KEEYASK TRANSMISSION PROJECT

ENVIRONMENTAL EFFECTS MONITORING PLAN

ECOSYSTEM DIVERSITY MONITORING IN 2018

Prepared for

Manitoba Hydro

By

ECOSTEM Ltd.

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SUMMARY

This report provides results for the ecosystem diversity monitoring conducted in 2018/2019 for the Keeyask Transmission Project (the Project), specifically for the Generation Outlet Transmission and Unit Lines.

Ecosystem diversity is a type of biodiversity that essentially refers to the variety of ecosystem types. Maintaining native ecosystem diversity is fundamental to maintaining terrestrial ecosystem health. The monitoring uses stand level habitat composition and priority habitat types as the indicators for ecosystem diversity. Priority habitat types are those native habitat types that are regionally rare or uncommon, highly diverse (i.e., species rich and/or structurally complex), highly sensitive to disturbance or have high potential to support rare plants.

Habitat mapping completed for the Project's environmental assessment report identified 110 patches of priority habitat along the Generation Outlet Transmission and Unit Line rights-of-way prior to construction. Of these, 47 were entirely or almost entirely removed by Project clearing. The 63 remaining patches were surveyed from a helicopter, and 23 of these patches were also surveyed by ground.

Monitoring conducted in summer 2018 found that minor effects on the 63 surveyed priority habitat patches. The one effect that was large enough to be detected during the aerial surveys was still small in area. Ground surveys found 14 additional minor effects outside of the cleared ROW at 12 priority habitat patches. All of these effects were localized, small in area and did not extend more than a few meters into the habitat patch.

Effects on priority habitat that were attributed to the Project included tree damage, collapse or mortality at eight locations, and understorey vegetation mortality or loss at seven locations. Observed direct effects included mechanical damage to tree trunks or roots, vegetation and soil excavation, and deposition of excavated material on vegetation in the habitat edge. Likely or possible indirect effects from Project construction included tree windthrow, tree collapse, understorey vegetation mortality and changes to soil conditions. These indirect effects were thought to be related to Project-related alterations to surface water flow, the water table, soil moisture regime, or edge effects (e.g., increased sunlight and wind at the cleared edge).

Likely or possible indirect Project effects on habitat included localized tree mortality, tree collapse, moss and lichen mortality due to erosion and/or possible changes to the moisture regime.

Monitoring results to date indicated that actual Project effects on priority habitats situated along the Generation Outlet Transmission and Unit Lines were consistent with those predicted in the EA Report. Monitoring to date also indicated that Environmental Protection Plan measures were implemented well during Project construction. No follow-up mitigation is recommended based on the findings.

Planned field surveys for priority habitat are now complete. Further field surveys are not recommended given the limited degree of Project effects to date. Results to date, in combination

with mapping completed for a synthesis report in 2019, will confirm actual Project effects on ecosystem diversity during construction.

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STUDY TEAM

Dr. James Ehnes was the project manager and study designer.

Fieldwork in 2018 was conducted by Brock Epp and Nathan Ricard.

Data analysis and report writing in 2018 were completed by Brock Epp and James Ehnes. GIS analysis and cartography was completed by Nathan Ricard.

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1.0 INTRODUCTION

In 2014, Manitoba Hydro received an Environment Act Licence for the construction, operation and maintenance of the Keeyask Transmission Project (the Project). The Project consists of a Construction Power line and Station; four Unit lines originating at the Keeyask Generating Station, and terminating at the Keeyask Switching Station; and three Generation Outlet Transmission (GOT) lines link the Keeyask Switching Station to the northern collector system, terminating at the Radisson Converter Station.

Licence requirements include monitoring the environmental effects of the Project as outlined in the licence conditions and the Project Environmental Assessment (EA) Report (Manitoba Hydro 2012). The Keeyask Transmission Project Environmental Effects Monitoring Plan (Manitoba Hydro 2015) describes how this monitoring will be undertaken.

The Keeyask Transmission Project Environmental Effects Monitoring Plan includes monitoring effects on terrestrial ecosystems and vegetation, focusing on intactness, ecosystem diversity, priority plants and invasive plants. This report provides results for the ecosystem diversity monitoring which is based on field surveys conducted in summer 2018.

Ecosystem diversity refers to the number of different ecosystem types and their areal distribution at various ecosystem levels. Maintaining native ecosystem diversity is fundamental to maintaining terrestrial ecosystem functions and overall ecosystem health.

The indicators for ecosystem diversity are stand level habitat composition and priority habitat types. Priority habitat types are those native habitat types are regionally rare or uncommon, highly diverse (i.e., species rich and/or structurally complex), highly sensitive to disturbance or have high potential to support rare plants.

The EA Report (Manitoba Hydro 2012) predicted that, before considering additional mitigation measures, Project construction is expected to affect 32 of the 46 priority habitat types, and the effects would be relatively small. Project construction will not change the total number of native broad habitat types in the region, and changes in the regional representation of the affected regionally common or uncommon native habitat types is expected to be very small (<=0.01%).

Even with the very small Project effects, the EA Report concluded that cumulative effects on ecosystem diversity from past and current projects and activities were already in the moderate magnitude range for all of the affected priority habitat types. On this basis, mitigation included avoiding all of the priority habitat types to the extent practicable during final routing of the transmission lines. Also, the EnvPPs include measures to minimize the risk that accidental fires and accidental spills will affect priority habitat. The EnvPPs will include measures to minimize the risk that invasive plants will affect terrestrial habitat.

The objectives of the ecosystem diversity monitoring (Manitoba Hydro 2015) are to:

- Determine the degree that priority habitat patches identified for avoidance where practical, are not disturbed; and,
- Confirm actual project effects on ecosystem diversity during construction.

Monitoring activities in the 2018/2019 monitoring year included fieldwork to address the first study objective, specifically with respect to the Keeyask Generation Outlet Transmission (GOT) Line and Unit Line rights-of-way (ROWs). A separate report (ECOSTEM 2017) addressed priority habitat patches affected by the Construction Power Line.

2.0 METHODS

Section 4.2.3 of the monitoring plan outlines the methods for this study (Manitoba Hydro 2015). The following summarizes the activities conducted during summer 2018.

Priority habitat surveys in summer 2018 were conducted along the GOT and Unit Line ROWs. The standard cleared ROW width for the GOT and Unit Line was 200 m and 265 m, respectively. In the field or while examining remote sensing, the standard ROW clearing boundary was the continuous straight line or curve apparent from the hard edge created by ROW clearing.

Habitat mapping completed for the Project environmental impact assessment studies identified 110 priority habitat patches intersecting or within 20 m of the Unit Line and GOT ROW clearing (Table 2-1; Map 2-1). In 2018, monitoring of the priority habitat patches focused on Project effects in the portion of each that was outside of the cleared portion of the ROWs. Forty-seven of these habitat patches were not surveyed because they fell either entirely or almost entirely within the cleared ROW. The remaining 63 priority habitat patches were surveyed by air. The 23 of these that were within walking distance of a road were ground surveyed.

Aerial surveys along the ROWs were conducted by two qualified surveyors in a Bell Jet Ranger helicopter on July 6, 2018. These surveys extended along the entire GOT and Unit Line ROW (Map 2-1). During the aerial surveys, one person noted any disturbances potentially affecting the 63 mapped priority habitat patches adjacent to the ROW as the helicopter flew along each side of the ROW. That person also identified any additional priority habitat patches that may not have been detected in the mapping. Meanwhile, the second surveyor acquired low-level oblique photography of the entire cleared ROW. These photos were reviewed in the office for any evidence that a priority habitat patch had been missed, and to further document effects on the 110 known priority habitat patches.

Ground surveys of priority habitat patches along the Project ROW (Map 2-1) were conducted by a terrestrial ecologist on July 7 to 9, 2018. At each of these priority habitat patches, the surveyor noted any disturbances or understorey clearing within the portion of the priority habitat patch that was outside of the ROW, and unusual impacts within the adjacent transmission ROW (e.g. deep rutting). The location of any encountered impact or effect was recorded with a GPS (Garmin Map 62 or Map 78), and photos were acquired.

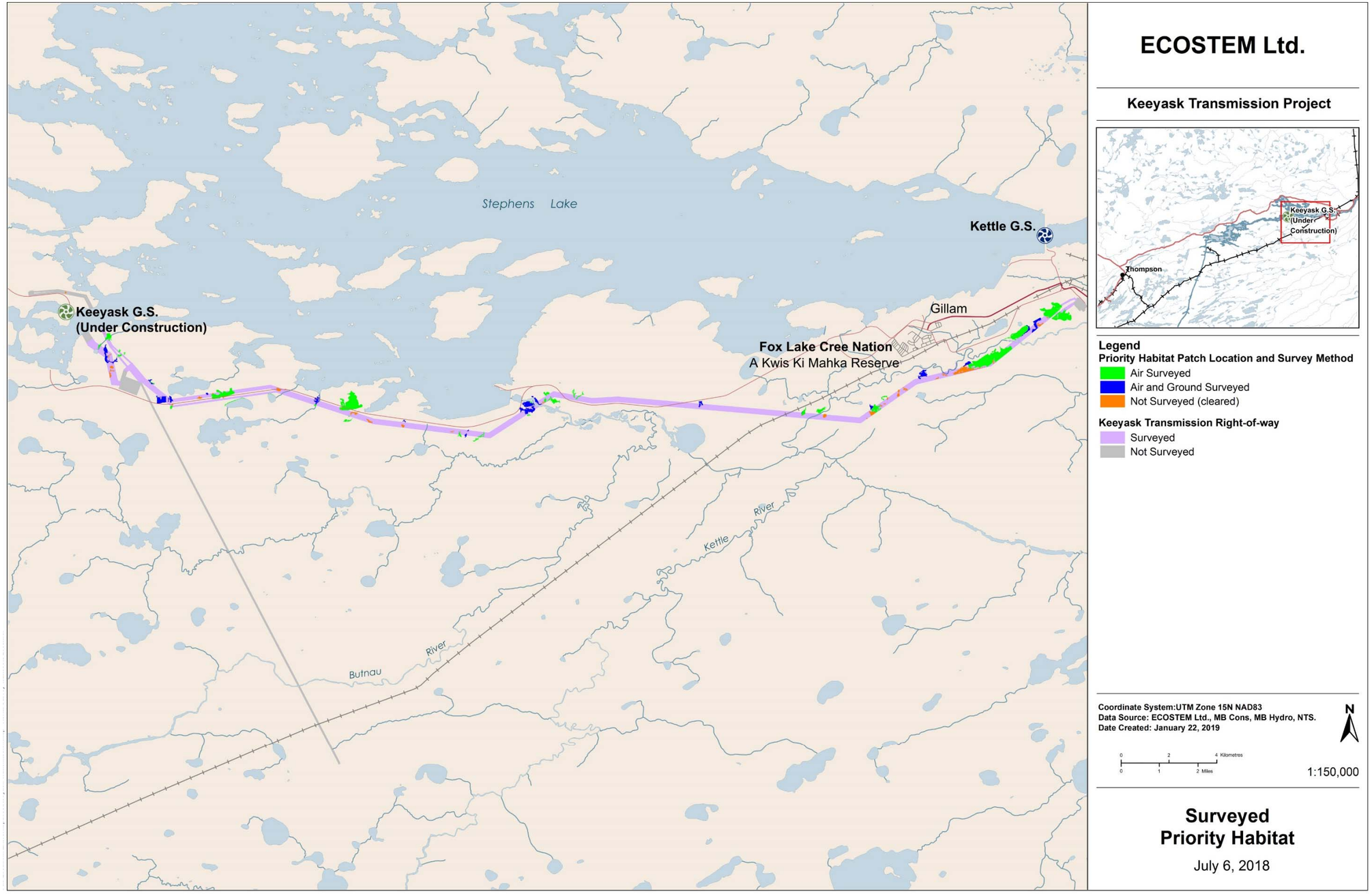
An observed change in was described in terms of the relevant Project impacts at that location and the associated direct and indirect effects on priority habitat. In this report, an impact is what the Project did in terms of the ecosystem component of interest (e.g. vegetation clearing). An effect is any direct or indirect consequence of the source impact (e.g. habitat loss).

Following the field surveys, available information was reviewed for the possible causes of any changes observed in the priority habitat patches. This review evaluated whether or not the change was due to the Project or some other factor such as natural ecosystem dynamics.

Table 2-1: Total number of priority habitat patches adjacent to or overlapping the cleared Project ROWs and their survey type.

Priority Habitat Type	EnvPP Sensitivity Type	Total Number of Patches	Not Surveyed[1]	Surveyed by Air Only	Surveyed by Air and Ground
Black spruce dominant on riparian peatland	Riparian wetland	6	1	5	-
Black spruce mixedwood on mineral	Rare upland forest/woodland	3	3	-	-
Black spruce mixedwood on thin peatland	Rare, highly affected upland forest/woodland	2	2	-	-
Black spruce mixture on mineral	Rare, highly affected upland forest/woodland	6	3	2	1
Black spruce mixture on shallow peatland	Rare forest/woodland on peatland	9	4	5	-
Black spruce mixture on thin peatland	Uncommon forest/woodland on peatland	20	7	1	12
Jack pine dominant on mineral	Rare, highly affected upland forest/woodland	9	3	6	-
Jack pine mixedwood on mineral	Rare, highly affected upland forest/woodland	1	-	1	-
Jack pine mixture on thin peatland	Rare, highly affected upland forest/woodland	5	3	-	2
Tall shrub on riparian peatland	Riparian wetland	4	1	1	2
Tall shrub on shallow peatland	Rare tall shrub on peatland	1	-	1	-
Tall shrub on thin peatland	Rare tall shrub on peatland	5	2	1	2
Tall shrub on wet peatland	Uncommon tall shrub peatland	1	-	1	-
Tamarack dominant on mineral	Rare, highly affected upland forest/woodland	2	1	1	-
Tamarack dominant on shallow peatland	Rare forest/woodland on peatland	1	1	-	-
Tamarack dominant on wet peatland	Uncommon forest/woodland on wet peatland	1	-	1	-
Tamarack mixture on mineral	Rare, highly affected upland forest/woodland	1	1	-	-
Tamarack mixture on shallow peatland	Rare, highly affected forest/woodland on peatland	12	5	6	1
Tamarack mixture on thin peatland	Rare, highly affected forest/woodland on peatland	14	8	3	3
Trembling aspen dominant on all ecosites	Rare, rich, highly affected upland forest/woodland	5	2	3	-
Trembling aspen mixedwood on all ecosites	Rare, rich, highly affected upland forest/woodland	1	-	1	-
Tamarack- black spruce mixture on riparian peatland	Riparian wetland	1	-	1	-
All patches		110	47	40	23

Notes: [1] Not surveyed because they were either entirely or mostly cleared.



Map 2-1: Priority habitat patches surveyed by foot on July 6, 2018

3.0 RESULTS

Priority habitat patches in addition to those already included in the habitat mapping were not identified during the aerial surveys, nor during a subsequent review of the oblique aerial photos acquired during this survey.

The 2018 aerial surveys of the 63 priority habitat patches along GOT and Unit Line ROWs (Table 2-1; Map 2-1) searched for clearing or disturbance outside of the standard ROW clearing boundary. Only one location (patch PH1874) had effects on priority habitat (including the indirect effects of a Project impact) that could be due to the Project. This location was included in the subsequent ground surveys.

During the ground surveys at 23 patches (Table 2-1; Map 2-1), 14 minor effects on priority habitat were observed outside of the cleared ROW (Table 3-1). All of these effects were localized, small in area and not extending more than a few meters from the edge of ROW clearing.

Map 3-1 shows the status of the priority habitat patches as observed during the 2018 aerial and ground surveys, including the type of effect at each patch.

Available information was reviewed for the possible causes of the 15 observed priority habitat effects recorded 12 patches during the aerial and ground surveys. Table 3-1 summarizes impacts, direct effects and indirect effects for each while Photo 3-1 to Photo 3-5 illustrate these them. In each case, the effect on priority habitat was either a direct effect or a mixture of direct and indirect effects (see below).

Natural processes were determined to be the cause for one of the 15 observed effects. At the edge of patch PH1840 (adjacent to a pre-existing deep, wet peatland), tree mortality and collapse extended into the patch for approximately 10 m from the cleared ROW edge (Photo 3-4). While some of the tree collapse closest to the ROW and further away from the wet peatland was likely due to the Project (see below), photography of this particular location from 2009 showed that the tree mortality and collapse was occurring adjacent to the wet peatland before the Project. That habitat change appeared to be caused by permafrost melt, and was therefore not attributed to the Project.

The largest effect by far was the one observed in patch PH1874 during aerial surveys. In this patch, collapsing and dying trees extended for approximately 70 m along a pre-existing runnel. Also, runoff from the ROW was flowing into the patch along this runnel and depositing sediment. Examination of aerial photos of the area taken in 2015 showed that the majority of the tree collapse and mortality that was near the ROW edge occurred after clearing. It is uncertain how much of the total observed tree collapse was due to Project effects. At minimum, some of the effects at the ROW edge were definitely Project-related while the rest was likely accelerated by indirect Project effects.

Five of the remaining 14 effects were definitely due to ROW clearing or transmission tower installation during construction (Table 3-1). Six of the recorded effects were evaluated as being likely due to the Project, and three as being possibly due to the Project.

The five definite Project effects were on trees or understorey vegetation (Table 3-1). At one patch (PH1834) the bark and trunk of a tree adjacent to the clearing was damaged. In patches PH1839, PH1831 and PH1833, excavation was present, or excavated material was deposited over understorey vegetation near the ROW edge. At PH1874, erosion in the ROW was carrying sediment down a runnel that extended into the patch, and this sediment was covering vegetation in the understorey. The tree collapse in this patch was also very likely caused, or at least accelerated by the Project.

At two patches (PH1829, PH1840), several black spruce (*Picea mariana*) trees at the edge were beginning to collapse into the ROW. At each location, tree roots were likely severed by peat scalping in the adjacent ROW (Table 3-1). Another likely indirect Project effect was at patch PH1832, where one black spruce tree at the cleared edge had fallen down, apparently due to windthrow.

At three other priority habitat patches (PH1835, PH1837, PH1842), which were forest or woodland types, ground moss or lichen was either dead or in poor health. This occurred in localized patches adjacent to the cleared edge, and in one case extended for approximately 15 m along the ROW. The mortality extended less than four meters from the cleared edge at all of the locations.

The three effects possibly due to the Project were on tamarack (*Larix laricina*) trees at patches PH1828, PH1840 and PH1839. At each patch, dead or dying tamarack trees were observed within 20 metres of the cleared ROW. This was the only tree species with dead stems in the patch, and the black spruce appeared to be healthy. Tamarack further from the clearing and at other areas along the ROW edge appeared healthy. The mortality was possibly caused by a combination of root damage and change in the soil moisture regime resulting from the ROW clearing and peat scalping (Photo 3-5).

Table 3-1: Priority habitat patches with effects outside of the cleared ROW during 2018 surveys.

Patch ID	Observed Change Type	Observed Change in Priority Habitat Patch[1]	Direct Effect	Indirect Effect- Primary[2]	Extent	Likelihood that Change is Due to Project
PH1834	Tree damage	Bark and trunk damage to one black spruce tree at the edge.	Mechanical construction damage to tree	-	4	Definite
PH1831	Vegetation loss	Excavated organic material deposited on understorey vegetation inside uncleared vegetation.	Excavated material dropped in edge	-	4	Definite
PH1833	Vegetation mortality	Wood chips deposited over understorey vegetation in first 3 m of the edge.	Wood chips dropped in edge	Changes to soil conditions (e.g., temperature, pH, nutrients)	4	Definite
PH1839	Vegetation loss	Excavation for guyline installation extending 4 m into patch.	Excavation and excavated material in edge.	-	4	Definite
	Tree mortality	Two dead tamarack within 4 m of ROW clearing. 2016 photo found that trees had died recently.	Tree roots possibly severed by peat scalping in the ROW	Possible change to water table, moisture regime or other edge effects due to peat scalping in ROW > Drier moisture regime	3	Possible
PH1874	Tree collapse or mortality. Vegetation loss	Tree collapse/mortality and buried understorey along runnel with surface water, erosion and sediment deposition.	None	Increased water flow down runnel after ROW clearing > Erosion > Sediment burying understorey vegetation	2	Definite
PH1840	Tree collapse	Black spruce trees beginning to collapse around a runnel draining out of the ROW and at uncleared edge.	Tree roots severed by peat scalping in the ROW	Support for tree roots partially removed	3	Likely
	Tree mortality	Two dead tamarack within 4 m of ROW.	None	Possible change to water table, moisture regime or other edge effects (e.g., increased light and wind at edge)	3	Possible
	Tree collapse and mortality	Dying and other collapsing black spruce around the runnel. Not attributed to Project as a 2009 photo found that some collapsing trees and mortality was already underway.	None	-	3	None
PH1829	Tree collapse	Collapsing trees at uncleared edge.	Tree roots severed by peat scalping in the ROW	Support for tree partially removed > Drier moisture regime	3	Likely
PH1832	Tree mortality	Windthrow of black spruce tree at edge of ROW.	None	Windthrow	3	Likely
PH1835	Vegetation mortality	Dead and dying moss extending 3 to 4 m into forest for approximately 15 m along ROW edge.	None	Increased light and wind at edge > Drier soil moisture regime > Drying out of peat and moss	4	Likely
PH1837	Vegetation mortality	Localized dead and dying moss and lichen extending 2 m into forest from ROW edge.	None	Increased light and wind at edge > Drier soil moisture regime > Drying out of moss and lichen	4	Likely
PH1842	Vegetation mortality	Localized dead and dying moss extending approximately 2 m into forest from ROW edge.	None	Drier moisture regime due to peat removal in ROW > Drying out of peat and moss	4	Likely

Patch ID	Observed Change Type	Observed Change in Priority Habitat Patch[1]	Direct Effect	Indirect Effect- Primary[2]	Extent	Likelihood that Change is Due to Project
PH1828	Tree mortality	Dead or dying tamarack trees within 20 m of the cleared ROW edge at two locations.	None	Possible change to water table, moisture regime or other edge effects (e.g., increased light and wind at edge)	3	Possible

Notes: [1] Based on field notes and photos. [2] Only those effects that relate to the direct impacts. ">" indicates the pathway of effects.

PH1874 in July, 2018

PH1874 in August, 2015

Source: ECOSTEM Ltd.

Photo 3-1: Erosion and sediment deposition with tree mortality in priority habitat patch PH1874.

PH1834 (mechanical damage to tree)

PH1831 (excavated material outside ROW)

PH1832 (windthrow at ROW edge)

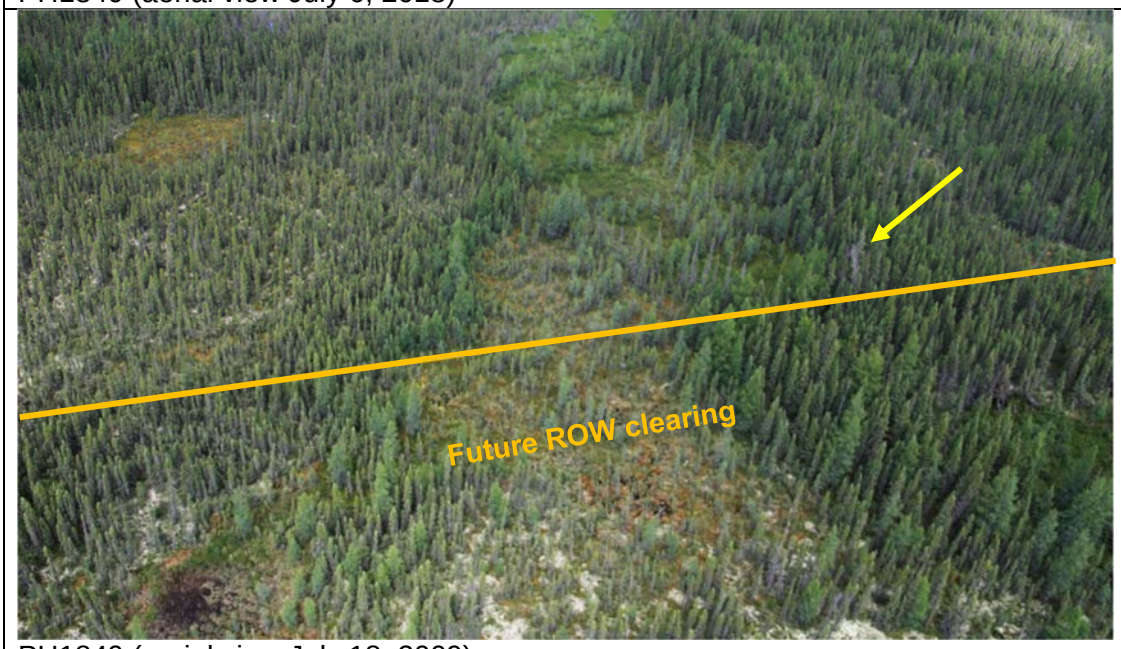
Source: ECOSTEM Ltd. 2018

Photo 3-2: Examples of mechanical damage observed in priority habitat patches in 2018.

Source: ECOSTEM Ltd. 2018

Photo 3-3: Leaning trees adjacent to ROW in priority habitat patch PH1829.

PH1840 (aerial view July 6, 2018)



PH1840 (aerial view July 18, 2009)

Source: ECOSTEM Ltd.

Photo 3-4: Tree collapse and mortality observed beside ROW clearing in 2018 that was present prior to the Project.

PH1837 (dead and dying moss and lichen adjacent to edge of ROW)

PH1839 (dead tamarack)

PH1828 (dead tamarack concentrated at edge of ROW)

Source: ECOSTEM Ltd. 2018

Photo 3-5: Examples of vegetation mortality observed in priority habitat patches in 2018.

Map 3-1: The status of priority habitat patches, and locations where effects occurred outside of the cleared ROW

4.0 SUMMARY

Ecosystem diversity refers to the number of different ecosystem types and their areal distribution at various ecosystem levels. Maintaining native ecosystem diversity is fundamental to maintaining terrestrial ecosystem functions and overall ecosystem health.

The indicators for ecosystem diversity are stand level habitat composition and priority habitat types. Priority habitat types are those native habitat types which are regionally rare or uncommon, highly diverse (i.e., species rich and/or structurally complex), highly sensitive to disturbance or have high potential to support rare plants.

The EA Report (Manitoba Hydro 2012) predicted that the Project would affect 32 of the 46 priority habitat types found in the study region. The Project was not expected to change the regional proportions of any of the regionally common or uncommon native habitat types by more than 0.01%, and that no native habitat type would be removed.

For all 32 of the priority habitat types that would be affected by the Project, the EA Report concluded that cumulative effects of the Project in combination with past and current projects and activities were already in the moderate magnitude range. On this basis, mitigation included avoiding all of these priority habitat types to the extent practicable during final routing of the transmission lines. Also, measures to minimize the risk that accidental fires and accidental spills will affect priority habitat were included in the environmental protection plans (EnvPPs). The EnvPPs also included measures to minimize the risk that invasive plants would affect priority habitat.

Ecosystem diversity monitoring for the Project is: determining the degree to which priority habitat patches are avoided where practical; and, confirming actual Project effects on ecosystem diversity during construction. In support of these objectives, aerial and ground surveys in the 2018/2019 year determined the locations and nature of effects on the priority habitat patches found along the Keeyask Unit Line GOT Line and ROWs.

Pre-Project habitat mapping completed for the environmental assessment report identified 110 priority habitat patches along the Unit Line and GOT ROWs. Additional patches that may have been missed in the mapping were not discovered from the information collected during aerial surveys.

Of 110 priority habitat patches along the Unit Line and GOT ROWs existing prior to the Project, 47 were entirely or almost entirely removed by Project clearing. This left 63 patches to monitor through aerial and ground surveys.

Aerial and ground surveys conducted in July, 2018 found only minor effects on the 63 priority habitat patches that were surveyed. Of the 15 effects observed during these surveys (Map 3-1), one was evaluated to be from natural causes rather than from the Project, five were definitely caused by the Project, six were likely caused by the Project, and three were possibly caused by the Project. Due to their small size, all of these effects were classified as habitat disturbance as opposed to habitat loss or alteration.

Only one of the effects attributed to the Project was large enough to be seen during low-altitude aerial surveys. Aside from that case, all of the remaining effects were localized, small in area and never extending more than four meters from the edge of ROW clearing.

The effect that was evaluated as being from natural causes was a situation where trees were dying and collapsing at the cleared edge of the habitat patch. In the field it appeared that the opening created by ROW clearing or the associated edge effects may have caused a local change to the water regime and/or permafrost melting, leading to tree collapse and mortality. However subsequent review of photography acquired before the Project showed that these trees were already dying and collapsing at that time.

The largest Project effect on priority habitat was at patch PH1874 (i.e., the effect visible during the aerial surveys). This effect consisted of collapsing and dying trees extending for approximately 70 m along a pre-existing runnel. Project related changes associated with this effect included erosion, sedimentation and localized flooding produced by water moving from the cleared ROW into the habitat patch.

Thirteen much lesser effects on priority habitat were identified at 11 of the 23 priority habitat patches (Map 3-1). The types of effects were a mixture of tree damage, collapse or mortality, and understorey vegetation mortality or loss. Definite Project causes of the observed priority habitat effects included mechanical damage to trees or substrate, and erosion or changes to water flow while likely causes included an altered water table or altered moisture regime. The following summarizes Project effects on priority habitat outside of the cleared ROW.

Tree damage, collapse and/or mortality was observed at eight locations in seven habitat patches. These effects were the direct result of construction activity in four cases, and the likely or possible indirect effects of Project construction in the other four cases.

At one location, a tree at the edge of the cleared ROW was snapped by windthrow. A study conducted for the Wuskwatim Transmission Project, which is also in northern Manitoba, found that windthrow was the most common disturbance along the edge of a recently cleared ROW (ECOSTEM 2010).

The other Project sources of likely or possible indirect effects causing tree damage, collapse or mortality were changes to water flow, the water table, or moisture regime related to ROW clearing. At one location, water flow through the ROW appeared to be causing erosion in the patch. The water and sediment were flowing into the patch along a runnel, causing tree collapse and covering understorey vegetation with sediment.

At the other two locations, the cause for tree mortality was more uncertain. While the mortality was limited to tamaracks (black spruce trees still appeared healthy), all of the mortality was within approximately 20 m of the clearing edge. Similar tamarack mortality was also observed at a few locations along the Construction Power ROW during the 2016 surveys (ECOSTEM 2017). In that case, and here, the Project appeared to be the most likely cause of this mortality since all of the affected trees were adjacent to ROW clearing and trees further away appeared healthy. ROW clearing may have damaged tree roots or indirectly led to localized permafrost melting or changes to ground/surface water conditions and/or drainage, which eventually led to tree mortality (see

Section 7.2.5.1 of EA Report for pathways of potential Project effects). However, as stated in ECOSTEM (2017), a natural cause was also possible since tamarack was the only species with mortality.

Other vegetation mortality or loss was observed in the understorey at seven locations. With the exception of the sediment deposition at patch PH1874, the observed habitat change at these locations was quite localized and limited (i.e., not extending more than four meters into the habitat patch and for a short length along the ROW edge). Direct effects from Project construction at three locations were from excavation outside the cleared ROW, or excavated material being dropped into the patch edge. Indirect effects at the remaining three locations appeared to be caused by edge effects and/or peat scalping in the ROW, which resulted in localized moss and lichen mortality near the patch edge. Possible pathways for these edge effects included increased sun exposure and wind exposure at the forest edge, as well as localized changes to ground moisture and drainage due to clearing and removal of organic substrate in the ROW. These impacts and indirect effects can cause the substrate and moss adjacent to the clearing to dry out. Eldegard et al. (2015) found that moss cover declined substantially from the forest interior to the forest edge along transmission lines.

Based on the results, follow-up mitigation at the affected locations is not recommended. At every patch, the effects were likely too small to affect the natural characteristics or functioning of the portion of the priority habitat patch not already subject to edge effects (i.e., resulting from vegetation clearing in the ROW). Additionally, over time, natural revegetation is adequately replace the plants that died, and to cover exposed mineral sites that may become colonization opportunities for invasive plants.

Ground surveys conducted at 23, or 42%, of the priority habitat patches along the ROWs confirmed that ground surveys need not be conducted at every patch. All of the disturbances not observed during aerial surveys were minor based on their nature, size and proximity to the ROW edge.

5.0 CONCLUSIONS

The following are the conclusions from the 2018/2019 priority habitat monitoring.

Monitoring results indicated that actual direct Project effects on priority habitats situated along the GOT Line and Unit Line ROWs were consistent with those predicted in the EA Report. No follow-up mitigation is recommended based on the findings.

Monitoring results also indicated that Environmental Protection Plan measures were well implemented during Project construction.

Planned field surveys for priority habitat are now complete. Further field surveys are not recommended given the limited degree of Project effects to date.

A more detailed evaluation of actual Project effects on priority habitat will be provided in the construction synthesis report. In addition to the results gathered to date, that report will include updated mapping showing actual versus predicted clearing in priority habitat (*i.e.*, for the second study objective).

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