5.0 EFFECTS AND MITIGATION

Manitoba Hydro conducted a process to select the final preferred transmission line routes and station sites, which is described in Chapter 6 of the Environmental Assessment Report (Manitoba Hydro 2012). As a result of the site selection and evaluation process, Construction Power Transmission Alternative 1 and a combination of segments from Generation Outlet Transmission Alternatives B and C (with one minor modification) were the selected routes. The Project Footprint components are shown in Map 5-1.

This section describes and assesses Project effects on terrestrial habitat, ecosystems and plants based on the final selected locations for each Project component, including predicted potential Project effects, mitigation measures designed to minimize effects to the extent practicable, and the expected residual effects with mitigation measures in place. Monitoring is outlined for situations where a prediction has substantial uncertainty or a difference between predicted and actual residual effects could substantially alter the effects assessment.

5.1 OVERVIEW

The potential pathways for Project effects on terrestrial habitat, ecosystems and plants were described in Sections 1.3 and 2.5.

5.1.1 Terrestrial Habitat Affected

5.1.1.1 Construction

During construction, the Project Footprint could directly affect approximately 958 ha of terrestrial habitat (Table 5-1), assuming all of the borrow areas and construction camps are in pre-existing sites and/or within the transmission line ROWs.

The Project was predicted to indirectly affect an additional 628 ha of terrestrial habitat (Table 5-1) based on overestimates of the anticipated width of the terrestrial habitat zone of influence. It was assumed that all terrestrial habitat within 50 m of the transmission line ROWs and within 150 m of the station sites would be indirectly affected whereas the expected distances of effects were 10 m and 50 m, respectively. Two of the Project Footprint components affect no terrestrial habitat area because they are contained within areas where habitat was already altered and/or cleared by previous projects.

Table 5-1: Estimated Maximum Potential Amount (ha) of Terrestrial Habitat Affected During Construction by Source

Project Footprint Component	Area (ha)		
	Project Footprint	Habitat Zone of Influence	Total
Construction Power Station	0	0	0
Construction Power Line	111	173	285
Construction Power Temporary Line	23	17	39
Unit Transmission Lines	81	35	116
Keeyask Switching Station	35	30	64
Generation Outlet Transmission Lines	708	373	1,081
Radisson Converter Station	0	0	0
All	958	628	1,586

Needleleaf treed vegetation on mineral or thin peatland, and on other peatlands made up 85% of the native terrestrial habitat in the Project Footprint (Table 5-2). Most of this land cover was comprised of the black spruce treed on thin peatland (43%) and black spruce treed on shallow peatland (28%) coarse habitat types. Most of the remaining habitat in the Project Footprint was comprised of low vegetation on shallow peatland and low vegetation on mineral or thin peatland (7% combined). Broadleaf treed on all ecosites made up less than 2% of the total land cover in the project footprint. The terrestrial habitat composition of the terrestrial habitat zone of influence was virtually identical to that of the Project Footprint (Table 5-2).

Table 5-2: Composition (percentage) of Terrestrial Habitat Affected During Construction by Habitat Type as a Percentage of Terrestrial Habitat Area

Land Cover Type	Coarse Habitat Type	Project Footprint	Habitat Zone of Influence	Total
Broadleaf treed on all ecosites	Broadleaf mixedwood on all ecosites	1.1	0.8	1.0
	Broadleaf treed on all ecosites	0.5	1.0	0.7
Needleleaf treed on mineral or thin peatland	Black spruce mixedwood on mineral or thin peatland	1.1	0.3	0.8
	Black spruce treed on mineral soil	4.9	5.8	5.3
	Black spruce treed on thin peatland	42.5	39.8	41.5
	Jack pine mixedwood on mineral or thin peatland	0.2	0.3	0.2
	Jack pine treed on mineral or thin peatland	3.1	2.4	2.8
Tall shrub on mineral or thin peatland	Tall shrub on mineral or thin peatland	0.2	0.2	0.2
Low vegetation on mineral or thin peatland	Low vegetation on mineral or thin peatland	1.7	2.1	1.9
Needleleaf treed on other peatlands	Black spruce treed on shallow peatland	28.0	29.1	28.4
	Black spruce treed on wet peatland	2.4	2.4	2.4
	Tamarack treed on shallow peatland	1.9	1.6	1.8
	Tamarack- black spruce mixture on wet peatland	0.3	0.4	0.3
	Tamarack treed on wet peatland	0.1	0.3	0.2
	Black spruce treed on riparian peatland	0.2	0.3	0.2
	Tamarack- black spruce mixture on riparian peatland		0.0	0.0
Tall shrub on other peatlands	Tall shrub on shallow peatland	0.1	0.1	0.1
	Tall shrub on wet peatland	0.2	0.3	0.2
Low vegetation on other peatlands	Low vegetation on shallow peatland	4.9	6.9	5.7
	Low vegetation on wet peatland	2.5	2.0	2.3
Shrub/ low vegetation on riparian peatland	Tall shrub on riparian peatland	0.1	0.1	0.1
	Low vegetation on riparian peatland	0.6	0.8	0.7
Nelson River shore zone	Nelson River shrub and/or low vegetation on ice scoured uplands	0.2	0.2	0.2
	Nelson River shrub and/or low vegetation on sunken peat	3.2	2.9	3.1
All types		100	100	100
Total habitat area (ha)		*958*	*628*	*1,586*

5.1.1.2 Operation

Components of the Project not required for the operation phase include the Construction Power Transmission temporary line and 2 ha of the land on which the Construction Power Station occurs.

The portion of the construction power line ROW allocated for the temporary power line will be left to regenerate to a natural condition after removal of the temporary infrastructure. The extent of native habitat recovery in this ROW will vary depending on a number of factors such as degree of vegetation removal, degree of soil compaction, soil type and topography. Additionally, portions of the decommissioned ROW would become the terrestrial habitat zone of influence for the permanent backup power line. For the Project effects assessment it was cautiously assumed that approximately one half of the area would recover to habitat types. On this basis, the amount of affected terrestrial habitat in the Project Footprint could decline during operation by about 8 ha in the Construction Power Transmission temporary line ROW and by 2 ha in the Construction Power Station site.

Taking a cautious approach, the sizes of the terrestrial habitat zone of influence along the remainder of the Construction Power transmission line ROW and along the Generation Outlet transmission line ROW were assumed to remain unchanged during operation. On this basis, the assumed extent of edge effects during construction and operation were the same.

5.2 VALUED ENVIRONMENTAL COMPONENTS

5.2.1 Fragmentation

Potential Project effects on fragmentation include increased linear feature density, lower total core area and fewer large core areas. Newly constructed roads, transmission lines, trails and cutlines add to linear feature density. Core area is reduced by Project features that either remove existing core area or are near an existing core area. FLCN noted that trappers are concerned about hunters that will use the transmission corridor to access areas (Keeyask Transmission Project Workshop 2012).

5.2.1.1 Construction

Potential Project Effects

Linear Disturbance

The combined total length of the various Project linear features is approximately 147 km, which includes approximately 20.5 km for the construction power line, approximately 112.5

km for the three Generation Outlet Transmission lines and 14 km for the four Unit Transmission Lines.

The Project was predicted to increase total linear feature density from 0.45 km/km^2 to 0.47 km/km^2 for the entire Regional Study Area and from 0.32 km/km^2 to 0.34 km/km^2 in the portion of the Regional Study Area that is outside of the Thompson area. Total linear feature density for the entire Regional Study Area was expected to remain at the low end of the moderate magnitude effects range (between 0.40 km/km^2 and 0.60 km/km^2) and well within the small magnitude range for the Regional Study Area outside of the Thompson area.

Locating the

Core Areas

Project construction would reduce total core area by approximately 1,835 ha (Table 5-3). Since the reduction was relatively small in the regional context, the percentage of the Regional Study Area in core areas larger than 1,000 ha would remain at approximately 82%, which was still well within the small magnitude range of 66% to 100%. The percentage of the Regional Study Area in core areas larger than 1,000 ha would remain at approximately 84%.

Project construction would affect five core areas. Three cores larger than 1,000 ha would be reduced in size and fragmented (Table 5-3). The fifth largest core area in the Regional Study Area would become 1,194 ha smaller and be fragmented into four core areas. The remaining affected core areas are all less than 2,400 in size. One 315 ha core area would be removed.

Table 5-3: Core areas in Existing Environment and During Construction

Core Area ID*	Number of Fragments Post-Project**	Area (ha)		
		Existing Environment	With Project	Change
4	4	69,165	97,972	-1,194
37	1	2,360	2,162	-198
40	2	2,074	2,020	-54
92	1	322	248	-74
94	0	315	0	-315
All		74,236	72,401	-1,835

* See Map 4-1 for core area IDs.
** If the number of fragments equals one then the core area is not subdivided by the Project. If number of fragments equals zero then the core area is either completely lost or subdivide into fragments smaller than 200 ha.

Mitigation

Some of the potential fragmentation effects of the Project were already mitigated through the site selection process for the transmission line routes. Locating the Generation Outlet Transmission line route near existing human features minimized the risk that the ROW would provide hunters with better access to the area. Mitigation beyond that already incorporated through the preferred route selection process was not proposed.

Residual Project Effects

After considering mitigation and the effects of other past and existing human projects and activities, residual Project effects on fragmentation during construction were expected to include a small increase to linear feature density and a very slight reduction to total core area percentage. Total linear feature density for the entire Regional Study Area was expected to remain at the low end of the moderate magnitude effects range (between 0.40 km/km^2 and 0.60 km/km^2) and well within the small magnitude range for the Regional Study Area outside of the Thompson area. The predicted total core area percentage during construction would be reduced from 82.5% to 82.4%, which was considerably above the 65% value for the transition from small to moderate magnitude effects.

Using the criteria established to determine the significance of Project effects for regulatory purposes (Section 2.5.1.6), the likely residual effects of Project construction on fragmentation were expected to be adverse, medium in geographic extent, long-term in duration and small in magnitude.

5.2.1.2 Operation

Potential Project Effects

Removal of the temporary construction power line would reduce the total length of linear features in the Regional Study Area by approximately 5 km. Total linear feature density would remain at 0.47 km/km^2 for the entire Regional Study Area and at 0.34 km/km^2 in the portion of the Regional Study Area outside of the Thompson area.

To the extent that native habitat recovers in the temporary construction line ROW, total core area may increase very slightly over time. It was cautiously assumed that approximately 8 ha of native terrestrial habitat could recover and contribute to core area during operation. On this basis, total core area percentage would remain at 82% for core areas larger than 1,000 ha and at 84% for all core areas.

Mitigation

Mitigation beyond that already incorporated through the preferred route selection was not proposed.

Residual Project Effects

After considering mitigation and the effects of other past and existing human projects and activities, residual Project effects on regional fragmentation were not expected to measurably change during operation.

Using the criteria established to determine the significance of Project effects for regulatory purposes (Section 2.5.1.6), the likely residual effects of Project operation on fragmentation were expected to be adverse, medium in geographic extent, long-term in duration and small in magnitude.

5.2.2 Ecosystem Diversity

The potential pathways of Project effects on terrestrial habitat (Sections 1.3 and 2.5.1.6) also apply to ecosystem diversity because ecosystem diversity indicators were measured using the terrestrial habitat mapping. Potential Project effects on ecosystem diversity include reducing the number of native ecosystem types, altering the distribution of area amongst the ecosystem types, reducing the total number of stands representing an ecosystem type and/or reducing the total area of a priority ecosystem type.

Better access brings more equipment, material and/or people into an area, which could lead to increased resource harvesting, invasive plant spread and human-caused fires, among other things. In extreme cases, a single accidental fire that is severe could alter ecosystem diversity, either by extirpating a habitat type or substantially reducing its abundance (by degrading site conditions and/or decimating the propagule bank). Invasive plants have the potential to crowd out native plant species and, in extreme cases, alter ecosystem diversity through changes to broad habitat composition.

5.2.2.1 Construction

Potential Project Effects

The risk that a Project-related fire would substantially affect native terrestrial habitat composition and priority habitat was anticipated to be low. Transmission line ROW clearing, brush burning and infrastructure construction occurs in the winter. The Environmental Protection Plan (EnvPPs) can include measures to minimize the risk that invasive plants, accidental fires and accidental spills will affect terrestrial habitat.

Habitat Composition Measures

The 1,586 ha of terrestrial habitat directly and indirectly affected by Project construction (Section 5.1.1.1) would have some consequences for the habitat composition and priority habitat measures used to assess ecosystem diversity.

Project construction will not change the total number of native broad habitat types in the Regional Study Area.

Project construction was not expected substantially change the regional proportions of any of the regionally common or uncommon native habitat types. All of the predicted changes are less than 0.01% of existing habitat area (Table 5-4). Changes to the regionally rare habitat types are evaluated below.

Project construction was expected to reduce the total number of stands for four out of the 12 native habitat types with less than 10 stands in the detailed habitat mapping area. Although black spruce mixedwood on thin peatland and tamarack-black spruce mixture on riparian peatland were the most affected, in both cases the removed stands were very small and represented far less than 1% of the total stand area. In addition, it was likely that there were additional stands representing each of these habitat types in the portion of the Regional Study Area that was outside of the detailed habitat mapping area. A simple area based extrapolation to provide a very crude estimate increased the total number of stands for each type by approximately 7.5 times.

Table 5-4: Estimated Broad Habitat Composition (percentage) of the Regional Study Area in the Existing Environment and With the Project

Broad Habitat Type	Existing Environment	With Project
Black spruce dominant on shallow peatland	20.5	20.5
Black spruce dominant on thin peatland	32.6	32.6
Low vegetation on mineral soil	0.4	0.4
Black spruce dominant on ground ice peatland	12.0	12.0
Black spruce mixture on ground ice peatland	0.1	0.1
Jack pine mixture on ground ice peatland	0.0	0.0
Low vegetation on ground ice peatland	3.7	3.7
Tall shrub on ground ice peatland	0.1	0.1
Tamarack dominant on ground ice peatland	0.0	0.0
Tamarack mixture on ground ice peatland	0.1	0.1
Balsam poplar dominant on all ecosites	0.0	0.0
Balsam poplar mixedwood on all ecosites	0.0	0.0

Table 5-4: Estimated Broad Habitat Composition (percentage) of the Regional Study Area in the Existing Environment and With the Project

Broad Habitat Type	Existing Environment	With Project
Black spruce dominant on mineral	7.7	7.7
Black spruce dominant on riparian peatland	0.7	0.7
Black spruce dominant on wet peatland	2.1	2.1
Black spruce mixedwood on mineral	0.2	0.2
Black spruce mixedwood on shallow peatland	0.0	0.0
Black spruce mixedwood on thin peatland	0.1	0.1
Black spruce mixture on mineral	0.8	0.8
Black spruce mixture on shallow peatland	0.5	0.5
Black spruce mixture on thin peatland	0.6	0.6
Black spruce mixture on wet peatland	0.1	0.1
Jack pine dominant on mineral	1.2	1.2
Jack pine dominant on shallow peatland	0.0	0.0
Jack pine dominant on thin peatland	0.1	0.1
Jack pine mixedwood on mineral	0.2	0.2
Jack pine mixedwood on shallow peatland	0.0	0.0
Jack pine mixedwood on thin peatland	0.1	0.1
Jack pine mixture on shallow peatland	0.0	0.0
Jack pine mixture on thin peatland	0.4	0.4
Low vegetation on riparian peatland	1.9	1.9
Low vegetation on shallow peatland	3.3	3.3
Low vegetation on thin peatland	4.2	4.2
Low vegetation on wet peatland	1.6	1.6
Tall shrub on mineral	0.0	0.0
Tall shrub on riparian peatland	0.6	0.6
Tall shrub on shallow peatland	0.3	0.3
Tall shrub on thin peatland	0.2	0.2
Tall shrub on wet peatland	0.1	0.1
Tamarack- black spruce mixture on riparian peatland	0.0	0.0
Tamarack dominant on mineral	0.0	0.0
Tamarack dominant on riparian peatland	0.0	0.0
Tamarack dominant on shallow peatland	0.0	0.0
Tamarack dominant on thin peatland	0.0	0.0
Tamarack dominant on wet peatland	0.2	0.2
Tamarack mixture on mineral	0.1	0.1
Tamarack mixture on shallow peatland	0.3	0.3

Table 5-4: Estimated Broad Habitat Composition (percentage) of the Regional Study Area in the Existing Environment and With the Project

Broad Habitat Type	Existing Environment	With Project
Tamarack mixture on thin peatland	0.2	0.2
Tamarack mixture on wet peatland	0.8	0.8
Trembling aspen dominant on all ecosites	0.6	0.6
Trembling aspen mixedwood on all ecosites	0.5	0.5
White birch dominant on all ecosites	0.0	0.0
White birch mixedwood on all ecosites	0.0	0.0
Emergent on upper beach	0.0	0.0
Emergent on lower beach	0.0	0.0
Emergent island in littoral	0.0	0.0

Priority Habitat Types

Before considering additional mitigation measures, the Project is not expected to affect 14 of the 46 priority habitat types. The Project could affect up to 0.8% of the area of the remaining priority habitat types (Table 5-5). Past and current projects have already affected many priority habitat types to the extent that moderate magnitude effects already exist. After considering the effects of the Project in combination with these projects, the Project was not expected to increase effects to 10% of historical area for any of the priority habitat types (Table 5-5). For all of the affected priority habitat types, estimated Project effects in combination with past and current projects accounted for less than 6% of historical area, which was substantially lower than the 10% benchmark used to identify high magnitude effects.

In descending order, the priority habitat types that were most affected before mitigation were tamarack mixture on shallow peatland, tamarack mixture on mineral, tamarack mixture on thin peatland, black spruce mixedwood on mineral and tamarack dominant on mineral (Table 5-5).

FLCN expressed concern that the switching station is on or near a jack pine ridge, which is a rare vegetation type, and would prefer not to see a tower there (Keeyask Transmission Project Workshop. 2012). It was determined that the jack pine ridge is southeast of the final switching station location.

Table 5-5: Estimated Amounts of Priority Habitat Affected by the Project as a Percentage of Regional Study Area land area, and in Combination with Historical Effects

Priority Habitat Type	Rarity (R, U, D, S)*	Project Footprint	Project Footprint and Zone of Influence	In Combination With Historical Effects
Balsam poplar dominant on all ecosites	RD	-	-	5.0
Balsam poplar mixedwood on all ecosites	RDS	-	-	-
Black spruce dominant on mineral	U	0.0	0.1	5.0
Black spruce dominant on riparian peatland	RDS	0.0	0.0	5.0
Black spruce dominant on wet peatland	UD	0.1	0.1	5.1
Black spruce mixedwood on mineral	R	0.3	0.4	5.3
Black spruce mixedwood on shallow peatland	RD	-	-	5.0
Black spruce mixedwood on thin peatland	RDS	0.1	0.1	5.0
Black spruce mixture on mineral	RD	0.0	0.1	5.0
Black spruce mixture on shallow peatland	RD	0.2	0.2	5.2
Black spruce mixture on thin peatland	R	0.2	0.3	5.3
Black spruce mixture on wet peatland	R	0.0	0.1	5.0
Jack pine dominant on mineral	UDS	0.2	0.2	5.2
Jack pine dominant on shallow peatland	RS	-	-	5.0
Jack pine dominant on thin peatland	RDS	0.0	0.0	5.0
Jack pine mixedwood on mineral	RD	0.1	0.2	5.1
Jack pine mixedwood on shallow peatland	RS	-	-	5.0
Jack pine mixedwood on thin peatland	RDS	-	0.0	5.0
Jack pine mixture on shallow peatland	RDS	-	-	5.0
Jack pine mixture on thin peatland	R	0.1	0.1	5.0
Low vegetation on riparian peatland	U	0.0	0.0	5.0
Low vegetation on shallow peatland	U	0.1	0.1	5.1
Low vegetation on thin peatland	U	0.0	0.1	5.0
Low vegetation on wet peatland	U	0.1	0.2	5.1
Tall shrub on mineral	RD	-	-	5.0
Tall shrub on riparian peatland	R	0.0	0.0	5.0
Tall shrub on shallow peatland	RDS	0.0	0.1	5.0
Tall shrub on thin peatland	RDS	0.1	0.2	5.1
Tall shrub on wet peatland	R	0.1	0.2	5.1
Tamarack- black spruce mixture on riparian peatland	RD	-	0.0	5.0
Tamarack dominant on mineral	RDS	0.1	0.4	5.3
Tamarack dominant on riparian peatland	R	-	-	-
Tamarack dominant on shallow peatland	R	-	-	-

Table 5-5: Estimated Amounts of Priority Habitat Affected by the Project as a Percentage of Regional Study Area land area, and in Combination with Historical Effects

Priority Habitat Type	Rarity (R, U, D, S)*	Project Footprint	Project Footprint and Zone of Influence	In Combination With Historical Effects
Tamarack dominant on thin peatland	RDS	-	0.0	5.0
Tamarack dominant on wet peatland	R	0.0	0.1	5.1
Tamarack mixture on mineral	RDS	0.2	0.5	5.4
Tamarack mixture on shallow peatland	RD	0.5	0.8	5.7
Tamarack mixture on thin peatland	RDS	0.2	0.4	5.4
Tamarack mixture on wet peatland	RD	0.0	0.0	5.0
Trembling aspen dominant on all ecosites	RD	0.1	0.2	5.1
Trembling aspen mixedwood on all ecosites	RDS	0.2	0.3	5.2
White birch dominant on all ecosites	RD	-	-	5.0
White birch mixedwood on all ecosites	R	-	-	5.0
Emergent on upper beach	R	-	-	1.7
Emergent on lower beach	R	-	-	1.7
Emergent island in littoral	R	-	-	1.7

Notes: R = Rare, U = Uncommon, D = Diverse, S = Relatively high potential to support rare plant species.

Mitigation

Since ecosystem diversity effects from past and current projects and activities were already in the moderate magnitude range for all of the affected priority habitat types, all of these types will be avoided to the extent practicable during final routing of the transmission lines for the EnvPPs. Additionally, since this Project will not proceed without the Keeyask Generation Project, consideration was given to interactions with the Keeyask Generation Project as described in Section 5.4. Those priority habitat types identified by the Keeyask Generation Project Environmental Impact Statement as being of particular concern will be given special consideration for avoidance during the final transmission line routing.

The EnvPPs will include measures to minimize the risk that accidental fires and accidental spills will affect terrestrial habitat. The EnvPPs will also include measures to minimize the risk that invasive plants will affect terrestrial habitat. Control and eradication measures will be implemented in the event that invasive plants become a problem.

Residual Project Effects

After considering mitigation and the effects of other past and existing human projects and activities, Project construction was not expected to create additional effects on 14 priority habitat types and was expected to affect between 0.1% and 0.8% of the estimated area for the 32 remaining priority habitat types. After considering these remaining Project effects in combination with other past and current projects and activities, it was predicted that the residual effects of Project construction on ecosystem diversity would include affecting between 5.0% and 5.8% of estimated historical area for 32 priority habitat types, which was well within the range for moderate magnitude effects.

Using the criteria established to determine the significance of Project effects for regulatory purposes (Section 2.5.1.6), the likely residual effects of Project construction on ecosystem diversity were expected to be adverse, medium in geographic extent, long term in duration and, depending on the ecosystem diversity indicator either nil or moderate in magnitude. The moderate magnitude residual effects were expected to be irreversible, continuous in frequency, and low in ecological context.

5.2.2.2 Operation

Potential Project Effects

As described in Section 5.1.1.2, the decline in habitat affected during operation when compared to construction was expected to be very small in regional terms. Since the ecosystem diversity indicators were measured using habitat composition, Project effects on ecosystem diversity were not expected to substantially change from construction to operation.

Mitigation

Mitigation during operation, in addition to that already incorporated during construction, was not proposed.

Residual Project Effects

After considering mitigation and the effects of other past and existing human projects and activities, Project operation was not expected to create additional effects on 14 priority habitat types and was expected to affect between 0.1% and 0.8% of the estimated area for the 32 remaining priority habitat types. After considering these remaining Project effects in combination with other past and current projects and activities, it was predicted that the residual effects of Project operation on ecosystem diversity would include affecting between 5.0% and 5.8% of estimated historical area for 32 priority habitat types, which were moderate magnitude effects.

Using the criteria established to determine the significance of Project effects for regulatory purposes (Section 2.5.1.6), the likely residual effects of Project operation on ecosystem diversity were expected to be adverse, medium in geographic extent, long term in duration and, depending on the ecosystem diversity indicator either nil or moderate in magnitude. The moderate magnitude residual effects were expected to be irreversible, continuous in frequency, and low in ecological context.

5.2.3 Priority Plants

Direct Project effects on terrestrial plants will include loss and disturbance of plants and plant populations as well as loss, alteration and disturbance of their habitats in the Project Footprint and any Project activities that may ultimately occur outside of the Project Footprint, if any. These direct effects will lead to indirect effects on terrestrial plants, both within the Project Footprint and in some adjacent areas surrounding the physical footprint, through pathways such as edge effects and altered groundwater levels. That is, a Project impact creates indirect effects on plants, which are referred to as the terrestrial plants zone of influence. A particular indirect effect can be several stages removed from the direct Project effect. For example, clearing trees on permafrost soils often leads to higher soil temperatures within and adjacent to the cleared area. Many of the potential pathways for Project effects on plants are demonstrated in Figure 2-2.

The size and nature of an impact's zone of influence will be a function of how the impact interacts with the plant species of interest and local conditions. For example, vegetation clearing in dense, mature forest on permafrost soils will have a much larger zone of influence than vegetation clearing on a bedrock outcrop. The nature and spatial extent of indirect effects on plants and their habitat will range from not measurable to conversion to aquatic vegetation.

In general, Project effects on plants were expected to decline with distance from the Project Footprint and be confined to the terrestrial habitat zone of influence that is described in Section 1.3. The spatial extent of the Project zone of influence on terrestrial plants (*i.e.*, the terrestrial plants zone of influence) was expected to be the same as the terrestrial habitat zone of influence, which was generally less than 10 m adjacent to transmission line ROWs and less than 50 m around the stations. For the effects assessment, it was cautiously assumed that all plants within 50 m of the transmission line ROWs and within 150 m of the stations would be affected by the Project. That is, it was assumed that all terrestrial plants in the Terrestrial Plants Local Study Area (Map 2-5) would be affected.

Improved access is another potentially important pathway for indirect Project effects on terrestrial plants since this will bring more equipment, material and/or people into an area, which could lead to increased resource harvesting, invasive plant spreading and/or human-caused fires, among other things. The Generation Outlet Transmission ROW was not

expected to substantially increase plant harvesting since it will largely follow roads. Access along the Construction Power Transmission ROW will be difficult in the summer due to its remoteness and the number of waterways and very wet wetlands that cross the route.

Due past projects, berry patches were lost through hydro development related infrastructure including converter stations, transmission lines, camps, borrow areas, and roads (FLCN. SV. 2012)

Past and current projects and activities, as well as natural dispersal processes, have introduced and will continue to introduce and spread invasive plants into the Terrestrial Plants Local Study Area. The Project was not expected to substantially increase the rate at which invasive plants are introduced and/or spread in the Terrestrial Plants Local Study Area. Project environmental protection plans can include measures that minimize the risk that equipment transported to the area will spread seeds in the area. Additionally, weed control on the rights-of-way is required for regulatory (i.e., *The Noxious Weed Act*), operational and safety reasons.

5.2.3.1 Construction

Potential Project Effects

Endangered and Threatened Plant Species

Project effects on endangered or threatened plant species during construction are not expected since none of these species are either known to occur or expected to occur within the terrestrial plants zone of influence (see Section 3.2.4.2).

Provincially Very Rare to Uncommon Plant Species

Project effects on provincially very rare plant species were not expected since none were found during extensive field studies in the Regional Study Area and, to the extent that these species were associated with regionally rare habitat types, Project effects on their anticipated habitats were expected to be nil or low, depending on the species (see Section 5.2.2).

Elegant hawk's-beard was the only species found during field studies with an uncertain rank of provincially very rare or rare. The likelihood that it occurred in the terrestrial plants zone of influence Terrestrial Plants Local Study Area was considered to be low because it was not found there during extensive field studies in the Local Study Area and its recorded local habitat was roadsides.

The three provincially rare to uncommon plant species recorded in the Terrestrial Plants Local Study Area during field studies were swamp lousewort, rock willow and shrubby willow.

Project effects on swamp lousewort were not expected. The only recorded location for this species in the Project Study Area was within the Terrestrial Plants Local Study Area outside of the Construction Power Transmission ROW in a horizontal fen. Since this fen extends into the ROW, it is possible that additional swamp lousewort locations occur in the Project Footprint at this location. ROW clearing was not expected to have overstorey removal or edge effects on swamp lousewort at this location because clearing is not required where the ROW crosses this fen since the vegetation is already low. Once pre-construction rare plant surveys are completed, access trails can be routed to avoid any potential effects on unobserved plants. Towers can be located outside of the area where the ROW crosses this fen. Indirect effects on hydrology were not expected since there is no vegetation clearing and construction occurs in the winter.

Project effects on rock willow were expected to be low. After correcting for differences in sampling intensity (Section 2.2.4), the estimated percentage of locations in the Regional Study Area falling within the Terrestrial Plants Local Study Area was approximately 0.8 % (Table 5-6). Rock willow was found at an additional 399 locations northeast of the Regional Study Area.

Project effects on shrubby willow were expected to be low. Approximately 0.8% of the estimated number of shrubby willow locations in the Regional Study Area were within the Terrestrial Plants Local Study Area (Table 5-6). Shrubby willow was found at an additional 745 locations northeast of the Regional Study Area. Shrubby willow was often recorded on veneer bogs on slopes, which was a common habitat type in the Regional Study Area.

Section 3.3.2.4 identified an additional 50 species ranked as being of provincial conservation concern that were not found but could potentially occur in the Terrestrial Plants Local Study Area. Of these, the 42 species ranked S1 to S2 were of highest concern. None of these species were found in the Terrestrial Plants Local Study Area despite extensive surveys in these areas. To the extent that the distributions of the provincially very rare to uncommon plant species were related to broad habitat type, Project-related effects on all of the native broad habitat types were expected to be nil to moderate in magnitude (Section 5.2.2).

Regionally Rare and Range Limit Plant Species

Seven regionally rare and/or range limit plant species were observed within the Terrestrial Plants Local Study Area. Of these, balsam poplar, goldthread, jack pine, northern Labrador-tea and hairy goldenrod were the species not already discussed in the previous section.

After correcting for differences in sampling intensity (Section 2.5.2.3), the estimated percentage of known locations in the Regional Study Area falling within the Terrestrial Plants Local Study Area was less than 1% for all five species except for goldthread (Table 5-6). The Project could affect approximately 3% of goldthread locations before considering mitigation.

An additional 28 regionally rare and 4 range limit species were not encountered but could potentially occur in the Terrestrial Plants Local Study Area. To the extent that the distributions of these species were related to the broad habitat types, the Project was predicted to affect less than 1% of their habitat.

Plant Species of Particular Interest to the KCNs

Seven of the eleven species identified as being of particular interest to the KCNs were recorded in the Terrestrial Plants Local Study Area. These species were white birch (16 locations), northern Labrador-tea (1 location), red currant (1 location), cloudberry (12 locations), red raspberry (3 locations), bog bilberry (14 locations) and rock cranberry (26 locations). Substantial Project effects on the species of particular interest to the KCNs were not expected. Most of these species were either generally widespread or widespread in their preferred habitat. After correcting for differences in sampling intensity, the percentage of locations within the Terrestrial Plants Local Study Area was less than 1% for all species. Additionally, to the extent that the distributions of these species was related to broad habitat type, the Project was predicted to affect less than 1% of their habitat (Table 5-6).

Mitigation

Because it is possible that existing locations of swamp lousewort and other provincially very rare to rare species were not found, mitigation for these species will include:

- In the segment of the Construction Power Transmission line ROW that is near the swamp lousewort location, access trails will be located to avoid swamp lousewort locations and towers will be sited outside of the area where the ROW crosses this fen;
- Pre-construction rare plant surveys will be conducted in portions of the Terrestrial Plants Local Study Area that were not previously surveyed and have the highest potential for supporting provincially very rare to rare species; and,
- In the unlikely event that a provincially very rare to rare species is discovered in the Project Footprint, the plants will be transplanted outside of the Terrestrial Plants Local Study Area.

Table 5-6: Number of Observations of Provincially Rare Plant Species in the Project Footprint and Other Study Areas

S-Rank	Species		Number of Locations Recorded During Field Studies**					Estimated Percentage of Total Locations***
	Scientific Name*	Common Name	Project Footprint	Construction Zone of Influence	Operation Zone of Influence	Regional Study Area	Areas to the Northeast	
Provincially Rare								
S2	*Pedicularis macrodonta*	swamp lousewort	0	1	1	7	12	0.5
S3	*Salix arbusculoides*	shrubby willow	2	1	1	38	745	0.3
S3	*Salix vestita*	rock willow	1	1	1	26	399	0.3
Regionally rare								
S5	*Populus balsamifera*	balsam-poplar	3	0	0	62	947	0.2
Range Limit								
S5	*Coptis trifolia*	goldthread	1	0	0	2	3	3.0
S5	*Pinus banksiana*	jack pine	4	0	0	104	56	0.2
S4	*Rhododendron tomentosum*	northern Labrador-tea	1	0	0	7	221	0.5
S5	*Solidago hispida*	hairy goldenrod	1	2	2	30	36	0.5
KCN importance								
S5	*Betula papyrifera*	white birch	12	4	4	197	181	0.4
S5	*Ribes triste*	red currant	1	0	0	66	285	0.1
S5	*Rubus chamaemorus*	cloudberry	11	1	1	178	304	0.3
S5	*Rubus ideaus*	red raspberry	2	1	1	30	123	0.5
S5	*Vaccinium uliginosum*	Bog bilberry	11	3	3	309	986	0.2
S5	*Vaccinium vitis-idaea*	rock cranberry	20	6	6	392	844	0.3

* *Salix arbusculoides* and *Salix vestita* are also range limit species. *Rhododendron tomentosum* is also a KCN importance species.
** Number of locations is the total within the area only except for Regional Study Area which includes all of the nested areas within it.
*** Estimated percentage of Regional Study Area locations is after correcting for the much lower sampling density in the Regional Study Area compared with the Project Footprint and terrestrial plants zone of influence using the method described in Section 2.5.2.3.

Additional mitigation during construction to minimize the risk of introducing and spreading invasive plants will include:

- Equipment and machinery that was recently used more than 150 km from the Project area will be washed prior to transport to the Project area;
- Containment, eradication, and/or control programs will be implemented if monitoring identifies problems with invasive plants; and,
- Personnel working on the Project will be educated about the importance of cleaning their vehicles, equipment and footwear before travelling to the area.

Mitigation for habitat effects provided by the mitigation for priority habitats could benefit priority plants to the extent that a species is associated with these habitat types.

The EnvPPs will include measures to minimize the risk that accidental fires and accidental spills will affect priority plants.

The risks that there would be adverse Project effects on priority plants due to Project-related spreading of invasive plants, increased harvesting and fire regime changes should be low assuming that the EnvPP measures are effective.

Residual Project Effects

After considering mitigation and the effects of other past and existing human features, substantial residual Project effects on priority plants during construction were not expected. None of the species of highest conservation concern are either known or expected to occur in the Terrestrial Plants Local Study Area. For the remaining species, the Project was expected to affect low percentages of their known locations and/or available habitat.

Using the criteria established to determine the significance of Project effects for regulatory purposes (Section 2.5.1.6), the likely residual effects of Project construction on priority plants were expected to be adverse, medium in geographic extent, long-term in duration and, depending on the species, nil to moderate in magnitude.

5.2.3.2 Operation

Potential Project Effects

As described in Section 5.1.1.2, the decline in habitat area affected during operation when compared to construction was expected to be very small in regional terms. Consequently, Project effects on priority plants during operation were expected to remain similar to those described for Project construction. The potential for maintenance activities to affect priority plant

locations or further spread invasive plants was not expected to change substantially when compared with the construction phase.

Herbicides may be used to control the growth of trees in the ROW. Since these herbicides are formulated to target broad-leafed plants, they may affect species of conservation concern.

Mitigation

Mitigation during operation to minimize the risk of introducing and spreading invasive plants will include:

- Equipment and machinery that was recently used more than 150 km from the Project area will be washed prior to transport to the Project area;
- Containment, eradication, and/or control programs will be implemented if monitoring identifies problems with invasive plants;
- Personnel working on the Project will be educated about the importance of cleaning their vehicles, equipment and footwear before travelling to the area; and,
- The locations of any provincially very rare or rare species in the transmission line rights-of-way will be clearly and permanently marked. Herbicides will not be applied within 100 m of these locations.

Residual Project Effects

After considering mitigation and the effects of other past and existing human features, substantial residual Project effects on priority plants during operation were not expected. None of the species of highest conservation concern were expected to occur in the Terrestrial Plants Local Study Area. For the remaining species, the Project was expected to affect low percentages of their known locations and/or available habitat.

Using the criteria established to determine the significance of Project effects for regulatory purposes (Section 2.5.1.6), the likely residual effects of Project operation on priority plants were expected to be adverse, medium in geographic extent, long-term in duration and, depending on the species, nil to moderate in magnitude.

5.3 RESIDUAL EFFECTS

This section summarizes the residual effects conclusions for the VECs used for the terrestrial habitat, ecosystems and plants assessment.

5.3.1 Fragmentation

Overall, the likely residual Project effects on regional fragmentation were expected to be adverse but regionally acceptable because the increase to total linear feature density was small, no very large core areas were lost and core area percentage was expected to remain over 80%, which was well within the small magnitude range. In part this occurred because the Project was located in a portion of the Regional Study Area where fragmentation already exists due to past and current human development.

Using the criteria established to determine the significance of Project effects for regulatory purposes, the likely residual effects of Project operation on fragmentation were expected to be adverse, medium in geographic extent, long-term in duration and small in magnitude.

5.3.2 Ecosystem Diversity

Overall, the likely Project residual effects on ecosystem diversity were expected to be adverse but regionally acceptable because no stand level habitat types were lost, the distribution of area amongst the stand level habitat types was not expected to change substantially and the cumulative area losses for all of the priority habitat types remained well below 10%.

Using the criteria established to determine the significance of Project effects for regulatory purposes, the likely residual effects of Project operation on ecosystem diversity were expected to be adverse, medium in geographic extent, long term in duration and, depending on the ecosystem diversity indicator either nil or moderate in magnitude. The moderate magnitude residual effects were expected to be irreversible, continuous in frequency, and low in ecological context.

5.3.3 Priority Plants

Overall, the likely Project residual effects on priority plants were expected to be adverse but regionally acceptable. Project effects on endangered or threatened plant species were not expected since none of these species were either known to occur or were expected to occur in areas affected by the Project. Effects on the species of particular interest to the KCNs were expected to be low because most of these species were widespread in appropriate habitats and the percentages of known locations and/or available habitat affected by the Project were low. While the Project would affect the locations and/or habitat for some of the remaining priority plant species, the magnitude of these effects was anticipated to range from small to moderate, depending on the species, based on the percentage of known locations affected and/or the cumulative percentage area losses for the native habitat types. Regarding ecological context for species with moderate magnitude effects, although population trend information for these species in the Regional Study Area was not available, there were no substantial ongoing adverse trends in the amounts of native habitat types (Section 2 of Keeyask HydroPower

Partnership 2012b). Additional pre-construction mitigation was included for the species of highest conservation concern to address the unlikely event that patches of these species exist but were not discovered to date due to the rarity of the species.

5.3.4 Summary

Table 5-7 summarizes the predicted residual effects and assessment conclusions for the VECs.

Table 5-7: Residual Environmental Effects summary – Terrestrial Habitat, Ecosystems and Plants

VEC	Project Component	Phase	Residual Effects	Assessment
Fragmentation	Construction Power, Generation Outlet and Unit Transmission Lines	Construction & Operation	Small increase to linear feature density.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
	All Project components	Construction & Operation	Very slight reduction to total percentage of Regional Study Area in core areas.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Ecosystem Diversity	All Project components	Construction & Operation	Remove or alter priority habitat.	Direction: Adverse Magnitude: Nil or moderate depending on the priority habitat type Geographic Extent: Small to medium depending on the priority habitat type Duration: Long-term **Overall – Not Significant**
Priority Plants	All Project components	Construction & Operation	Remove or alter priority plants.	Direction: Adverse Magnitude: Nil or moderate depending on the priority plant species Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**

Table 5-7: Residual Environmental Effects summary – Terrestrial Habitat, Ecosystems and Plants

VEC	Project Component	Phase	Residual Effects	Assessment
	All Project components	Construction & Operation	Remove or alter priority plant habitat.	Direction: Adverse Magnitude: Nil or moderate depending on the priority plant species Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**

Notes: See Table 2-6 for definition of criteria used to assess residual Project effects.

5.4 INTERACTIONS WITH FUTURE PROJECTS

5.4.1 Introduction

For all of the VECs, adverse residual effects were evaluated for interactions with reasonably foreseeable future projects and human activities. The effects past and current projects and activities was described in the preceding sections as a component of the residual effects assessment for each VEC. The reasonably foreseeable future projects and activities considered for the cumulative effects assessment were Bipole III Transmission Project, Gillam Redevelopment, Conawapa Generation Project and the Keeyask Generation Project. The information provided below was largely based on the analysis presented in Sections 2 and 3 of the Keeyask Generation Project environmental impact statement terrestrial supporting volume (Sections 2 and 3 of Keeyask HydroPower Partnership 2012b).

5.4.2 Fragmentation

Effects from Gillam Redevelopment, Bipole III Transmission Project and the Keeyask Generation Project would overlap spatially and temporally with residual Project effects on fragmentation.

Based on the anticipated locations of the reasonably foreseeable overlapping future projects, total linear feature density could increase from 0.47 km/km^2 to approximately 0.48 km/km^2 in the Regional Study Area, and from 0.34 km/km^2 to approximately 0.36 km/km^2 in the portion of the Regional Study Area outside of the Thompson area, which is still in the lower half of the moderate magnitude effects range (between 0.40 km/km^2 and 0.60 km/km^2) for the entire Regional Study Area and within the small magnitude range for the Regional Study Area outside of the Thompson area. The Bipole III contribution to higher linear feature is somewhat offset by linear features removed by the Keeyask Generation Project project footprint.

The reasonably foreseeable future projects would increase core area effects. Based on their anticipated locations, total core area could decline to 83% or to 81% for core areas larger than 1,000 ha. Both of these percentages are still well within the range for small magnitude core area effects (*i.e.*, 66% to 100% of land area). These core area reductions could be partially offset by natural regeneration on portions of existing, disused cutlines would increase core area over time.

5.4.3 Ecosystem Diversity

Effects from Gillam Redevelopment, Bipole III and the Keeyask Generation Project would overlap spatially and temporally with residual Project effects on ecosystem diversity.

Based on the anticipated location of Gillam Redevelopment, this project could affect an approximately 50 ha of terrestrial habitat in addition to that already affected by the Project [*DN: Confirm area.*]. Based on its anticipated location, the Bipole III Transmission Project could affect approximately 3,700 of terrestrial habitat (effects analysis included the preferred route ROW plus a 50 m buffer of it). Since detailed habitat mapping was not available for the Bipole III footprint, the composition of the affected habitat was assumed to be similar to that of detailed habitat mapping area. On this basis, approximately 70% of the affected habitat is not priority habitat. Although the increased amounts of additional habitat affected would be relatively high for some of the priority habitat types using this assumption, the increases in the percentage of affected habitat area could remain below 10% of historical area for all priority habitat types, depending on the final location of the ROW.

A detailed assessment of the combined effects of all projects considered in this section on ecosystem diversity is provided in Section 2 of Keeyask HydroPower Partnership (2012b). Based on these predictions and the anticipated locations of the future projects, the residual effects of the Project in combination with the reasonably foreseeable future projects could remain at the low end of the moderate range for total habitat area affected and the common habitat types and within the small to moderate range for all of the priority habitat types.

5.4.4 Priority Plants

Effects from all of the future projects would overlap spatially and temporally with residual Project effects on priority plants. All of these future projects, except for the Conawapa Generation Project, are expected to remove individual plants and their habitat and alter plant populations. Transportation and increased activity along PR 280 for the Conawapa Generation Project could spread invasive plants and increase the risk of access-related effects.

A detailed assessment of the combined effects of all projects considered in this section on priority plants is provided in Section 2 of Keeyask HydroPower Partnership (2012b). Additional locations of swamp lousewort were not discovered in during Keeyask Generation Project field studies. Although a number of additional rock and shrubby willow locations would be affected by the Keeyask Generation Project, it has already been noted that these species are more regionally common than indicated by their provincial conservation concern ranking. Based on the Keeyask Generation Project predictions, the residual effects of the Project in combination with the Keeyask Generation Project were not expected to increase effects on priority plants to the high magnitude degree.

5.5 MONITORING

Monitoring to verify the short and long-term effects of the Project on terrestrial habitat, ecosystems and plants is outlined in Table 5-8. The monitoring focuses on the VECs. Monitoring is recommended for situations where a difference between predicted and actual residual effects could substantially alter the effects assessment or where a prediction can easily be verified using data collected for another purpose (*e.g.*, Project effects on fragmentation can be measured from data collected for ecosystem diversity monitoring).

Table 5-8: Monitoring for terrestrial Habitat, Ecosystems And Plants

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
Terrestrial Habitat and Ecosystems			
Ecosystem Diversity (VEC)	• To verify the predicted amounts and composition of direct and indirect habitat loss, alteration and disturbance during construction and operation.	• Measure direct habitat loss and disturbance, by habitat type, in the Project Footprint. • Measure indirect habitat loss and change, by habitat type, in areas where indirect effects are predicted to occur.	Once at start of operation. Periodically thereafter as needed depending on the degree of indirect effects.
	• To verify that priority habitat patches marked for avoidance in the environmental protection plans are not disturbed.	• Monitor to confirm avoidance of priority habitat patches.	Regularly during clearing activities.
Fragmentation (VEC)	• To verify Project effects on linear feature density and core area abundance.	• Measure Project linear features and the Project Footprint relative to core areas.	Once at start of operation.

Table 5-8: Monitoring for terrestrial Habitat, Ecosystems And Plants

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
TERRESTRIAL PLANTS			
Priority plants (VEC)	• To verify that recommendations from pre-construction rare plant surveys are implemented.	• Monitor to confirm avoidance of priority plant patches.	Regularly during clearing activities.
Invasive plants (Supporting Topic)	• To verify that the environmental protection plan measures limit the further introduction and spreading of invasive non-native plants.	• Conduct invasive plant surveys within and near to the Project Footprint.	Once during construction and periodically thereafter depending on the extent and nature of invasive plant spread.

Manitoba Hydro

Keeyask Transmission Project

Project Footprint Components

- Construction Power Line (KN36) Right-of-Way
- Construction Power Line (Temporary) Right-of-Way
- Generation Outlet Lines Right-of-Way
- Unit Transmission Lines Right-of-Way
- Construction Power Station Site
- Keeyask Switching Station
- Radisson Converter Station

Study Areas

- Project Study Area
- Fragmentation Local Study Area
- Ecosystem Diversity and Terrestrial Plants Local Study Area

Infrastructure

- Generating Station (Proposed)
- Generating Station
- Bipole I and II (Existing 500 kV DC Line)
- Other Existing Transmission Line
- Transmission Line KN36

Landbase

- Provincial Road
- Municipal Road
- Active Railway

Coordinate System:UTM Zone 15N NAD83
Data Source: ECOSTEM Ltd., MB Cons, MB Hydro, NTS.
Date Created: September 27, 2012

N

0 2 4 Kilometres
0 1 2 Miles

1:150,000

Project Footprint Components

Map 5-1

File Location: Z:\Workspaces\Keeyask Transmission\Figures\Map 5-1 Project Footprint Components V5.wor