3.0 STUDY AREA CHARACTERIZATION

3.1 STUDY AREA OVERVIEW

Most of the Regional Study Area (Map 2-1) is located within the Boreal Shield **Ecozone** and the Hayes River Upland Ecoregion (Ecological Stratification Working Group 1996). There is some overlap with the Taiga Shield Ecozone and the Selwyn Lake Upland Ecoregion in the northeast and with the Churchill River Upland Ecoregion in the northwest. The Regional Study Area overlaps seven Ecodistricts. Most of the Local Study Area is within the 2,300,000 ha Knee Lake Ecodistrict.

Land accounted for approximately 87% of the 1,420,000 ha Regional Study Area in 2010 (Table 3-1). The percentage of land area was higher for the Alternative Routes Local Study Area due to the lesser influence of the Nelson River.

Table 3-1: Total Land and Water Areas and Percentages of Total Area for the Study Areas and Alternative Route Evaluation Corridors

Study Area*	Total Area (ha)	Land Area (ha)**	Water Area (ha)**
Regional Study Area	1,420,000	1,240,000 (*87*)	180,000 (*13*)
Project Study Area[1]	34,145	29,010 (*85*)	5,140 (*15*)
Alternative Routes Local Study Area	22,170	26,841 (*95*)	2,469 (*5*)
Alternative Route Evaluation Corridors	9,171	8,816 (*96*)	355 (*4*)

* Each study area includes all of the study areas nested within it.
** Percentage of total area shown in brackets. Land and water areas and percentages were estimated by extrapolating detailed terrestrial habitat mapping for the sub-region (identified as study zone 4 in the Keeyask Generation Project environmental impact statement (Section 2 of Keeyask HydroPower Partnership 2012b). Water area for portion of Local Study Area with missing habitat data was obtained from the National Hydrography Network data (GeoBase Secretariat 2007).
[1] This table only includes the portion of the Project Study Area for which detailed terrestrial habitat mapping exists (Map 2-2).

3.2 ENVIRONMENTAL SETTING

3.2.1 Physiography

The terrain is broadly similar throughout the Regional Study Area, having been shaped by glaciation and subsequent inundation by glacial Lake Agassiz. Undulating **morain**al plains are punctuated by ridges and hills (Smith *et al.* 1998). Much of this morainal terrain is overlain by clayey **glaciolacustrine** deposits, which are more prominent and extensive in lower-laying areas and more continuous toward the south in the basin of former Lake Agassiz. **Glaciofluvial** and morainal deposits form ridges and hills throughout the area. Extensive areas of shallow to deep organic soils have developed on the glaciolacustrine deposits.

Peatlands dominate the Project Study Area. According to Soil Landscapes of Canada (Agriculture and Agri-Food Canada 1996), which is 1:1,000,000 scale mapping, surficial materials in and around the Project Study Area consist of approximately two-thirds organic deposits and one-third lacustrine mineral deposits. Large scale (1:15,000 scale) mapping indicates that organic and mineral deposits account for approximately 92% and 8% of the detailed habitat mapping area (Map 2-2), respectively. Veneer bogs and blanket bogs are the most common peatland types covering approximately 62% of the land area. Veneer bogs are thin peats (i.e., less than 1.5 m thick) that primarily occur on slopes in the detailed habitat mapping area. Blanket peatlands are thicker than veneer bogs and occur on lower slopes, valleys and level areas. Peat plateau bogs are ice-cored bogs with a relatively flat surface that is elevated from the surroundings, and has distinct banks. Peat plateau bogs and associated peatland types, which cover about 16% of the land area, primarily occur in the western two-thirds of the detailed habitat mapping area. The remaining peatland types are horizontal peatlands, aquatic peatlands and thin wet peatlands. These peatlands are generally found in lower slope and depression locations; aquatic peatlands occur along the shorelines of waterbodies. Mineral deposits are more common in the eastern one-third of the area. Human infrastructure accounts for approximately 3% of the detailed habitat mapping area.

Large scale mapping indicates that discontinuous surface permafrost is widespread, occurring as cold soil temperatures, ice crystals, ice lenses and thick ground ice. Consequently, Cryosols (organic) are the dominant soil order type in the detailed habitat mapping area, followed in descending order by Organics, Brunisols, Gleysols, Luvisols and Regosols.

Climate parameters vary across the Regional Study Area with mean annual temperatures and total annual precipitation generally decreasing toward the northeast. Mean annual temperatures across the Regional Study Area range from about -2.4°C to -4.9°C, with growing seasons ranging from 124 days in the northeast extent, to 149 days in the southwest extent (Smith *et al.* 1998).

The weather station at Gillam, which is at the eastern end of the Alternative Routes Local Study Area, was used to characterize climate for the Alternative Routes Local Study Area. Mean annual temperature at Gillam is approximately -4.2°C while mean daily temperatures in the coldest and warmest months are -25.8°C in January and 15.3°C in July. The total accumulated growing degree days are 969.6 with a 5°C threshold base temperature, and 428.6 using a 10°C threshold base temperature. The average number of frost-free days is 91.9.

Total annual precipitation is approximately 499.4 mm on average. Rainfall accounts for approximately 63% of the total annual precipitation. Annual precipitation is highly variable throughout the Regional Study Area. The highest mean annual precipitation is 530 mm in the northwestern extent of the Regional Study Area in the Pikwitonei Lake, Orr Lake and Waskaiowaka Lake Ecodistricts, (Smith *et al.* 1998). Mean annual precipitation decreases to approximately 480 mm at the northeastern extent. At Gillam, mean annual precipitation ranges from approximately 500 – 530 mm, most of which falls during the summer months.

3.2.2 Terrestrial Habitat

Land cover in 2010 was dominated by sparsely to densely treed needleleaf vegetation on thin or shallow peatlands (about 80% of the land in the Regional Study Area; Section 2 of Keeyask HydroPower Partnership 2012b). Broadleaf treed land cover accounted for approximately 1% of the land area, typically occurring on upland mineral soils, in richer riparian areas and near the Nelson River (Map 3-1). Tall shrub and low vegetation on mineral or peatland ecosites covered 16% of land area, primarily occurring along streams and rivers, other wet areas and in poorly regenerating burned areas (a substantial proportion of the low vegetation on mineral, thin peatland and shallow peatland was treed vegetation prior to burning in wildfires during the 1980s and 1990s). Shoreline wetlands other than shallow water wetlands accounted for less than 1% of land area. Human infrastructure comprised approximately 2% of the existing land area.

Black spruce (*Picea mariana*) on thin peatlands and black spruce on shallow peatlands were the two most abundant coarse habitat types by far, with each covering approximately one-third of land area (Table 3-2). The other needleleaf coarse habitat types were jack pine (*Pinus banksiana*) and tamarack (*Larix laricina*) types. The overstorey species included in the broadleaf treed and mixedwood coarse habitat types were trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*) and white birch (*Betula papyrifera*). Black spruce and jack pine typically were the needleleaf species in the mixedwood types.

Because of frequent large fires, approximately one-quarter of inland terrestrial habitat in the Regional Study Area was less than 50 years old in 2010 (Section 2 of Keeyask HydroPower Partnership 2012b).

Shoreline wetland coarse habitat types comprised less than 1% of land area (shallow water wetland class not included in land area or as a type since bathymetry data were not available to separate shallow from deep water throughout the Regional Study Area). Shrub and/or low vegetation on upper beach on the Nelson River was the most abundant of these types (0.6% of the land area).

Land cover in the Alternative Routes Local Study Area was similar to that in the Regional Study Area. There was a lower proportion of needleleaf vegetation on mineral, thin or shallow peatlands (71% vs. 80%), and a higher proportion of tall shrub and low vegetation cover (24% vs. 16%). Much of this difference is due to slowly regenerating burned areas occurring throughout a large portion of the Alternative Routes Local Study Area. The overall habitat composition with respect to overstorey species was very similar to that of the regional study area, with black spruce on thin peatlands and black spruce on shallow peatlands being the most abundant habitat types.

Table 3-2: Land cover and Coarse Habitat Composition of the Regional, Project and Alternative Routes Local Study Areas, as a Percentage of Total Land Area

Land Cover	Coarse Habitat Type	Regional Study Area	Project Study Area	Alternative Routes Local Study Area
Mineral and Thin Peatland Types				
Broadleaf Treed on All Ecosites	Broadleaf treed on all ecosites	0.6	0.3	0.3
	Broadleaf mixedwood on all ecosites	0.5	0.3	0.3
Needleleaf Treed on Mineral or Thin Peatland	Black spruce mixedwood on mineral or thin peatland	0.3	0.3	0.3
	Jack pine mixedwood on mineral or thin peatland	0.3	0.2	0.3
	Jack pine treed on mineral or thin peatland	1.8	2.1	2.1
	Black spruce treed on mineral soil	8.4	4.6	4.4
	Black spruce treed on thin peatland	33.2	28.6	28.7
Tall Shrub on Mineral or Thin Peatland	Tall Shrub on Mineral or Thin Peatland	0.2	0.2	0.3
Low Vegetation on Mineral or Thin Peatland	Low Vegetation on Mineral or Thin Peatland	4.6	7.2	8.0
Other Peatland Types				
Needleleaf Treed on Other Peatlands	Jack pine treed on shallow peatland	0.1	0.0	0.0
	Black spruce mixedwood on shallow peatland	0.0	0.0	0.0
	Black spruce treed on shallow peatland	32.8	28.8	28.3
	Black spruce treed on wet peatland	2.1	2.7	3.1
	Tamarack- black spruce mixture on wet peatland	0.9	0.7	0.8
	Tamarack treed on shallow peatland	0.4	1.2	1.2
	Tamarack treed on wet peatland	0.2	0.3	0.4
	Black spruce treed on riparian peatland	0.7	0.8	0.9
	Tamarack- black spruce mixture on riparian peatland	0.0	0.1	0.1
	Tamarack treed on riparian peatland	0.0	0.0	0.0

Table 3-2: Land cover and Coarse Habitat Composition of the Regional, Project and Alternative Routes Local Study Areas, as a Percentage of Total Land Area

Land Cover	Coarse Habitat Type	Regional Study Area	Project Study Area	Alternative Routes Local Study Area
Tall Shrub on Other Peatlands	Tall Shrub on Shallow Peatland	0.3	0.1	0.2
	Tall Shrub on Wet Peatland	0.1	0.1	0.1
Low Vegetation on Other Peatlands	Low Vegetation on Shallow Peatland	7.0	10.2	10.1
	Low Vegetation on Wet Peatland	1.6	2.2	2.3
Shrub/Low Vegetation on Riparian Peatland	Tall shrub on riparian peatland	0.6	0.5	0.5
	Low vegetation on riparian peatland	1.8	2.2	2.0
Shore Zone Types				
Nelson River Shore Zone	Nelson River shrub and/or low vegetation on ice scoured upland	0.0	0.2	0.2
	Nelson River shrub and/or low vegetation on upper beach	0.1	0.2	0.1
	Nelson River shrub and/or low vegetation on sunken peat	0.0	0.8	0.5
	Nelson River marsh	0.0	0.0	-
Off-system Shore Zone	Off-system marsh	0.0	0.1	0.1
Other Land Cover Types				
Human Infrastructure		0.9	4.8	4.3
Unclassified		0.5	0.1	0.0
All		100.0	100.0	100.0
Total Land Area (ha)		*1,239,328*	*29,010*	*20,024*

Note: Cells with 0 values are values that round to 0, while “-“ cells indicate a value of 0. Reported areas are land area only.

3.2.3 Terrestrial Ecosystems

3.2.3.1 Fragmentation

Linear Feature Density

The Regional Study Area included 5,628 km, or 0.45 km/km^2, of mapped linear features in 2010 (Section 2 of Keeyask HydroPower Partnership 2012b). Per lineal kilometre, roads are the linear feature type that have the highest adverse effects on ecosystems and species, especially those linear features that are passable all year. The 738 km of existing roads created a road density of 0.06 km/km^2 in the Regional Study Area, with PR 280 making the largest contribution. The remaining roads occurred around small communities, such as York Landing and Ilford, with about half of these being winter roads.

Roads and rail lines combined to create a regional transportation density of 0.13 km/km^2 (Section 2 of Keeyask HydroPower Partnership 2012b). Transmission line density in 2010 was 0.06 km/km^2.

At 0.30 km/km^2, cutlines made the highest contribution to total linear feature density in the Regional Study Area (Section 2 of Keeyask HydroPower Partnership 2012b). The ecological effects of cutlines are expected to be lower than those of other linear features for a variety of reasons (*e.g.*, narrower footprint, lower habitat disturbance). Regarding the access function of linear features, it is likely that portions of the mapped cutlines and transmission line rights-of-way were not being used as human or wildlife corridors because they were partially overgrown, distant from any current human uses and/or were accessible only in winter due to natural barriers. For example, approximately 35% of the 883 km of cutlines surveyed for vegetation regeneration and game trails in 2011 had regenerated to the degree that they were no longer expected to function as travel corridors (Section 2 of Keeyask HydroPower Partnership 2012b). To illustrate the effect of cutlines on linear density, total linear feature density declined from 0.45 km/km^2 to 0.15 km/km^2 when cutlines were not considered.

There was a very high concentration of linear features near Thompson, which skewed the linear feature densities for the rest of the Regional Study Area (Section 2 of Keeyask HydroPower Partnership 2012b). Whereas the Thompson area comprised only 15% of the Regional Study Area, it included 38% of the linear features. Total linear feature density in the Thompson area was 1.27 km/km^2 compared with only 0.32 km/km^2 in the rest of the Regional Study Area.

Core Areas

Core areas larger than 200 ha accounted for 84% of Regional Study Area land area in 2010 (Section 2 of Keeyask HydroPower Partnership 2012b). When the minimum size for a core area was increased to 1,000 ha, then core area percentage only dropped to 83% because almost 98% of total core area occurred in core areas that were larger than 1,000 ha.

The three largest core areas contributed over half of the total core area (Section 2 of Keeyask HydroPower Partnership 2012b). The largest core area (270,769 ha) was located north of PR 280 between Split Lake and Long Spruce Generating Station. The second largest core area (181,147 ha) was located north of PR 280 between Split Lake and Thompson.

3.2.3.2 Ecosystem Diversity

The Regional Study Area included 56 native broad habitat types (Appendix A).

The distribution of area amongst the native broad habitat types was very uneven (Section 2 of Keeyask HydroPower Partnership 2012b). Three black spruce habitat types (black spruce dominant on thin peatland, black spruce dominant on shallow peatland, and black spruce dominant on ground ice peatland) accounted for nearly 65% of the total land area. In contrast, the 44 least abundant broad habitat types covered less than 9% of land area.

The four broad habitat types represented by less than ten stands included balsam poplar dominant on all ecosites, balsam poplar mixedwood on all ecosites, jack pine dominant on shallow peatland, and jack pine mixedwood on shallow peatland (Section 2 of Keeyask HydroPower Partnership 2012b). 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 would increase the total number of stands for each type by approximately 7.5 times.

Due to the highly uneven distribution of area amongst the broad habitat types, 46 broad habitat types met the regional rarity criterion for priority habitat types. Of this total, 28 habitat types satisfied at least two priority habitat criteria. The two rarest habitat types in the Regional Study Area were balsam poplar mixedwood on all ecosites and balsam poplar dominant on all ecosites. The abundances of regionally rare and uncommon habitat types in the Alternative Routes Local Study Area was similar to that in the rest of the Regional Study Area. These types were generally located on an esker and along the Nelson River (Map 3-1).

The most structurally and/or plant species diverse priority habitat types were tall shrub on shallow peatland, tall shrub on thin peatland, balsam poplar mixedwood on all ecosites, trembling aspen mixedwood on all ecosites, black spruce mixedwood on thin peatland, jack pine dominant on mineral, jack pine dominant on thin peatland, jack pine mixedwood on thin peatland, jack pine mixture on shallow peatland, tamarack dominant on mineral, tamarack mixture on mineral, tamarack dominant on thin peatland and tamarack mixture on thin peatland.

Priority habitat types with the highest potential to support rare plant species were jack pine, trembling aspen mixedwood on all ecosites, balsam poplar mixedwood on all ecosites, tamarack on mineral or thin peatland ecosites, black spruce mixture and mixedwood on thin peatland, and tall shrub types.

3.2.4 Terrestrial Plants

3.2.4.1 Plant Communities

The plant species occurring in the Regional Study Area are typical of the central Canadian boreal forest, consisting primarily of species that are tolerant of the cold, harsh climate and can grow in wetlands. Available information indicated that over 750 terrestrial **vascular plant** species could potentially occur in the Regional Study Area (Section 2 of Keeyask HydroPower Partnership 2012b). Of this total, 120 species and 12 additional species groups (e.g., species only identified to the genus level) were detected by field studies conducted in the alternative routes evaluation corridors (Map 2-1). Based on field data and ground layer samples collected at the terrestrial habitat plots, 88 mosses, six lichens and two liverworts were identified to either a species or a broader taxon (field studies only attempted to identify the most common and abundant ground mosses and lichens in the field).

In descending order, the most widespread and abundant inland plant species recorded to the species level during field studies were black spruce, green alder (*Alnus viridis*), Bebb's willow (*Salix bebbiana*), myrtle-leaved willow (*S. myrtillifolia*), flat-leaved willow (*S. planifolia*), bog willow (*S. pedicellaris*), swamp birch (*Betula pumila*) Labrador tea (*Rhododendron groenlandicum*) and rock cranberry (*Vaccinium vitis-idaea*). Of the plants that were only identified into species groups, peat mosses (*Sphagnum* spp.) were the only group that was widespread and abundant. The most widespread shoreline wetland plants found on the Nelson River and off-system waterbodies were marsh reed-grass (*Calamagrostis canadensis*), common horsetail (*Equisetum arvense*) and water sedge (*Carex aquatilis*). More beach and sub-littoral zone species occurred in off-system waterbodies. Species only found in off-system waterbodies included bitter-cress (*Cardamine pensylvanica*), wooly sedge (*Carex pellita*), thread rush (*Juncus filiformis*), small yellow pond-lily (*Nuphar lutea* ssp. *variegata*) and several pondweed species. Of the shoreline plants that were only identified into groups, none of the groups were widespread and abundant.

3.2.4.2 Priority Plants

The priority plant list for the Regional Study Area consisted of 101 vascular plants. Appendix B provides the species list, their MBCDC conservation concern ranking (G-Rank and S-Rank), their reasons for inclusion as a priority plant species, the number of sample locations where the species was found at in the Regional Study Area, and very general habitat associations.

Species listed as endangered or threatened under MESA, SARA or COSEWIC were not expected to occur in the Regional Study Area. All of these except for flooded jellyskin lichen (*Leptogium rivulare*) are prairie species. Flooded jellyskin lichen was not expected to occur in the area, primarily because its required microhabitat was not found in the study area.

None of the 13 provincially very rare species that could potentially occur in the Regional Study Area were found during field studies. One species with an uncertain rare or very rare conservation concern ranking, elegant hawk's-beard (*Crepis elegans*), was found at nine roadside locations.

Field studies recorded seven of the 45 provincially rare (Map 3-2) to uncommon (Map 3-3) upland and wetland plant species that could potentially occur in the Regional Study Area, including small pondweed (*Potamogeton pusillus* ssp. *tenuissimus*), Robbin's pondweed (*Potamogeton robbinsii*), shrubby willow (*Salix arbusculoides*), rock willow (*Salix vestita*), horned pondweed (*Zannichellia palustris*), oblong-leaved sundew (*Drosera anglica*), muskeg-lousewort (*Pedicularis macrodonta*) and American milk-vetch (*Astragalus americanus*). All species except for American milk-vetch were more regionally common than suggested by their provincial conservation concern rank, being found at more than 25% of locations sampled in appropriate habitat. American milk-vetch, which was recorded in a few locations at the eastern end of the Regional Study Area, was found at a larger number of locations to the northeast of the Regional Study Area.

Of the remaining 42 priority plants, 27 were regionally rare and/or near a range limit. Map 3-4 shows the locations of the regionally rare species found in the Alternative Routes Local Study Area during field studies. Range limit species included jack pine (*Pinus banksiana*), shrubby willow, rock willow, northern Labrador tea (*Rhododendron tomentosum*), wolf-willow (*Elaeagnus commutata*), elegant hawk's-beard, hairy goldenrod (*Solidago hispida*), arctic wintergreen (*Pyrola grandiflora*) and small yellow pond-lily. Map 3-4 shows the locations of the range limit species found in the Alternative Routes Local Study Area during field studies.

Plants of particular interest to the KCNs were sweet flag (*Acorus americanus*; locally known as ginger root in English; *wekes*, *wekas* or *wihkis* in Cree), white birch (*Betula papyrifera* and *B. neoalaskana*; *asatee* in Cree), strawberries (*Fragaria virginiana*; *odahihminah* in Cree), northern Labrador tea, currants and gooseberries (*Ribes triste or R. lacustre*; *ekomina* or a*nikimina* in Cree), cloudberries (*Rubus chamaemorus*; *ostikonihminah* in Cree), red raspberry (*Rubus ideaus*; *anouskanuk* in Cree), dewberry (*Rubus pubescens*; *ooskeesihikoominh* in Cree), blueberries (*Vaccinium uliginosum*; *niskeminah* in Cree) and cranberries (*Vaccinium vitis-idaea*; *wesahkeminah* in Cree). Most of these species were common in their preferred habitats. Exceptions were ginger root and northern Labrador tea. Ginger root was not found during field studies. Northern Labrador tea was recorded at seven locations in the Regional Study Area.

None of the provincially very rare species that could potentially occur in the Alternative Routes Local Study Area were found during field studies. Shrubby willow, rock willow and muskeg-lousewort were the provincially rare to uncommon species recorded in the Alternative Routes Local Study Area (Table 4-5 and Table 4-18). One regionally rare species and six range limit species were recorded in the Alternative Routes Local Study Area. Seven of the plants of particular interest to the KCNs were also recorded in the Alternative Routes Local Study Area (Table 4-5 and Table 4-18).

3.2.4.3 Invasive Plants

Invasive plants are widely considered to be a threat to species and ecosystems. Invasive plants are introduced and spread by human activities and natural dispersal mechanisms. Invasive plants are spreading in Manitoba (ISCM 2012).

Field studies detected all of the 19 invasive plants known to occur in the Regional Study Area (Section 2 of Keeyask HydroPower Partnership 2012b). Two of these species occurred within the alternative route evaluation corridors (Map 3-6). The majority of invasive plant locations were in disturbed areas, such as along PR 280 or in borrow pits, or along Nelson River shorelines having substrates similar to those in human-disturbed inland areas.

Reed-canary grass (*Phalaris arundinacea*), the only detected plant species that is currently classified as highly invasive, was found at 27 locations in the Regional Study Area (primarily along Nelson River shorelines), but was not found in the Alternative Routes Local Study Area. Moderately invasive species included smooth brome grass (*Bromus inermis*) and white sweet-clover (*Melilotus albus*). These species were not found in the Alternative Routes Local Study Area. Common dandelion (*Taraxacum officinale*) was recorded at 5 locations in the Construction Power Alternative Route 1 evaluation corridor while wild barley (*Hordeum jubatum*) was recorded at one location in the Construction Power Alternative Route 2 evaluation corridor. No invasive non-native species were recorded along the Generation Outlet Alternative Route evaluation corridors.

Purple loosestrife (*Lythrum salicaria*) and leafy spurge (*Euphorbia esula*), other species classified as being highly invasive, have not been recorded in the Regional Study Area to date. Purple loosestrife has been extending its range northward in Manitoba.