time	Once	April 1 - July 31	Presence/Absence Abundance
	Construction phase	Point Counts	Presence/Absence Abundance	Applicable Project Component Footprint	During Construction	Annual	April 1 - July 31	Presence/Absence Abundance
	Post-construction	Point Counts	Presence/Absence Abundance	Applicable Project Component Footprint	2018,2019	Annual	April 1 - July 31	Presence/Absence Abundance

Methods and Reporting

Manitoba Hydro will:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Share results of key monitoring activities with interested local stakeholders , First Nations and Metis; and*
- *Participate as a stakeholder in committees or working groups whose purpose is for the ongoing conservation of wildlife.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of bird species of concern and mitigation performance at ESS sites within project footprint.*
- *Record observations with photo and waypoint and store in EPIMS; and*

- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro for identification of potential species of concern habitat;*
- *Review Environmental Inspector and Monitor daily reports for identification of bird species of concern;*
- *Design and conduct specific survey methods that sample site fidelity and abundance and compare to controls sites to verify accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on species of concern discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of species of concern populations to inform ongoing analyses related to biophysical monitoring (e.g. population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Species of concern point count sites within project footprint have significant reduction in abundance compared to pre-construction baseline and control point counts away from the project.*

4.6.6 Birds of Prey

While land clearing of ROW has the potential to destroy raptor nests, the resulting transmission towers have shown to provide suitable nesting habitat where electrical safety concerns are not an issue. Peregrine Falcons are listed as endangered under both MESEA and SARA. Manitoba Hydro has historically funded several Peregrine Falcon research and captive breeding programs over the past decade in efforts to restore this species to Manitoba's landscape. Manitoba Hydro is currently funding a Ph.D. study for captive breeding and release of Peregrine Falcons with radio transmitters in an effort track their behaviours, interactions with transmission lines and survivability to maturity.

Objective(s):

- *Identify raptor nests in Project footprint that require removal or relocation; and*
- *Determine the effects of transmission lines on Peregrine Falcon mortality.*

Applicable Project Component (s): N1,N2,N3,N4,C1,C2,S1,S1, AC Collectors and Construction Power

Monitoring Activities:

Table 4-20 Birds of Prey

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Raptor nest and mortality	Pre construction/ Construction	Incidental Raptor Observation Recording	Mortality and nest site locations	Project Footprint	4 years	Continuous	Year-round	Presence/Absence of nests and mortality, Nest removal or relocation
	Operations				As per Line Maintenance Schedule	As per Line Maintenance Schedule	During Asset Inspection surveys	Presence/Absence of nests and mortality, Nest removal or relocation
Peregrine falcon research	Pre Construction/ Construction	PTT-marked Peregrine Ph.D. Study	Mortality and habitat use	Southern Manitoba	PH.D Study Completed	One time	Year-round	Peregrine Falcon flight paths, interactions with transmission lines, migration routes, habitat use

Methods and Reporting

Manitoba Hydro is committed to:

- *Continue to fund PTT- Marked Peregrine Falcon Ph.D. Study;*
- *Supply nest site, nest removal or relocation activities and mortality locations observed to MCWS; and*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period and a Transmission Line Maintenance System that records raptor nest observations and nest relocations during operation period.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of raptor nests, mortality and mitigation performance at ESS sites within project footprint;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Conduct pre-clearing non-invasive nest surveys;*
- *Based on pre-clearing survey results flag buffer zones around active bird nests;*
- *Review Environmental Inspector and Monitor daily reports for identification of raptor nests;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on raptors discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of peregrine populations to inform ongoing analyses related to biophysical monitoring (e.g. population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Manitoba Hydro is committed to review PTT-Marked Peregrine Falcon Study results and implement additional mitigation if mortality due to MH transmission lines is an adverse effect to the population.*

4.7 MAMMALS COMPONENT

4.7.1 Moose

Linear corridors may create or remove habitat for moose depending on the habitat types they are traversing. Any linear development through a closed forest will open up the canopy, creating edges that encourage the growth of shrubs, preferred browse species for moose such red oisier dogwood, willow spp., trembling aspen and birch saplings. Conversely, corridors that traverse riparian areas already providing good foraging habitat for moose act to remove habitat, reducing the carrying capacity of the landscape. . The degree of impact is proportional to the width and length of the disturbance corridor. Linear corridors may also act to enhance habitat if they serve as travel corridors for moose, ease of movement along corridors can make them attractive travel routes. However, mortality associated with the use of these potential travel corridors may offset any benefits moose may derive from using them**;** effects on moose populations are also anticipated to arise from increased predation from wolves as a result of their increased rate of movement along the ROW.

In general, moose avoid human related activity. The development of roads into new areas allows for hunting in previously inaccessible areas. Moose have been found to avoid habitat in the vicinity of roads because of human activity, this response is most evident in hunted populations (Jalkotzky, 1997). Mortality associated with ROWs may occur due to increased human access and subsequent increases in hunting or poaching (Jalkotzy et al., 1997; Richard and Doucet, 2003).These effects may not to be necessarily significant at the population level (Richard and Doucet, 1999). Potential effects to moose habitat were primarily mitigated in the project design during the routing and planning process where sensitive moose areas and habitats were avoided. Moose are anticipated to avoid the Project area during noise and other sensory disturbance-related activities of construction, such as road use and creation, construction of the ROW and transmission lines. Lastly ungulates in western Manitoba are susceptible to parasites (*P. tenuis*) and diseases (e.g. Bovine Tuberculosis and Chronic Wasting Disease (CWD); new linear corridors ultimately contribute to improving ungulate movement capabilities which act to facilitate disease and parasite transmission rates.

Moose are an important species to Manitobans. They are a focus of the follow-up monitoring program due to concerns raised during the Environmental Impact Statement (EIS) Review and the Manitoba Clean Environment Commission (CEC) Hearings regarding the current population decline and unknown extent and magnitude of potential ROW impacts.

Applicable Project Component(s): N1,N2, N3, N4, C1, AC Collectors and Construction Power

Monitoring Activities:

Table 4-21 Moose

Monitoring Objectives / Hypotheses	Study Area	Time Period	Data Collection Methods	Summary of Analysis
1. Determine changes to the <u>quantity</u> of potential moose browse H_0-(Null): The Project will result in no change in index of potential browse quantity along the ROW. H_1-(Alternate): The Project will result in change in index of potential browse quantity along the ROW.	ROW within defined moose sensitive areas: [Pine River (GHA14A/19A), Moose Meadows (portion of GHA 14) and Tom Lamb WMA (GHA8)]	2014 and 2019	Remote Sensing (NDVI)	Statistical analyses conducted on NDVI values for RoW areas, compared to the same areas prior to construction. The objective of these analyses will be to determine with statistical confidence when a negative difference value is indicative of a practically-meaningful reduction in NDVI value pre and post construction. Statistical analyses included frequency histograms and quartile analysis to understand the character and distribution of mean pre and post RoW values. For difference values, values will be plotted against the expected normal distribution, quartiles were determined, and percentiles and residuals (difference between actual difference values and expected values.
2. Determine changes in winter moose <u>distribution</u> H_0-(Null): The Project will result in no change in winter distribution of moose adjacent to the centerline. H_1-(Alternate): The Project will result in change in winter distribution of moose adjacent to the centerline.	1. Helicopter survey of Project sections N1,N2, N3, N4, and C1 and sensitive moose areas 2. Woodland caribou monitoring blocks (P-Bog, N-Reed, Wabowden) (Refer to	2016,2017, 2018,2019, 2020	1. Helicopter Multi Species Parallel Transect Surveys *upgrade to helicopter from fixed-wing aircraft 2. Ungulate-Wolf Distribution Surveys (annual, 50% coverage) in woodland caribou monitoring blocks (P-Bog, N-Reed and Wabowden = N3 and N4)	1. Comparative statistical analysis will be performed at samples 500 m wide transect strips parallel to the ROW centered on distances of 0.25 km, 1.25 km, 3.25 km, 5.25 km along construction segments N1, N2, N3, N4 and north half of C1 construction segments. Additional strip transects are flown at 10.25 km from the ROW in the sensitive moose areas (Pine River/GHA 14A/19A, Moose Meadows and Tom Lamb/GHA 8) and along the ROW from Thompson (northern portion of N2 construction segment) to the Keewatinoow Converter Station (N1

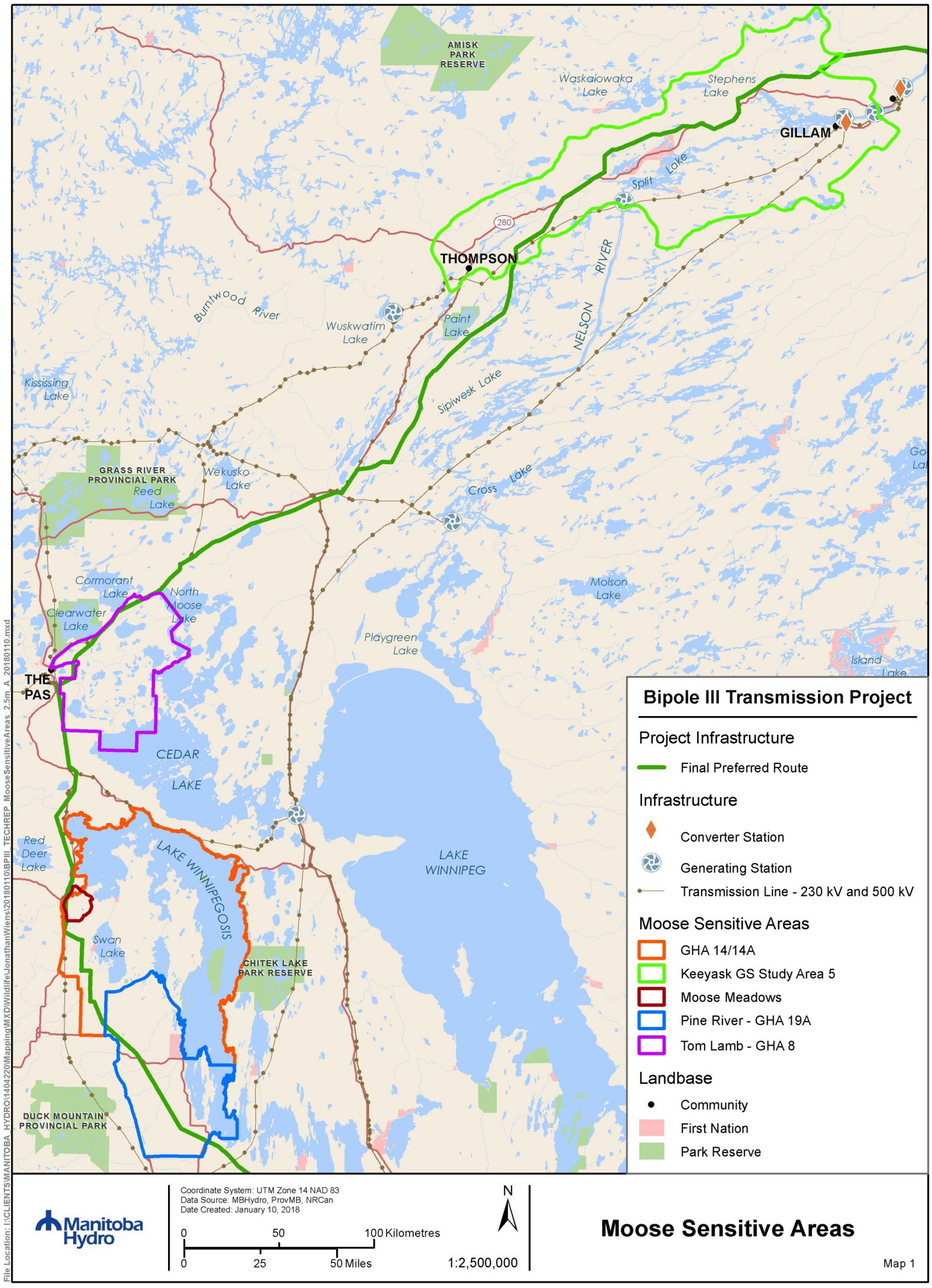
Monitoring Objectives / Hypotheses	Study Area	Time Period	Data Collection Methods	Summary of Analysis
	woodland caribou section 4.7.2)			construction segment) 2. Systematic winter distribution survey data to assess shifts in winter via distribution kernels, and via analysis at varying distance bands from the. ROW (e.g. frequency of occurrence) * These have already been reported and described in 2015/16 and 16/17 Bipole III annual environmental effects monitoring reports.
3. Investigate changes in population abundance trend over time H_0-(Null): Temporal trend in regional moose abundance in GHAs intersected by the Project do not differ from adjacent reference populations H_1-(Alternate): Temporal trend in regional moose abundance in GHAs intersected by the Project differ from adjacent reference populations	1. Moose population surveys of GHA's bisected and adjacent to the Project 2. Keeyask Generating Station - Study Area 5	2016,2017, 2018,2019, 2020 **If** collected and shared by **Keeyask Hydro Limited Partnership,** Provincial or Federal Agency (Riding Mountain National Park)	1. Moose population survey data collected by Provincial and Federal Agencies 2. Moose population surveys (Keeyask Generating Station - Study Area 5)	1&2. Use of Gasaway population survey data to investigate if project has population level effects on abundance (moose/km2) or rate of population change (λ) by comparing population performance of those interacting with the project to adjacent reference populations via population modeling. * These have already been reported and described in 2015/16 and 16/17 Bipole III annual environmental effects monitoring reports. ** After 2020, Keeyask GS Study Area Moose Population Survey Analysis will be reported under the Keeyask Generating Station Annual Environmental Report
4. Investigate wolf presence on ROW **Local scale** **H_0-(Null):** Wolf presence not detected on the Project ROW as a travel corridor. **H_1-(Alternate):** Wolf presence detected on Project ROW as a travel corridor. **Regional scale** **H_0-(Null):** Relative distribution of wolves and/or moose is not altered by ROW, and therefore does not affect moose predation risk. **H_1-(Alternate):** Relative distribution of wolves and/or ungulates is altered by ROW, and therefore affects moose predation risk.	1. Project sections N1-N4 and Moose Sensitive Area - GHA 19a. 2. Woodland caribou monitoring blocks (P-Bog, N-Reed, Wabowden) (refer to woodland caribou section 4.7.2)	2015,2016, 2017,2018, 2019,2020	1. Ground track survey transects and correlated trail cameras within Project sections N1-N4; Trail cameras only in GHA 19a. 2. Ungulate-Wolf Distribution Surveys in woodland caribou monitoring blocks (3km transect spacing) 3. Helicopter Multi-Species Parallel Transect Surveys	1. Linear Mixed Model Testing the Correlation between Density of Gray Wolf Tracks and Distance to the ROW during Winter Construction. Trail camera data is analyzed using t-Test Paired Two Sample for Means 2. Within Caribou Monitoring Blocks assess and analyze change in predation risk (relative distribution of predators and prey in winter) by comparing overlap of predator-prey distribution kernels and predator-prey dispersion distances **3.** Comparative statistical analysis will be performed at samples 500 m wide transect strips parallel to the ROW centered on distances of 0.25 km, 1.25 km, 3.25 km, 5.25 km along construction segments N1, N2, N3, N4 and north half of C1 construction segments. Additional strip transects are flown at 10.25 km from the ROW in the sensitive moose areas (Pine River/GHA 14A/19A, Moose Meadows and Tom Lamb/GHA 8) and along the ROW from Thompson (northern portion of N2 construction segment) to the Keewatinoow Converter Station (N1 construction segment) * These have already been reported and described in 2015/16 and 16/17 Bipole III annual environmental effects monitoring reports.

Monitoring Objectives / Hypotheses	Study Area	Time Period	Data Collection Methods	Summary of Analysis
5. Investigate human presence on ROW **H_0-(Null):** Human presence not detected on the Project ROW. **H_1-(Alternate):** Human presence detected on the Project ROW.	Project sections N1-N4 and GHA 19a Moose Sensitive Area	2015,2016, 2017,2018, 2019,2020 ROW Trail Cameras; 2014, 2015,2016, 2017,2018, 2019,2020 2021,2022 Construction Access Trail Cameras	1. Construction Access Trail and ROW Trail Cameras; 2. Linear Feature Analysis and Access Trail Mapping using Remote Sensing Imagery in 2019	1. Presence and magnitude of Human use will be analyzed based on a range of detected variables: -# of human detections per day/week/month - seasonality - time of day - mode of transportation (ATV, truck, foot) - project segment 2. Compare linear feature presence with pre-construction imagery. * These have already been reported and described in 2015/16 and 16/17 Bipole III annual environmental effects monitoring reports.
6. Determine change in Project related vehicle- wildlife (deer/moose) collisions H_0-(Null): The construction of the Project will result in no vehicle-wildlife collisions. H_1-(Alternate): The construction of the Project will result in vehicle-wildlife collisions.	Entire Project Area	2014,2015 2016,2017, 2018	Project Related Vehicle accident reports that involve wildlife (deer/moose) will be reported to applicable Project assigned Conservation Officer.	Frequency, occurrence and distribution of vehicle-wildlife collisions, will be summarized and reported annually by construction segment during the construction phase. These have been reported in the 2015/16 and 16/17 Bipole III annual monitoring reports.
7. Moose Stewardship Study and Conservation Program. Manitoba Hydro has provided $800,000 of total funding for the establishment of Moose Stewardship Study and Conservation Programs. The Study and the Conservation Programs will be available for researchers, public, indigenous communities and organizations, and other stakeholders as a source of funding to investigate factors affecting moose population dynamics in Manitoba and to enhance and sustain moose populations in Manitoba. Review and management of the proposed programs and/or research will be made by staff from Manitoba Hydro and Manitoba Sustainable Development, with input from qualified experts. Final recommendations for the Study Program project proposals will be made jointly by senior staff from Manitoba Hydro and Manitoba Sustainable Development. Details can be found here: **https://www.hydro.mb.ca/environment/moose/index.shtml**	Manitoba	2018,2019, 2020 **or longer as funds remain**	Establishment of a Moose Stewardship Programs	Review by steering committee on program activities.

GLOSSARY OF TERMS USED IN MOOSE MONITORING COMPONENT SECTION 4.7.1

TERM	DEFINITION
Dispersion Distance (km)	Mean distance of predator (wolf) to prey (moose) in a defined study area
Distance Band	Buffer distance from a feature of interest (e.g. ROW)
Distribution Kernel	Probability distribution based on a distribution of occurrence data in an implicit space
Frequency of Occurrence	The occurrence (%) of observations at various distance bands within a defined study area
Population Abundance Trend	Regional change in population abundance over time using population performance metrics such as population density (moose/km^2), λ (population growth rate), frequency of occurrence (%)
Predation Risk	An animal's likelihood of predator-induced mortality (e.g. Risk of predation as a function of proximity and/or overlap of distribution kernels of prey relative to predator, or mean distance of prey species to predator species in a defined study area)
Relative Distribution	Comparison of a distribution of data (e.g. moose locations) in a defined area relative to another set of distribution data (e.g. in a different distance band; can be expressed as a relative frequency distribution

Figure 4-1 Defined sensitive moose range locations [(Pine River (GHA14A/19A), Moose Meadows (portion of GHA 14) and Tom Lamb WMA (GHA8)] relative to the Bipole III ROW.



4.7.2 Caribou

Manitoba barren-ground caribou consist of seasonal (winter) range occupancy by the Beverly-Qamanirjuaq herds, which may ocassionally range into the project area. Coastal caribou populations in Manitoba, are comprised of the Pen Island and Cape Churchill herds. They are located in the northern extent of the boreal zone and are not protected under the federal Species at Risk Act (SARA 2002) or the Manitoba Endangered Species and Ecosystems Act (MESEA) and are considered to be the forest-tundra ecotype. The Cape Churchill animals migrate south to Keewatinohk and Keeyask areas in the winter. The Pen island herd moves inland during the fall and may occasionally occur in the Project area. Barren-ground and coastal caribou in Manitoba are not listed under SARA or MESEA; however coastal caribou from the Cape Churchill and Pen Island herds were GPS collared as part of the *Pen Island and Cape Churchill Coastal Caribou Range Distribution Project, a collaborative project between Conservation and Water Stewardship and the Fox Lake, Split Lake and York Factory Resource Management Boards, Aboriginal and Northern Affairs and Manitoba Hydro* and included as part of the baseline assessment work.

Boreal Woodland Caribou (*Rangifer tarandus caribou*) have established sedentary ranges in several locations along the Project area. Boreal Woodland caribou are listed under the federal Species at Risk Act (SARA 2002) and the Manitoba Endangered Species and Ecosystems Act (MESEA) as threatened and were a significant focus for the EIS assessments including a comprehensive GPS collaring program

Caribou are sensitive to changes in habitat that involve loss or alteration of calving or wintering areas, sensory disturbance and/or increased predator presence. Residual effects on boreal woodland, coastal and barren-ground caribou were anticipated to include direct and functional habitat loss, range fragmentation, increased predation, increased mortality from hunting and pathogens. Requirements of both federal and provincial Species at Risk (SAR) acts indicate that monitoring of potentially adverse effects on SAR must also occur.

Objective(s):

- *Expand the baseline knowledge of annual and seasonal distribution, abundance, and population characteristics of boreal woodland and coastal caribou populations interacting with the Project;*
- *Investigate the influence (extent and magnitude) of disturbance related Project effects on local abundance and distribution of boreal woodland caribou. The use of a reference range (Charron Lake range) will allow for effects of the Project to be disseminated from natural variation. Complementary field and analytical methods and a variety of parameters at two scales;*
    a. *Local Scale: The Spatial dynamics including displacement/avoidance, neutral or positive Project responses will be evaluated using indicators such as site fidelity, habitat selection, seasonal habitat use, mortality rates (predators, roads/vehicle collisions) and evaluation of occupancy and movement dynamics before and after construction where pre-existing baseline data permits. Distance based analysis will used to elucidate the extent to which the Project has influenced behavior within and adjacent to the Project Zone of Influence (ZOI);*
    b. *Range Scale: Bog, Wabowden, Naosap-Reed and Charron Lake reference caribou ranges: Population abundance and recruitment in relation to changes in human access, hunting, predation and other mortality risks (such as vehicle collisions) will be assessed. Changes in population state (occupancy/seasonal distribution in calving, rearing and overwintering habitats, movements, home range size, and population abundance/viability) and vital rates (population structure, recruitment, survival) before and after construction will be undertaken where pre-existing baseline data permits. Analytical comparisons to reference conditions in the Charron Lake Range will used to elucidate the extent to which the Project has altered local population dynamics versus natural variation within the population.*

Applicable Project Component(s): N1,N2, N3, N4, AC Collectors and Construction Power

Monitoring Activities:

Table 4-22 Caribou

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Population State (viability, abundance)	Pre-Construction/Construction	Maintain 20 collars per year per affected range (The Bog, Wabowden + Charron Lake reference range. Monitor regional effects relative to control population	Population trend (λ) and abundance (density)	Boreal Woodland caribou ranges intersected by the Project (The Bog, Wabowden) + a reference range	4 years pre and 2 years during and 2019,2020 post construction	Annual	Year Round	Range scale population growth rate (λ), population size

Table 4-22 Caribou

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
	Construction/Post Construction	Non-invasive population surveys (genetic CMR)	Population trend (λ) and abundance (density)	Boreal Woodland caribou ranges intersected by the Project (The Bog, Wabowden, Naosap-Reed Lake) + Charron Lake reference range	2014, 2016, 2018, Up to 25 years or until suitable knowledge aquired	3 years	Winter	Range scale population growth rate (λ), population size
Population Vital Rates (structure, mortality)	Pre-construction Construction Post-construction	Aerial recruitment surveys (aided by collared female locations) Collar mortality signal investigation	Calf recruitment rate Collared female survival rate Female (collared) mortality rate/cause	Boreal Woodland caribou ranges intersected by the Project (The Bog, Wabowden,) + Charron Lake reference range	4 years pre and 2 years during and 2018,2019 post construction	Annual	Recruitment - Winter/ Mortality- Year-round	Range-scale project related significant changes in vital rates relative to control population
Range Occupancy (seasonal distribution, movements, home range size, ROW corridor use)	Pre-construction Construction Post-construction	Maintain 20 collars/yr/affected range (The Bog, Wabowden, Reed Lake) + Charron Lake reference range. Monitor regional effects relative to control population) and local effects (functional habitat loss, altered movement, shifts in centroids of use, altered HR size, barrier effects)	Locations (presence/ absence, home range), movement (barrier effects, core use areas, habitat use vs availability)	Boreal Woodland caribou ranges intersected by the Project (The Bog, Wabowden,) + Charron Lake reference range	Up to 2020 or until suitable knowledge acquired	Continuous	Year Round	Range/local scale project-related range contraction, movement barrier effects (range connectivity effects), altered RSF (seasonal or annual shifts), ROW corridor use (presence/absence), altered HR size or centroids of use
Functional Habitat Loss (displacement, avoidance and utilization relative to sensory disturbance)	Construction Post-construction	Use telemetry data to assess local Movements and habitat use in relation to project activities and habitat alteration. Use remote IR cameras to monitor ROW use by non-collared caribou	Locations (presence/ absence, Home range, movement (barrier effects, core use areas, habitat use vs availability)	Boreal Woodland caribou ranges intersected by the Project (The Bog, Wabowden, Naosap-Reed Lake) + Charron Lake reference range at LSA scale	2 years during and 2018,2019 post construction	Continuous (collar data)	Year-round	Local scale (zone of influence) effects of project activities and infrastructure on caribou movements (rate of movement, angle of approach) and habitat use (use vs availability relative to distance from project footprint)
Altered Predator-Prey Dynamics	Construction Post-construction	Winter track transects and remote IR cameras to monitor ROW use by ungulates and predators	Relative abundance of other ungulate species and predator occurrence	Boreal Woodland caribou ranges intersected by the Project (The Bog, Wabowden, Naosap-Reed Lake)	2018,2019 post construction pursuant to sufficient knowledge acquired	Annual	Year-round	Local scale (zone of influence) effects of project activities and infrastructure on ungulate and predator relative abundance

Table 4-22 Caribou

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Sensory Disturbance	Construction	Monitor Cape Churchill and Pen Island movements/occupancy via *Pen Island and Cape Churchill Coastal Caribou Range Distribution Project*	Locations (presence/ absence)	N1, – Pen Island, Cape Churchill winter distribution relative to LSA	2 years	Annual	Winter	Proximity relative to imminent construction
Reed Lake/ Naosap Range	Construction/Post Construction	Manitoba Hydro as a member of the Northwest Region Woodland Caribou Committee is collaborating in the implementation of a 20 GPS collar program in the Naosap-Reed LakeRange, being led by MCWS	Locations (presence/ absence, home range), movement (barrier effects, core use areas, habitat use vs availability)	Naosap-Reed Lake Range	1 year pre and 2 years during and 2018	Continuous	Year- round	Range scale population growth rate (λ), population size Range-scale project related significant changes in vital rates relative to control population Range/local scale project-related range contraction, movement barrier effects (range connectivity effects), altered RSF (seasonal or annual shifts), ROW corridor use (presence/absence), altered HR size or centroids of use

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Continue to participate in the Pen Island and Cape Churchill Coastal Caribou Range Distribution Project, a collaborative project between Conservation and Water Stewardship and the Fox Lake, Split Lake and York Factory Resource Management Boards, Aboriginal and Northern Affairs and Manitoba Hydro;*
- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Share results of key monitoring activities with interested local stakeholders , First Nations and Metis;*
- *Manage all Manitoba Hydro caribou monitoring activities across both Transmission and Power Supply projects through Internal Manitoba Hydro Caribou Committee; and*
- *Participate as a stakeholder in relevant committees or working groups whose purpose is for the ongoing conservation of wildlife.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of caribou and tracks, mineral licks, human access, mortality sites and mitigation performance at ESS sites within project footprint or access routes;*
- *During daily activities within designated sampling sites, collect fecal samples for genetic testing;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to assess mitigation effectiveness, share local/traditional knowledge and provide first hand overview of site conditions during construction phase.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro to assess project footprint effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of caribou observations, mineral licks, human access, and mortality sites;*
- *Design and conduct specific survey methods that sample boreal woodland caribou abundance, occupancy, population growth rate, movements, mortality, and human access to assess local level disturbance effects as well as larger populations level effects within affected ranges, while verifying accuracy of EIS predictions and effectiveness of mitigation measures implemented;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on caribou discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data required to assess caribou populations and inform ongoing analyses related to biophysical monitoring (e.g. harvest data, population survey data, observations, reports;*
- *Provide guidance in identifying significant effects;*
- *Provide guidance regarding mitigation strategies should unexpected impacts to occur as a result of the transmission line;*
- *MCWS biologists to collaborate and/or participate in survey method design and implementation;*
- *Continue to manage Naosap-Reed Lake Boreal Woodland Caribou Range Project; and*
- *Continue to manage the Pen Island and Cape Churchill Coastal Caribou Range Distribution Project, a collaborative project between Conservation and Water Stewardship and the Fox Lake, Split Lake and York Factory Resource Management Boards, Aboriginal and Northern Affairs and Manitoba Hydro.*

Decision Trigger(s)/Threshold(s) for Action

- *Project footprint exceeds predicted area within range*
- *Project related change in caribou mortality due to predation or hunting mortaility that exceeds 50% of collared animals*
- *Human access activity that causes disturbance effects within the project footprint or zone of influence during sensitive periods*
- *GPS collar data analysis illustrates project-related alteration of caribou movement (e.g. barrier effect of RoW) or occurrence (e.g.avoidance of RoW) as compared to pre-construction behaviour*
- *Caribou mortality along ROW*
- *GPS collar mortality signal*
- *Decline of caribou recruitment rate/range below 15% calves per adult for 3 successive years*
- *Populations trends in a monitored range (Wabowden, Pasquia-Bog, Naosap-Reed) significantly different than reference range (Charron Lake) due to project-related effects (e.g.site fidelity, loss, altered mortality rate, altered λ)*
- *Cape Churchill and/or Pen island herds in close proximity to construction activities*
- *Active GPS collar numbers fall below 15 active collars per range*
- *Mineral lick discovered on or near ROW*

4.7.3 Deer

White-tailed deer are an native species that select early succession deciduous dominant forest patches and riparian habitat. They are considered well adapted to habitat edges such as those created by disturbances. Therefore they are not particularly susceptible to the effects of habitat fragmentation (Stewart et al. 2011). Linear disturbances and riparian habitat have a large edge:area ratio which favours white-tailed deer habitat selection. Riparian areas, edge habitats, and linear features function as important habitats for travel and forage. Disturbed vegetation is favoured by white-tailed deer because of the high diversity of plants in those areas (Stewart et al. 2011). In northern portions of forested range, white-tailed deer will seasonally "yard-up" in winter ranges to reduce energetic costs of movement through deep snow. Often these winter ranges are conifer-deciduous mixedwood areas that offer winter browse and protection from deep snow (Stewart et al. 2011). The project potentially provides improved access of white-tailed deer to more northern portions of their current range. Ingress of white-tailed deer may serve as a vector for increased disease and/or parasite risk to other ungulate species (e.g. moose, woodland caribou). White-tailed deer with meningeal worm (*P. tenuis*) infection rarely display clinical signs of the disease, however infections within other native cervids causes devastating morbidity and mortality (Lankeser 2001), posing a significant threat to cervid species other than white-tailed deer (Campbell & VerCauteren 2011).

Objective(s):

- *To monitor presence of parasites/diseases and thereby the change in disease risk to other ungulate species in relation to change in white-tailed deer distribution (if any) from Project.*

Applicable Project Component(s): C1, N4, N3

Monitoring Activities:

Table 4-23 Deer

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Brainworm sampling	Construction	Examination of deer faeces	Change in disease presence	Where deer located in winter faecal collections	2-5 years	Annual	Faecal -Winter only when snow present	Brainworm Presence in deer along ROW
Distribution mapping	Construction/Post Construction	Monitor for northern progression of deer occurrence as component of ungulate aerial and ground surveys	Change in deer presence	Within Project footprint	A minimum of 10 years or until sufficient knowledge has been obtained	3 years	Winter	Presence/ Absence

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Share results of key monitoring activities with interested local stakeholders , First Nations and Metis; and*

- *Participate as a stakeholder in relevant committees or working groups whose purpose is for the ongoing conservation of wildlife.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of deer and tracks, mineral licks, human access, and mortality sites within project footprint or access routes;*
- *During daily activities within designated sampling sites, collect faecal samples for brainworm testing;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to share local/traditional knowledge.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro to assess project footprint effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of deer observations;*
- *Design and conduct specific survey methods that sample deer for brainworm, presence/absence on ROW and northern range expansion;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on deer discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including range expansion on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of deer populations and brainworm sampling results to inform ongoing analyses related to biophysical monitoring (e.g. harvest data, population survey data, observations, and reports); and*
- *Provide guidance regarding mitigation strategies should unexpected impacts occur as a result of the transmission line.*

Decision Trigger(s)/Threshold(s) for Action

- *Sustained (>3 successive years) ingress of white-tailed deer along ROW beyond the currently delineated MCWS deer range*
- *Presence of Brainworm in deer within or proximate (< 2 km) to the ROW within a sensitive moose or caribou range intersected by Bipole III*

4.7.4 Elk

Transmission lines are expected to have little impact on habitat availability for elk. Elk are typically associated with a heterogeneous mix of habitats including forest, grasslands, riparian areas and open water and will occur in managed landscape including those impacted by forestry, fire and agriculture. Populations in Manitoba are limited to several areas of upland forest in close proximity to prairie habitat including areas around Duck Mountain, Porcupine Mountain, Spruce Woods, Red Deer Lake, Swan River Valley, South Interlake and Riding Mountain. Mortality is largely due to hunting, predation, disease and extreme environmental conditions (severe winters). Predicted project effects included the potential for increased mortality due to hunter and predator access, sensory disturbance/altered movements during construction, vehicle collisions and increased disease transmission. Habitat related effects such as direct or indirect habitat loss are predicted to be minimal.

Objective(s):

- Assess changes in mortality risk (hunter-harvest, increased predation, elk-vehicle collisions, disease/ parasites) to elk due to Project effects of increased access, sensory disturbance/ displacement and habitat alteration.

Applicable Project Component(s): C1, C2, N4

Monitoring Activities:

Table 4-24 Elk

Key Monitoring Activity	Phase	Surveys and Data Collection Methods	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Range Occupancy Seasonal distribution and occupancy	Construction/ Post Construction	Aerial surveys, supplemented with ground-based methods (remote IR cameras and/or ATK and/or incidental sightings) to assess distribution at both range and local scales (where pre-construction data permits).	Locations (presence/absence)	C1, C2, N4	2016,2017,2018	Annual	Annual	Local scale project-related changes in distribution and occupancy. ROW corridor use (presence/absence)
Mortality Rates	Construction/ Post Construction	Monitor project-related vehicle collisions and near misses. Monitor annual hunter-harvest statistics for indications of project related overharvest. Monitor effects on elk in relation to human access and hunting mortality risk.	Mortality (hunter-harvest, vehicle collisions, predators) rate	C1, C2, N4	2016,2017,2018	Annual	Annual	Local scale project-related significant changes in mortality rates relative to historical trend (e.g. harvest size, structure, hunter success)

Table 4-24 Elk

Key Monitoring Activity	Phase	Surveys and Data Collection Methods	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Disease	Construction/ Post Construction	*P. tenuis* will be monitored in white-tailed deer	White-tailed deer occurrence (*P. tenuis* presence)	C1, C2, N4	2017,2018,2019	Annual	Winter	Project-related change in presence(compare LSA to adjacent population ranges) Change in white-tailed deer occurrence in Project footprint
Functional Habitat Availability (displacement/ avoidance, neutral or positive utilization relative to sensory disturbance or other factors)	Construction/ Post Construction	Remote IR camera studies, winter track transects and/or aerial survey methods	Locations (presence/absence,)	C1, C2, N4	2017,2018,2019	Annual	Annual	Project-related change in occurrence (compare LSA to adjacent population ranges).

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Share results of key monitoring activities with interested local stakeholders , First Nations and Metis; and*
- *Participate as a stakeholder in committees or working groups whose purpose is for the ongoing conservation of wildlife.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of elk and tracks, mineral licks, human access, and mortality sites within project footprint or access routes;*
- *During daily activities within designated sampling sites, collect fecal samples for brainworm testing;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to share local/traditional knowledge.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro to assess project footprint effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of elk observations, mineral licks, human access, and mortality sites;*
- *Design and conduct specific survey methods that sample elk abundance, occupancy, population growth rate, movements, mortality, and human access to assess local level disturbance effects as well as larger populations level effects within affected ranges, while verifying accuracy of EIS predictions and effectiveness of mitigation measures implemented;*

- *Report immediately to Manitoba Hydro any unanticipated project effects on elk discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including mitigation effectiveness on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of elk populations to inform ongoing analyses related to biophysical monitoring (e.g. harvest data, population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project*

.**Decision Trigger(s)/Threshold(s) for Action**

- *Mortality of elk on ROW or areas accessed via ROW*
- *Change in elk presence/occupancy along ROW*

4.7.5 Gray (Timber) Wolf

Large carnivores can have cascading effects on ungulates, despite their relatively sparse distribution (Ausband et al. 2014). Gray (Timber) wolf behavioural patterns and large territories make them challenging to monitor (Ausband et al. 2014). Multiple methods (e.g. remote IR cameras, aerial surveys, ungulate mortality) will be used to assess the effects of the project on wolf distribution, occurance, and on ungulate mortaility as a result of wolf predation.

Objective(s):

- *To assess changes in predation risk to caribou and moose due to Project effects on wolf occurrence and distribution*

Applicable Project Component(s): C1 (GHA 14A, GHA 19A), N3 (Wabowden, Reed Lake, Tom Lamb WMA/GHA 8), N4 (Pasquia-Bog, Moose Meadows/GHA 14)

Monitoring Activities:

Table 4-25 Gray (Timber) Wolf

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Altered Predator-prey Dynamics (monitor changes in caribou and moose predation-risk)	Construction Post-construction	Monitor changes in relative wolf prevalence on ROW relative to adjacent areas within affected caribou and moose ranges intersected by the Project using winter track transects, Remote-IR Cameras and/or multi-species aerial survey methods	LSA scale - Change in wolf prevalence on ROW vs adjacent to ROW	Project LSA intersecting caribou and sensitive moose ranges	2017,2018,2019	Continuous/ Annual	Year-round	Seasonal and annual change in wolf presence on ROW relative to adjacent area within LSA
Caribou/Moose Mortality	Pre-construction Construction Post-construction	Collared caribou/moose mortality investigation after confirmation of caribou/moose mortality signal from GPS Collar	Collared caribou/moose mortality	Caribou/moose ranges intersected by the Project	4 years pre and 2 years during and 2018,2019 post construction	Continuous	Year-round	Change in annual or seasonal mortality of caribou/moose from wolf predation
Wolf Distribution, Occupancy and Habitat Use	Construction Post-construction	Monitor wolf distribution and habitat use relative to human activity within the LSA using winter track transects, remote-IR cameras and/or multi-species aerial survey methods	LSA scale – seasonal and annual distribution and ROW use	Project LSA intersecting caribou and sensitive moose ranges	2017,2018,2019	Continuous/ Annual	Year-round	Seasonal and annual change in wolf presence on ROW relative to adjacent area within LSA and in relation to human activity levels

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Talking with local trappers about wolf distribution and abundance;*
- *Share results of key monitoring activities with interested local stakeholders , First Nations and Metis; and*
- *Participate as a stakeholder in relevant committees or working groups whose purpose is for the ongoing conservation of wildlife.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of wolves and tracks, ungulate mortality sites within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to share local/traditional knowledge.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro to assess project footprint effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of wolf observations;*
- *Design and conduct specific survey methods that sample wolf occurrence along ROW and investigate GPS collared caribou/moose to determine if avoidance of ROW caused by wolves;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on wolves discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including ROW use on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data of wolf populations to inform ongoing analyses related to biophysical monitoring (e.g. harvest data, population survey data, observations, reports);*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Increased wolf prevalence on ROW*
- *Increased collared caribou or moose mortality by wolves*
- *Increased wolf use of ROW resulting from human activity (e.g. packed trails to enhance wolf travel efficiency)*

4.7.6 Black Bear

Although black bears are known to be predators of ungulate neonates, predation rates will vary widely in response to geographic, seasonal, and spatial factors. They are less predatory than wolves, but bear density can be an order of magnitude greater that wolves, and therefore can have a significant effect on ungulate calf mortality (Tigner et al. 2014). Predation rates are thought to be facilitated by linear development. However, bears will avoid linear development with active human activity, as will some of their potential prey species (e.g. moose, caribou).

Objective(s):

- *Assess changes in predation risk to caribou and moose due to Project effects on black bear occurrence and distribution*

Applicable Project Component: C1 (GHA 14A, GHA 19A), , N3 (Wabowden, Reed Lake, Tom Lamb WMA/GHA 8), N4 (Pasquia-Bog, Moose Meadows/GHA 14), N1

Monitoring Activities:

Table 4-26 Black Bear

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Caribou Mortality	Pre-construction/ Construction/ Post construction	Monitor the Project's effect on bear-caused mortality on caribou from changes in bear/caribou occupancy and distribution • Remote cameras to assess bear prevalence • Collared caribou mortality investigation after confirmation of caribou mortality signal from GPS Collar	Presence (change in bear density)	LSA intersection with Wabowden and Bog caribou ranges	4 years pre and 2 years during and 2018,2019,2020 post construction	Continuous	Spring/ Summer (caribou calving period)	Presence/Absence Occupancy Caribou Mortalities

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Provide qualified Environmental Inspectors and Site Environmental Officers to conduct regular inspections of mitigation measure implementation;*
- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Share results of key monitoring activities with interested local stakeholders , First Nations and Metis; and*
- *Participate as a stakeholder in relevant committees or working groups whose purpose is for the ongoing conservation of wildlife.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of bear, dens and tracks, ungulate mortality sites within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to share local/traditional knowledge.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro to assess project footprint effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of wolf observations;*
- *Design and conduct specific survey methods that sample bear occurrence along ROW and investigate GPS collared caribou and moose to determine if caused by bears;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on bears discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data required to assess bear populations and inform ongoing analyses related to biophysical monitoring (e.g. harvest data, population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Increased bear prevalence on ROW*

4.7.7 Furbearers

There is the potential for improved access to resource use areas to result in increased pressure on the resource base if more people frequent an area. In addition, there could be an increase in disturbance to wildlife/game populations in the area which may result in a low level of avoidance by game and furbearers sensitive to repeated disturbance to these areas. Several fur-bearer VECs (e.g. beaver, marten, fisher, wolverine, gray (timber) wolf) may incur a change in distribution or abundance relative to project alignment. Many of the mesocarnivore species (e.g. lynx, bobcat, American marten, fisher, otter, mink, coyote, red fox, weasel spp., and wolverine) are challenging to monitor because, they occur at relatively low densities in closed forest habitats and are difficult or impossible to census using traditional methods designed to target large game species (Ray 2000). Habitat specialists such as American marten and lynx may experience greater effects from habitat loss and fragmentation than habitat generalists such as beaver.

Objective(s):

- *Monitor relative furbearer species composition in relation to potential overharvest, habitat change and altered habitat occupancy*

Applicable Project Component(s): N1, N2, N3, N4

Monitoring Activities:

Table 4-27 Furbearers

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Community Trapping Program – **monitor changes in trapping mortality**	Post-construction	Record all aspects of routine trapping using the community-based monitoring program – systematic trapping effort assessing at distance from disturbance Monitor for barrier effects of ROW hindering small-medium fur-bearer movement	Trapped species availability (harvest) at various distance bands	Community Registered trap lines intersected by Project footprint	2017,2018,2019	Annual	Winter	Harvest success Presence/Absence
Furbearer distribution and occurance	Construction /Post Construction	IR- Camera traps and winter ground transects located along and adjacent to the ROW	LSA scale – seasonal and annual distribution and ROW use	Project LSA	2017,2018,2019	Continuous	Year-round	Presence/Absence

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide funding to Communities or Local Fur Councils to design and implement Community Trapline Monitoring Program within their community/or youth registered traplines;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Summarize results of key monitoring activities in an annual monitoring report;*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis; and*

- *Participate as a stakeholder in relevant committees or working groups whose purpose is for the ongoing conservation of wildlife.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of furbearers and tracks within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to share local/traditional knowledge.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro to assess project footprint effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of furbearer observations;*
- *Work with Community Registered Trapline communities to design and conduct specific survey methods that sample furbearer occurrence along ROW;*
- *Report immediately to Manitoba Hydro any unanticipated project effects on furbearers discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including harvest success on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Communities or Local Fur Councils will be asked to:

- *Participate in Community Trapline Monitoring Program*
- *Work with Specialist to design and conduct specific survey methods that sample furbearer occurrence along ROW;*
- *Analyze, evaluate and report on monitoring findings including harvest success on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*
- *Provide historical and current data required to assess trapping harvest success and inform ongoing analyses related to biophysical monitoring (e.g. harvest data, population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide historical and current data required to assess trapping harvest success and inform ongoing analyses related to biophysical monitoring (e.g. harvest data, population survey data, observations, reports); and*
- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project.*

Decision Trigger(s)/Threshold(s) for Action

- *Project-related significant change in furbearer harvest levels of select furbearer species (marten, fisher, wolverine, gray wolf, blackbear) and/or general furbearer harvest by registered trapline.*
- *Significant project-related change in select furbearer distribution/occurrence relative to the ROW*

4.8 ACCESS

The Project will require several access routes to access the ROW for construction purposes, both existing and some new. Existing road, trails, transmission lines, these routes may require widening and upgrades to facilitate construction vehicles.

A potential effect of the Project to resource use is the use of the ROW as a point of access to previously inaccessible areas for trapping, hunting and gathering. This increased access may place an excessive pressure on the resource populations. Manitoba Hydro through its public engagement programs received continuous feedback and concern about access the ROW could create, CEC recommendations and Environment Act licence conditions also identified the requirement for monitoring of major access points along the ROW. The ROW will be monitored using trail cameras or sensors to track human access from major access points along the transmission line.

Objective(s):

- *Monitor seasonal presence and magnitude of human use of Project ROW's*

Applicable Project Component(s): All

Monitoring Activities:

Table 4-28 Access

Key Monitoring Activity	Phase	Task Description	Parameters	Site Location	Duration	Frequency	Timing	Measurable Indicator(s)
Human Access Monitoring	Construction/Post construction	Remote IR trail cameras or sensors at major access points to the ROW to monitor use of the ROW by humans	Human access	Major access points intersecting Project ROW	During construction and 2018,2019,2020,2021,2022	Continuos	Year-round	Prensence and magnitude of use of ROW by humans

Methods and Reporting

Manitoba Hydro is committed to:

- *Provide digital ortho-rectified imagery or georeferenced digital video/photo products;*
- *Supply an Environmental Protection Information Management System (EPIMS) that manages all project monitoring data and allows Specialist access to daily inspection and monitoring reports from construction period;*
- *Summarize results of key monitoring activities in an annual monitoring report; and*
- *Share results of key monitoring activities with interested local stakeholders, First Nations and Metis.*

Responsibilities of Environmental Monitor include:

- *During construction phase daily activities, record observations of human access within project footprint or access routes;*
- *Record observations with photo and waypoint and store in EPIMS; and*
- *Work with Specialist during field visits to share local/traditional knowledge.*

Specialist will:

- *Use the digital ortho-rectified imagery and/or georeferenced video/photo products provided by Manitoba Hydro to assess project footprint and access effects;*
- *Review Environmental Inspector and Monitor daily reports for identification of human access observations;*
- *Report immediately to Manitoba Hydro any unanticipated project effects as a result of human access discovered through monitoring activities;*
- *Analyze, evaluate and report on monitoring findings including human access on an annual basis; and*
- *Through an adaptive management framework, make recommendations for ongoing improvements to the mitigation measures, monitoring plan, methods, analysis and implementation in response to knowledge gained through ongoing monitoring and associated analysis.*

Manitoba Conservation and Water Stewardship will be asked to:

- *Provide guidance regarding mitigation strategies should unanticipated effects occur as a result of the project*

Decision Trigger(s)/Threshold(s) for Action

- *Increased collared caribou and moose mortality by humans accessing via ROW*
- *Increased human prevalence on ROW*

5.0 REPORTING

Reports detailing results of monitoring activities will be submitted to MCWS on a regular and at minimum annual basis. Reports will initially be generated annually, and provided to Manitoba Conservation and Water Stewardship, as well as uploaded to the Project Website (http://hydro.mb.ca/projects/bipoleIII/). Notifications of new reports on the website will be communicated to relevant federal and provincial regulatory agencies.

In addition to annual reports summarizing activities and general findings, technical reports will be prepared at appropriate intervals during the construction and post construction phases of the Project. These reports will on a cumulative basis compile and analyze monitoring results during the relevant period, and based on those results, make recommendations concerning the need for any changes to the mitigation or monitoring approach. In the spirit of knowledge sharing Manitoba Hydro will present and discuss monitoring results with MCWS, First Nations and Metis on request as the project proceeds.

Any significant unanticipated project effects on wildlife discovered through monitoring activities will be reported immediately to MCWS.

6.0 REFERENCES

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7.0 PROJECT AREA MAP

8.0 APPENDIX

8.1 APPENDIX A

MOOSE DATASETS FOR BIPOLE III PROJECT, AS OF DECEMBER 2017

Survey Method	Extent	Data Type
EIS Joro - HQ Moose Habitat Aerial Survey Blocks (n=4) (100% Coverage)	• **2010 - minimal overlap with ROW** (The Pas (< GHA 6), Webb Lake (< GHA 4), Winnapedi (<<GHA 7A), N Thompson (<<GHA 9A) ~ NW of Split Lake • 2010 – Moose Meadows + GHA 19A • 2012 – Moose Meadows moose count	Winter distribution, popn count
Gasaway Surveys	• MCWS - Various GHAs, various years - including moose sensitive ranges o Moose Meadows (GHA 14) - Jan 2011 o Pine R (GHA 14/14A) – Jan 2011 o Pine R (GHA 14A/19A) – Jan 2013 + **MH Jan 2014 (total count)** o Tom Lamb (GHA 8) - Jan 2011 + Jan 2016 o Red Deer Bog - Jan 2012 (GHA 12) + Jan 2016 (GHA 11) • MH - Keeyask /GHA 9A incl Split Lake – Jan 2010 + Jan 2015 + **MCWS** Jan 2014 (GHA 9A)	Coarse scale winter distribution, pop est,, pop structure
Alaskan Tracker Multi Spp Survey	• **2010** (ROW + 2 km) • **2014** (ROW + 1 +3 km) • **2016** (ROW + 1+ 3+ 5 along ROW +10 at Keeyask, GHA8, Moose Meadows, GHA19A)	Winter distribution (obs + tracks) *** survey design not consistent among years**
EIS Joro - Multi Spp Aerial 1.5-4 km grids	• **2011 only** – P-Bog (GHA 11/12) • **2010 only** – N-Reed (GHA 7) • **2010 + 2011** - Wabowden (<GHA7A + 10)	Winter distribution (obs + tracks) *** Study areas different than monitoring program**
AmecFW Ungulate-Wolf Winter Distribution Surveys (50% coverage)	• **2015** (P-Bog, N-Reed, Wabowden, Charron) • **2016** (P-Bog, N-Reed, Wabowden, Charron) + (The Pas, Moose Meadows) • **2016** Disease monitoring blocks	Winter distribution (obs + tracks)
Winter transects	• Joro EIS – sporadic distribution relative to ROW and short term dataset in LSA (2010) • AmecFW – systematic, annual • **2015** N2, N3 • **2016** N1, N2, N3	Local (**winter**) occurrence of mammals including moose and WTD ingress
Remote Cameras	• EIS (Joro) – sporadic distribution relative to ROW and short term in LSA (2010) • AmecFW – systematic, annual • **2015** N2, N3 • **2016** N1, N2, N3	Local (**seasonal**) occurrence of mammals including moose and WTD ingress