7.9 Vegetation

This subsection summarizes the 2007 and 2008 vegetation survey programs completed at and surrounding the Minago Project site. URS Canada Inc. (URS, 2008d) conducted a detailed vegetation survey on the Minago Project site in 2007 and Roche Consulting Group (Roche, 2008a) conducted a vegetation survey along a 24.4 km stretch on Highway 6, just south of the site's main entrance and along a potential railway siding near Ponton, Manitoba.

Prior to a detailed description of the vegetation survey methodology and results, characteristics of regional and local settings are summarized below in terms of ecozone and ecoregion.

7.9.1 Regional Setting – Ecozone

Regionally, the Minago Project Site is located within the Boreal Plains ecozone (URS, 2008d). This ecozone is a wide band that extends from the Peace River area of northeast British Columbia to the southeast corner of Manitoba. This zone is located immediately south of and is distinctly different from the Boreal Shield ecozone, which is bedrock controlled. The Boreal Plains ecozone is not bedrock controlled and contains fewer lakes. The dominant coniferous species in this ecozone are white and black spruce, jack pine and tamarack. Deciduous species consist predominantly of white birch, trembling aspen and balsam poplar, particularly in transition zones to the prairie grasslands to the south. Black spruce and tamarack are more abundant along the northern transition zone to the Boreal Shield ecozone.

7.9.2 Local Setting – Ecoregion

The Minago Project Area including the Site occupies approximately 2,428 hectares, west of Highway 6, and is located within the Mid-Boreal Lowland ecoregion of the northern section of the Manitoba Plain (URS, 2008d). The ecoregion is defined as having a sub-humid mid-boreal climate. It is part of a mixed deciduous and coniferous forest, which extends from northwest Ontario to the Rocky Mountain foothills. This mixed deciduous and coniferous forest is comprised of medium to tall, closed stands of balsam poplar and trembling aspen, white and black spruce, and balsam fir occurring in later successional stages.

The topography in the Minago Project Area is relatively flat with extensive low-lying areas containing wetlands covering approximately one-half of the ecoregion. Fens and bogs are poorly drained and frequently covered with tamarack and black spruce. Sites that are well drained consist mostly of plateaus above 265 m a.s.l. covered by limestone, tills and fluvio-glacial sands. These plateaus are usually colonized by an open conifer forest (Roche, 2008a).

Surficial materials of the Minago Project site consist essentially of three types: fine grained glaciolacustrine, till blanket and organic deposits. Glaciolacustrine deposits are sediments deposited in glacial lakes, which formed when meltwater was trapped between the front of a glacier and a moraine or rock wall that prevented drainage. Glaciolacustrine deposits consist primarily of well-stratified fine sand, silt and clay. Till is any sediment that was transported and deposited by a glacier without being sorted by meltwater. It consists of clay, sand and large rock fragments that are deposited in irregular sheets or in ridges called moraines. Organic deposits are rich in partially decomposed plant matter. They usually form and accumulate in poorly drained environments such as swamps and peat bogs (Roche, 2008a).

7.9.3 Scope/Objectives of Vegetation Assessments

The objectives of the 2007 vegetation survey program were to (URS, 2008d):

- establish pre-mining baseline vegetation species, spatial distribution and metal content for the Minago Project Area;
- provide baseline vegetation data required to complete an Environmental Impact Assessment of the Minago Project under the Manitoba *Environmental Assessment Act*;
- provide baseline surface vegetation data required to complete bankable Feasibility Study on the Minago Project; and
- provide baseline vegetation data for determining potential impacts to terrestrial resources during the future development, operation and post-closure phases of the Minago Project Site/Mine.

Upon completing the vegetation survey in the vicinity of Highway 6, established transportation corridors (i.e., Minago Project Site roads and trails) were also surveyed to assess the degree to which invasive/exotic species may have spread and established (URS, 2008d).

The objectives of the August 2008 vegetation survey program were to establish pre-mining baseline vegetation species, spatial distribution for the Highway 6 corridor that might be impacted by mining activities at the Minago Project and a potential railway siding near Ponton, MB. Roche (2008a) assessed vegetation along Highway 6 from the existing power station, located nearby the Minago Camp, to the main Minago entrance (54°06.031' N, 99°09.567'W). Roche (2008a) also recorded the main vegetation species on the Minago Property and at the potential railway siding.

7.9.4 Vegetation Survey Methodology

7.9.4.1 Existing Data Collection and Review

To assist in the identification and delineation of vegetation communities, URS (2008d) and Roche (2008a) reviewed existing data for background information prior to the vegetation field surveys. Data reviewed included:

- Existing GIS data layers including: 1) Forest Resources Management-Forest Inventory Maps (Manitoba Conservation, 2000a); 2) Land Use/Land Cover Maps, (Manitoba Conservation, 1989); and 3) Ecological Areas (Government of Canada, 1996);
- The Canadian Vegetation Classification System: First Approximation (National Vegetation Working Group, 1990);
- Plants of the Western Boreal Forest and Aspen Parkland (Johnson *et al.,* 1995);
- The Canadian Wetlands Classification (National Wetlands Working Group, 1997); and
- Resource specialists at the Manitoba Department of Conservation (Manitoba Conservation 2007d,e).

7.9.4.2 Field Data Collection

Existing vegetation community data and aerial photos were used to determine where field surveys should occur. Transportation in the Project Area was by vehicle (truck), an ARGO off-road vehicle, and foot. Vegetation field data was collected between September 5 and 9, 2007 and May 6 and 10, 2008. The 2007 vegetation field study was led by Eric Klein (Biologist, URS) and assisted by Chris Brown (Environmental Scientist, URS) and Trevor Wilson (Field Assistant, Norway House First Nations). The 2008 vegetation field study was led by Simon Thibault (Biologist) and assisted by Brigitte Dutil (Technician) and Ken Budd (Norway House Cree Nation, Technician).

7.9.4.3 Vegetation Communities

At each field location, the plant community was characterized in terms of species composition, structure, and density of cover (URS, 2008d). Photographs were also taken at each location. Data collected in the field were used to create a map showing the vegetation classifications in the Project Area according to ‘The Canadian Vegetation Classification System: First Approximation’ (National Vegetation Working Group, 1990).

7.9.4.4 Invasive/Exotic Communities

Non-native plant species have potential to cause significant impacts to native ecosystems. Invasive plant species aggressively compete for moisture, nutrients (primarily nitrogen and phosphorus), space, and light. This competition can lead to reduced numbers of native species and potentially, extinction (Royer and Dickinson, 1999).

Highway 6 runs parallel to the Minago Project Site and has wide clearings on both sides (~5 m on the western side and greater than 5 m on the eastern side) that have already been invaded by some exotic species. Subsequently, the area around the shoulders of Highway 6 would be the most likely source for non-native species that could impact the Project Area. Vehicles, as well as individual’s shoes and clothing, could disperse the seeds of these species and allow them to germinate and propagate within the Project Area. For this reason, the shoulder area of Highway 6 was surveyed for invasive species that could pose a threat to native species within the Project Area.

Upon completing a vegetation survey in the vicinity of Highway 6, established transportation corridors (i.e., Minago Project Site roads and trails) were surveyed in order to assess the degree to which some of these species may have already spread (URS, 2008d).

7.9.4.5 Plant Tissue Samples

In 2007, vegetation sampling for metals uptake was conducted within the Minago Property surrounding the Minago Project Site. Vegetation sample sites were located where vegetation could be impacted by effluent discharge and/or fugitive dust and where it could be sampled again during development, operation and post-closure.

Vegetation samples were taken from forty (40) locations and analyzed for total metals. To help assess local chemical variability, five (5) duplicate samples were also collected, for a total of forty-five (45) vegetation samples. Vegetation samples consisted of the living material (leaves, branches and stems).

The vegetation samples collected depended on the species present at each site, but focused on vegetation both commonly used by wildlife (i.e., diamond leaf willow-*Salix planifolia*) as forage and potentially used by local communities as traditional foods (i.e., bog cranberry-*Vaccinium oxycoccos*). Since lichen (i.e, *Cladina* spp.) are an important food source to woodland caribou, especially in the winter time, they were also a focus of the vegetation sampling.

The vegetation material was clipped with stainless steel shears, put in sample bags, labeled, and placed in a cooler with ice packs. At the conclusion of each workday, samples were placed in a refrigeration unit (for a maximum of five days for the samples collected earliest) to prevent decay or moisture loss prior to arriving at the lab. All samples were shipped in a cooler to the ALS Laboratory Group in Vancouver, BC for analysis. To help prevent contamination between samples, the shears were cleaned with alcohol after each sample collection.

7.9.5 2007 Vegetation Survey Results

7.9.5.1 Vegetation Communities near Minago Property

Eleven different vegetation communities were found within and adjacent to the Minago Property, which are described below in a general manner. Each vegetation classification is based on a seven level heirarchy, per 'The Canadian Vegetation Classification System' (National Vegetation Working Group, 1990). The seven levels of this classification system are as follows:

Level I: distinguishes broad physiognomic types (i.e., tree or shrub);

Level II: subdivides the physiognomic types on the basis of different growth-forms of plant communities (i.e., deciduous or graminoid);

Level III: subdivides the growth-forms of Level II on the basis of total stand ground cover (i.e., closed or sparse);

Level IV: subdivides the physiognomic classes within Level III on the basis of height (i.e., tall or low);

Level V: subdivides Level IV on the basis of dominant (a species having the greatest cover and/or biomass within a community) and co-dominant (two or more dominant species that occur in approximately equal abundance and have similar physiognomy) species (i.e., black spruce);

Level VI: subdivides Level V on the basis of major understory vegetation, if present (i.e., willow/reed grass); and

Level VII: subdivides Level VI classes on the basis of one or more major understory species using scientific names (i.e., *Picea glauca*, *Salix bebbiana, Hylocomium splendens* Community type (National Vegetation Working Group, 1990).

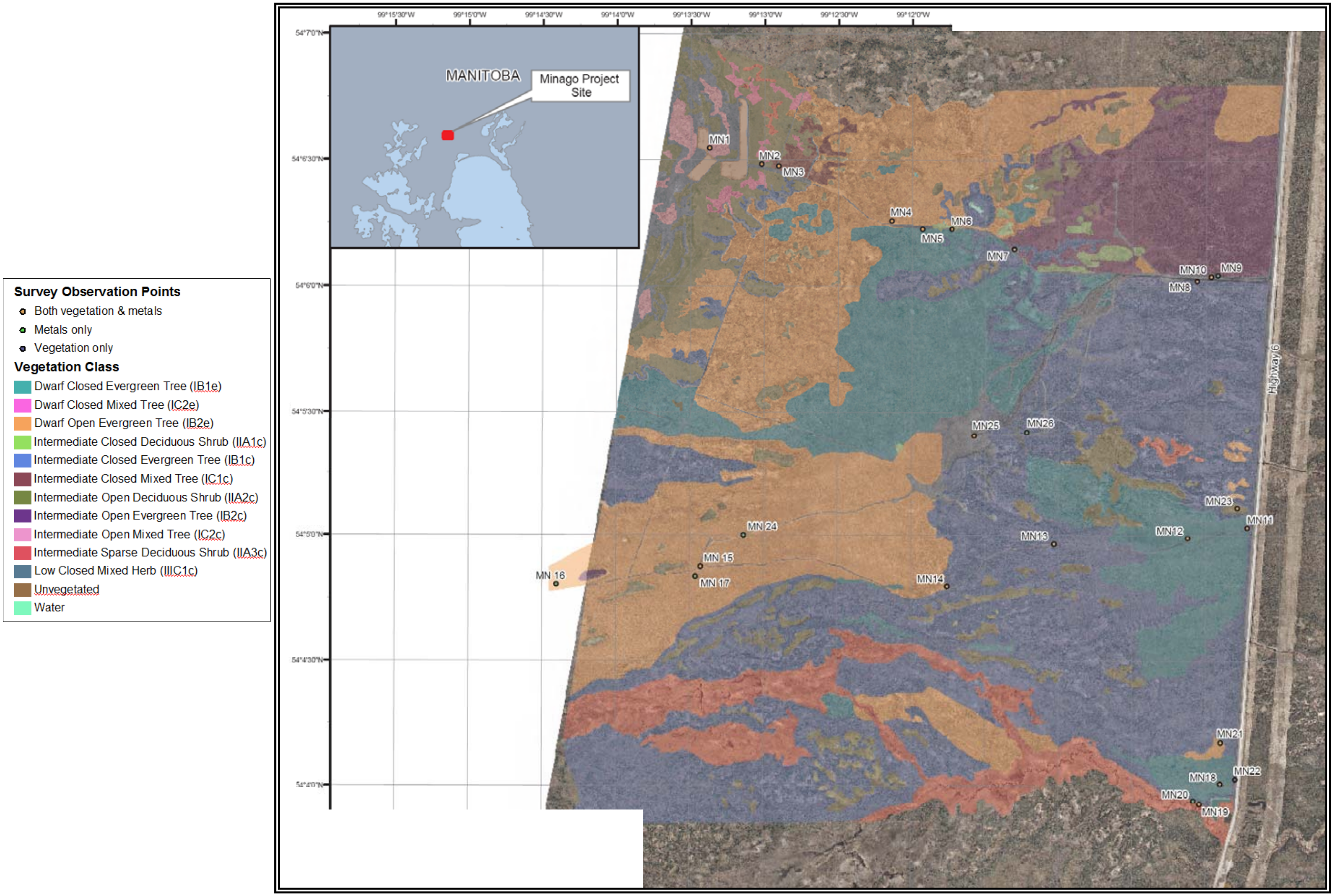
Figure 7.9-1 illustrates the distribution of various vegetation communities within the Minago Project Area. Based on the first four levels of the Canadian Vegetation Classification System, an abbreviated naming convention was devised to facilitate both the textual and visual representation of vegetation classification information (Table 7.9-1). Each heading in italics below the main unit is a Level IV classification and is followed by the naming convention devised from the Canadian Vegetation Classification System. Species that compose the bulk of the biomass are listed in descending order based on absolute cover percentage. Identification down to the species level was not possible in some cases and in these instances, only the genus was listed.

Table 7.9-2 provides an estimate of the area per vegetation classification in the Project Area. Representative photographs of vegetation communities occurring at the Minago site are provided in Appendix 7.9.

7.9.5.1.1 Tree Units

Intermediate Closed Evergreen Tree (IB1c)

The intermediate height, closed evergreen forests in the Project Area were found on poorly-drained soils and dominated by primarily black spruce (*Picea mariana*), but also had some tamarack (*Larix laricina*) in the tree stratum (URS, 2008d). The shrub stratum was composed of diamond leaf willow (*Salix planifolia*), green alder (*Alnus crispa*), and small paper birch (*Betula papyrifera*) found primarily atop the hummocks. The herb stratum was fairly diverse, but was dominated by sedges (*Carex* sp.), bluejoint reedgrass (*Calamagrostis canadensis*), and arrow-leaved coltsfoot (*Petasites sagittatus*). The nonvascular stratum was dominated by stair step moss (*Hylocomnium splendens*), spruce moss (*Evernia mesomorpha*), which was primarily hanging from the branches of black spruce, and hooded tube lichen (*Hypogymnia physodes*). Observation point MN 8, shown in Appendix 7.9, was within this vegetation classification. This vegetation is usually referred to as black spruce moss stand.



Source: adpated from URS, 2008d

Figure 7.9-1 2007 Vegetation Classification at the Minago Project

Table 7.9-1 Canadian Vegetation Classification Level IV Abbreviations

Level I	Level II	Level III	Level IV
I. Tree (≥10% cover of trees)	A. Deciduous (all broadleaf species, including the genus *Arbutus*)	(1) Closed (>60% cover)	a. Very tall (>25m) b. Tall (>15-25m) c. Intermediate (>3-15m) d. Low (< 3m due to age) e. Dwarf (≤3m due to environment)
		(2) Open (>25-60% cover)	a. Very tall (>25m) b. Tall (>15-25m) c. Intermediate (>3-15m) d. Low (< 3m due to age) e. Dwarf (≤3m due to environment)
		(3) Sparse (10-25% cover)	a. Very tall (>25m) b. Tall (>15-25m) c. Intermediate (>3-15m) d. Low (< 3m due to age) e. Dwarf (≤3m due to environment)
	B. Evergreen (all conifers, including the genus *Larix*)	(1) Closed (>60% cover)	a. Very tall (>25m) b. Tall (>15-25m) c. Intermediate (>3-15m) d. Low (< 3m due to age) e. Dwarf (≤3m due to environment)
		(2) Open (>25-60% cover)	a. Very tall (>25m) b. Tall (>15-25m) c. Intermediate (>3-15m) d. Low (< 3m due to age) e. Dwarf (≤3m due to environment)
		(3) Sparse (10-25% cover)	a. Very tall (>25m) b. Tall (>15-25m) c. Intermediate (>3-15m) d. Low (< 3m due to age) e. Dwarf (≤3m due to environment)
	C. Mixed	(1) Closed (>60% cover)	a. Very tall (>25m) b. Tall (>15-25m) c. Intermediate (>3-15m) d. Low (< 3m due to age) e. Dwarf (≤3m due to environment)
		(2) Open (>25-60% cover)	a. Very tall (>25m) b. Tall (>15-25m) c. Intermediate (>3-15m) d. Low (<3m due to age) e. Dwarf (≤3m due to environment)
			a. Very tall (>25m) b. Tall (<15-25m)

Table 7.9-1 (Cont.'d) Canadian Vegetation Classification Level IV Abbreviations

Level I	Level II	Level III	Level IV
		(3) Sparse (10-25% cover)	c. Intermediate (>3-15m) d. Low (< 3m due to age) e. Dwarf (≤3m due to environment)
	A. Deciduous	(1) Closed (>60% cover)	a. Very tall (>5m) b. Tall (>3-5m) c. Intermediate (>1-3m) d. Low (>0.2m-1m) e. Very low (≤0.2m)
		(2) Open (>25-60% cover)	a. Very tall (>5m) b. Tall (>3-5m) c. Intermediate (>1-3m) d. Low (>0.2m-1m) e. Very low (≤0.2m)
		(3) Sparse (2-25% cover)	a. Very tall (>5m) b. Tall (>3-5m) c. Intermediate (>1-3m) d. Low (>0.2m-1m) e. Very low (≤0.2m)
II. Shrub (≥10% cover if tallest stratum, or composes ≥50% of total vegetation if of a similar height as other species in stand)	B. Evergreen	(1) Closed (>60% cover)	a. Very tall (>5m) b. Tall (>3-5m) c. Intermediate (>1-3m) d. Low (>0.2m-1m) e. Very low (≤0.2m)
		(2) Open (>25-60% cover)	a. Very tall (>5m) b. Tall (>3-5m) c. Intermediate (>1-3m) d. Low (>0.2m-1m) e. Very low (≤0.2m)
		(3) Sparse (2-25% cover)	a. Very tall (>5m) b. Tall (>3-5m) c. Intermediate (>1-3m) d. Low (>0.2m-1m) e. Very low (≤0.2m)
	C. Mixed	(1) Closed (>60% cover)	a. Very tall (>5m) b. Tall (>3-5m) c. Intermediate (>1-3m) d. Low (>0.2m-1m) e. Very low (≤0.2m)
		(2) Open (>25-60% cover)	a. Very tall (>5m) b. Tall (>3-5m) c. Intermediate (>1-3m) d. Low (>0.2m-1m) e. Very low (≤0.2m)
		(3) Sparse (2-25% cover)	a. Very tall (>5m) b. Tall (>3-5m) c. Intermediate (>1-3m) d. Low (>0.2m-1m) e. Very low (≤0.2m)
		(1) Closed (>60% cover)	a. Tall (>3-5m) b. Intermediate (>1-3m) c. Low (>0.2m-1m) d. Very low (≤0.2m)

Table 7.9-1 (Cont.'d) Canadian Vegetation Classification Level IV Abbreviations

Level I	Level II	Level III	Level IV
III. Herb (Incl. ferns and their allies; ≥2% herb cover; nonvascular: herb cover ratio ≤2.0 i.e., 0-2)	A. Forb (incl. ferns and their allies)	(2) Open (>25-60% cover)	b. Intermediate (>1-3m) c. Low (>0.2m-1m) d. Very low (≤0.2m)
		(3) Sparse (2-25% cover)	a. Tall (>3-5m) b. Intermediate (>1-3m) c. Low (>0.2m-1m) d. Very low (≤0.2m)
	B. Graminoid	(1) Closed (>60% cover)	a. Tall (>3-5m) b. Intermediate (>1-3m) c. Low (>0.2m-1m) d. Very low (≤0.2m)
		(2) Open (>25-60% cover)	a. Tall (>3-5m) b. Intermediate (>1-3m) c. Low (>0.2m-1m) d. Very low (≤0.2m)
		(3) Sparse (2-25% cover)	a. Tall (>3-5m) b. Intermediate (>1-3m) c. Low (>0.2m-1m) d. Very low (≤0.2m)
	C. Mixed	(1) Closed (>60% cover)	a. Tall (>3-5m) b. Intermediate (>1-3m) c. Low (>0.2m-1m) d. Very low (≤0.2m)
		(2) Open (>25-60% cover)	a. Tall (>3-5m) b. Intermediate (>1-3m) c. Low (>0.2m-1m) d. Very low (≤0.2m)
		(3) Sparse (2-25% cover)	a. Tall (>3-5m) b. Intermediate (>1-3m) c. Low (>0.2m-1m) d. Very low (≤0.2m)
IV. Nonvascular (≥2% cover of nonvasculars, >2 times the cover of herbs)	A. Lichen	(1) Closed (>60% cover) (2) Open (>25-60% cover) (3) Sparse (2-25% cover)	
	B. Bryophyte	(1) Closed (>60% cover) (2) Open (>25-60% cover) (3) Sparse (2-25% cover)	
	C. Mixed	(1) Closed (>60% cover) (2) Open (>25-60% cover) (3) Sparse (2-25% cover)	

Source: URS, 2008d (Secondary source: National Vegetation Working Group, 1990)

Note: For example, the abbreviation IB1c translates to intermediate closed evergreen tree; IIIB2c translates to low open graminoid herb, etc.

Table 7.9-2 Area per Vegetation Classification in the Minago Project Area

Vegetation Classification	Hectares	Percent of Total
Intermediate Closed Evergreen Tree (IB1c)	894	34
Dwarf Closed Evergreen (IB1e)	362	14
Intermediate Open Evergreen (IB2c)	177	7
Dwarf Open Evergreen Tree (IB2e)	638	25
Intermediate Closed Mixed Tree (IC1c)	11	<0.01
Intermediate Open Mixed Tree (IC2c)	14	<0.01
Dwarf Closed Mixed Tree (IC2e)	9	<0.01
Intermediate Closed Deciduous Shrub (IIA1c)	10	<0.01
Intermediate Open Deciduous Shrub (IIA2c)	211	8
Intermediate Sparse Deciduous Shrub (IIA3c)	165	6
Low Closed Mixed Herb (IIIC1c)	112	4
Water	2	<0.01
Unvegetated	8	<0.01
TOTAL	**2613**	**100**

Source: URS, 2008d

Dwarf Closed Evergreen Tree (IB1e)

The dwarf height, closed evergreen forests in the Project Area were located on poorly-drained soils. The tree stratum was entirely composed of tamarack (*Larix laricina*). The shrub stratum was dominated by shrub birch (*Betula glandulosa*), bog rosemary (*Andromeda polifolia*), and small bog cranberry (*Vaccinium oxycoccos*). Sedges (*Carex* sp.) made up most of the herb layer, but buckbean (*Menyanthes trifoliata*) and bog violet (*Viola nephrophylla*) were also present to a lesser degree. The nonvascular stratum was dominated by large hummocks primarily composed of golden fuzzy fen moss (*Tomenthypnum nitens*). Observation point MN 12, shown in Appendix 7.9, was within this vegetation classification. This vegetation is usually referred to as treed bog or bog.

Intermediate Open Evergreen Tree (IB2c)

The intermediate height, open evergreen forests in the Project Area were found on poorly-drained soils and dominated by black spruce (*Picea mariana*). The shrub stratum was dominated by shrub birch (*Betula glandulosa*), Labrador tea (*Ledum groenlandicum*), and diamond leaf willow (*Salix planifolia*). The herb stratum was dominated by sedges (*Carex* sp.) and buckbean (*Menyanthes trifoliata*), while poor fen peat moss (*Sphagnum angustifolium*) was the dominant nonvascular. Observation point MN 5, shown in Appendix 7.9, was within this vegetation classification. This vegetation is usually referred to as treed bog or bog.

Dwarf Open Evergreen Tree (IB2e)

The dwarf height, evergreen open forests in the Project Area were on poorly-drained soils. The tree stratum was dominated by tamarack (*Larix laricina*). The shrub stratum was dominated by shrub birch (*Betula glandulosa*) and bog rosemary (*Andromeda polifolia*). Bog sedge (*Carex magellanica*) and swamp horsetail (*Equisetum fluviatile*) were the dominant herbs. The nonvascular stratum was dominated by midway peat moss (*Sphagnum magellanicum*) and Blandow's feather moss (*Helodium blandowii*). Observation point MN 4, shown in Appendix 7.9, was within this vegetation classification. This vegetation is usually referred to as treed bog or bog.

Intermediate Closed Mixed Tree (IC1c)

The intermediate height, mixed closed forests in the Project Area were found on moderately well-drained soils. The tree stratum was dominated by black spruce (*Picea mariana*), while Labrador tea (*Ledum groenlandicum*) and diamond leaf willow (*Salix planifolia*) were dominant in the shrub layer. The herb stratum was dominated by bluejoint reedgrass (*Calamagrostis canadensis*) and bishop's cap (*Mitella nuda*). *Sphagnum* moss was dominant in the nonvascular stratum. Observation point MN 3, shown in Appendix 7.9, was within this vegetation classification. This vegetation is usually referred to as black spruce moss stand.

Intermediate Open Mixed Tree (IC2c)

The intermediate height, open mixed forests in the Project Area were located on well-drained soils. The tree stratum was dominated by jack pine (*Pinus banksiana*), with lesser amounts of paper birch (*Betula papyrifera*) also present. The shrub stratum was dominated by diamond leaf willow (*Salix planifolia*), bog cranberry (*Vaccinium vitis- idaea*) and shrubby cinquefoil (*Potentilla futicosa*). Wild strawberry (*Fragaria virginiana*) dominated the herb stratum, while grey reindeer lichen (*Cladina rangiferina*) and dog pelt (*Peltigera mitis*) were dominant in the nonvascular layer. Observation point MN 1, shown in Appendix 7.9, was within this vegetation classification. This vegetation is usually referred to as open conifer forest.

Dwarf Closed Mixed Tree (IC2e)

The dwarf height, closed mixed forests in the Project Area were located on moderately well-drained soils. The tree stratum was dominated by black spruce (*Picea mariana*), with about half as much tamarack (*Larix laricina*). The shrub stratum was dominated by Labrador tea (*Ledum groenlandicum*), while meadow horsetail (*Equistem pratense*) dominated the herb layer. Green reindeer lichen (*Cladina mitis*) dominated the nonvascular stratum. Observation point MN 2, shown in Appendix 7.9, was within this vegetation classification. This vegetation is usually referred to as black spruce stand.

7.9.5.1.2 Shrub Units

Intermediate Closed Deciduous Shrub (IIA1c)

The intermediate height, closed deciduous shrub vegetation units in the Project Area were located in poorly-drained soils. The shrub stratum was dominated by shrub birch (*Betula glandulosa*) and diamond leaf willow (*Salix planifolia*) (URS, 2008d). Swamp horsetail (*Equistem fluviatile*) was dominant in the herb stratum, while *Sphagnum* moss dominated the nonvascular layer.

Intermediate Open Deciduous Shrub (IIA2c)

The intermediate height, open deciduous shrub vegetation units in the Project Area were located on poorly-drained soils. The dominant shrubs were shrub birch (*Betula glandulosa*) and tall blueberry willow (*Salix myrtillifolia* var. *cordata*). The herb stratum was dominated by swamp horsetail (*Equisetum fluviatile*) and bog sedge (*Carex magellanica*). Common tree moss (*Climacium dendroides*) dominated the nonvascular stratum. Observation point MN 23, shown in Appendix 7.9, was within this vegetation classification.

Intermediate Sparse Deciduous Shrub (IIA3c)

The intermediate height, sparse deciduous shrub vegetation units in the Project Area were located on very poorly-drained soils. The dominant plant in the shrub stratum was myrtle-leaved willow (*Salix myrtillfolia*). The herb stratum was dominated by beaked sedge (*Carex utriculata*) and water sedge (*Carex aquatilis*). Common tree moss (*Climacium dendroides*) was the dominant nonvascular. Observation point MN 19, shown in Appendix 7.9, was within this vegetation classification and is representative of the riparian zone within the Project Area.

7.9.5.1.3 Herb Units

Low Closed Mixed Herb (IIIC1c)

Low height, closed mixed herb vegetation units in the Project Area were located on moderately poorly-drained soils. The herb stratum was dominated by wild mint (*Mentha arvensis*) and nodding beggarticks (*Bidens cernua*) (URS, 2008d). Stiff club-moss (*Lycopodium annotinum*) was dominant in the nonvascular stratum. Observation point MN 10, shown in Appendix 7.9, was within this vegetation classification.

7.9.5.1.4 Other Units

Water

A portion of the Minago Project Area is covered by small ponds (URS, 2008d). These isolated water bodies are likely kettle ponds and make up a very small percentage (<0.01%) of the total Project Area.

Unvegetated

The northwest portion of the Minago Project area contains a small amount of unvegetated ground. This unvegetated area, which trends in a linear, mostly north-south direction, has a very small amount of herbaceous vegetation at various locations, but is primarily composed of rock-sized mineral cover (URS, 2008d).

7.9.6 2008 Vegetation Survey Results

Table 7.9-3 summarizes the main vegetation species observed by Roche (2008a) on the Minago Property. Roche (2008a) found that black spruce was by far the most abundant vascular species due to the badly drained soil conditions. On better drained soils, black spruce and jack pine were abundant. Jack pine was frequently dominating the more xeric environments. Well drained locations typically had limestone, tills and fluvio-glacial sands as substrate and were located above 265 m a.s.l. The well drained locations were usually colonized by an open conifer forest and sphagnum-spruce forest and treed bogs were colonizing depressions filled with marine clay and silt. These depressions were typically covered by peat, which was up to 4 m thick (Roche, 2008a).

7.9.6.1 Highway 6 Corridor

7.9.6.1.1 Terrestrial Habitats

Roche (2008a) found that the 24.4 km long Highway 6 corridor north of the power station (located near the Minago camp) up to the main entrance to the Minago Project (NAD 83 5994719, 489575 or 54°06.031' N, 99°09.567' W) was dominated by open conifer forests (Figure 7.9-2), black spruce moss stands and treed bogs. There were also some sparse mixed stands in the Highway 6 corridor, which were characterized by medium to tall, closed stands of trembling aspen and balsam poplar with white birch and willows. Roche (2008a) did not identify vegetation on rock outcrops near Highway 6 because of repeated disturbance due to human activities (recent construction works).

Black spruce moss stands constitute a transitional environment between wetlands (especially bogs) and drier stands such as open conifer forests. This is why this plant community is usually observed on a topographical gradient between the lowest depressions filled with clay and higher plateaus.

Table 7.9-3 Main Species Observed Within the Study Area

Common name	Latin name
Ligneous	
Black spruce	*Picea mariana*
Larch	*Larix laricina*
Jack pine	*Pinus banksiana*
Alder	*Alnus rugosa*
Labrador tea	*Rhododendron groenlandicum*
Leatherleaf	*Chamaedaphne calyculata*
Sheep laurel	*Kalmia angustifolia*
Blueberry	*Vaccinium angustifolium*
Cranberry	*Vaccinium oxycoccos*
Herbaceous	
Three-leaf false lily	*Maianthemum trifolium*
Cloudberry	*Rubus chamaemorus*
Tussock cottongrass	*Eriophorum vaginatum* var *spissum*
Few-seed sedge	*Carex oligosperma*
Thallophyta	
Schreber's feathermoss	*Pleurozium schreberi*
Lichens	*Cladina stellaris, C. mitis, C. stygia*
Sphagnum	*Sphagnum fuscum, S. capillifolium*
Brown mosses	*Mylia anomala, Dicranum* spp.

Source: Roche, 2008a

Black spruce moss stands (Figure 7.9-3) were the most abundant plant community at the margin of depressions filled with clay and silt. The moss layer was dominated by Schreber's feathermoss and, within the wetter stands, by Sphagnum mosses such as *Sphagnum fuscum*, *S. girgensohnii* and *S. capillifolium* (Roche, 2008a). The most abundant shrubs were Labrador tea, leatherleaf, blueberry and sheep laurel. Lichens such as *Cladina stellaris*, *C. mitis*, *C. rangiferina* and *C. stygia* often appeared as patches within the moss carpet. Some brown mosses also grew within this carpet, mainly *Mylia anomala* and *Dicranum* spp. Other than black spruce, alders and larches (*Larix laricina*) were the main tree species growing within this plant community. This plant community was also colonized by many herbaceous like few-seed sedge, three-leaf false lily (*Maianthemum trifolium*), cloudberry (*Rubus chamaemorus*) and tussock cottongrass. Horsetail (*Equisetum arvense*) was also growing within the moss carpet (Roche, 2008a).

Wetter stands, located nearby small creeks and at the border of bogs, showed more acidic soil conditions and were dominated by Sphagnum mosses rather than by Schreber's feathermoss.

However, the abundance of trees in these stands was indicative of better drainage conditions than in the bogs. Thus, species associated with wetlands were cohabitating with more xeric species.

Open conifer forests were the most abundant plant community on plateaus and had a far more open tree cover than black spruce moss stands. Main tree species were black spruce and jack

Source: Roche, 2008a

Figure 7.9-2 Open Conifer Forest

Source: Roche, 2008a

Figure 7.9-3 Black Spruce Moss Stand

pine, their relative abundance essentially depending on drainage conditions since jack pine is a more xeric species. At elevations above 274 m (a.s.l.), jack pine was the most abundant species since soils, at that elevation, essentially consisted of localized limestone bedrock outcrops. Again, the main shrubs were Labrador tea, sheep laurel and blueberry. However, what characterized these forests most was that their moss layer was dominated by lichens. In fact, in some areas, 90% of the moss layer consisted of lichens. Dominant species were *Cladina stellaris*, *C. mitis*, *C. rangiferina* and other *Cladonia* spp. Only some brown mosses such as hair-cap mosses, Schreber's feathermoss and *Dicranum* spp. are able to colonize the lichen carpet (often under shrubs, taking advantage of wetter conditions generated by their shade). Herbaceous species are rare in this plant community; only some willows are able to compete with the dominant ericaceous shrubs.

7.9.6.1.2 Wetlands

The 24.4 km long Highway 6 corridor studied was relatively flat and had extensive wetlands covering approximately one-third of the area. The poorly drained bogs located within the study area consisted essentially of treed bogs (Figure 7.9-4), which were largely dominated by Sphagnum mosses and were colonized by trees such as black spruce and larch. These ecosystems were colonized by the same species which were growing within the wetter black spruce moss stands. Schreber's feathermoss and lichens were also observed in treed bogs, especially under trees.

7.9.6.2 Railway Siding

Following is a description of vegetation that is growing in the area surrounding the proposed railway siding. The proposed railway siding is about 60 km north of the Minago Property and 5 km south of Ponton, Manitoba (where Highway 6 connects with Highway 39). The central geographical coordinates (UTM; NAD83) of that location are: 493 669 mE and 6 056 470 mN (Roche, 2008c).

The proposed railway siding is located along the existing Hudson Bay Railway, which is operating over 1,300 km in Northern Manitoba. It includes an existing gravel pit (Figure 7.9-5), which covers approximately half of the area (Figure 7.9-6), and a pond (Figure 7.9-7). The pond is located in the south-western corner of the proposed location. There is also a bog close by, but outside the proposed location of the railway siding.

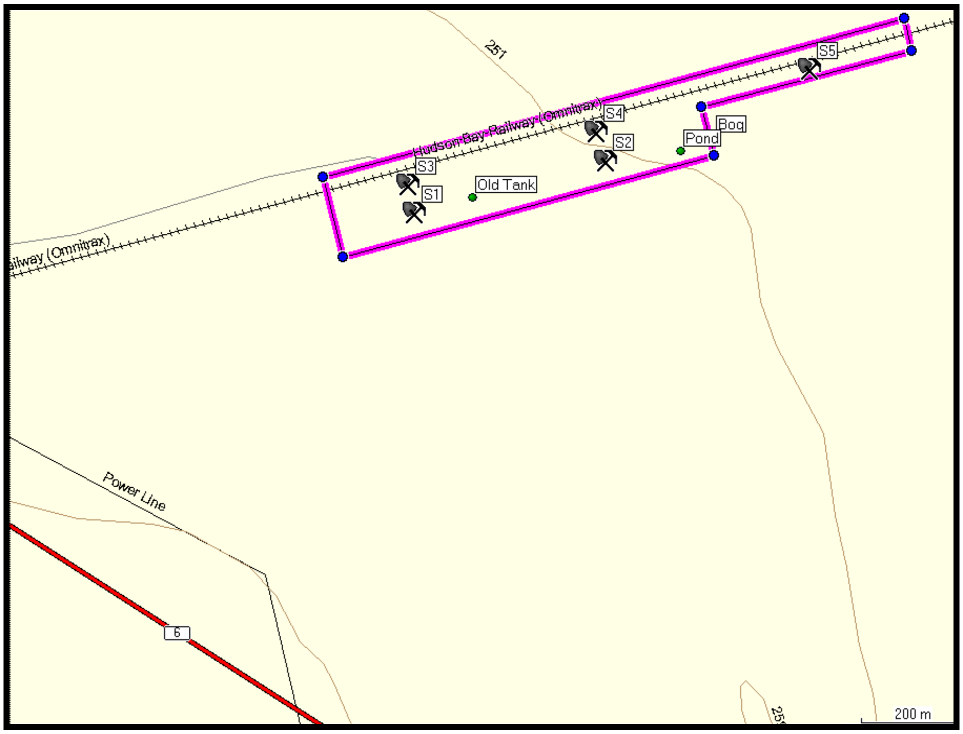
The pond is located within the proposed railway siding and will likely be destroyed, if the railway siding were to be built. Vegetation colonizing its margins does not differ from what was observed within black spruce moss stands, with exception of some sedges and grasses. These sedges and grasses are common in the surroundings of the study area where ponds and swamps tend to occur (poorly drained substrate) and are not listed as species of environmental concern or as special-status species. The pond is not connected with any streams or creeks, but appears to receive some runoff water from the nearby bog. Therefore, the pond is not a fish habitat.

Source: Roche, 2008a

Figure 7.9-4 Treed Bog

Source: Roche, 2008c

Figure 7.9-5 Existing Gravel Pit Located along the Hudson Bay Railway



Source: Roche, 2008c

Figure 7.9-6 Location Map of the Proposed Railway Siding

The treed bog is located at the margin of the study area and expands south and west from that corner (Figure 7.9-6). Species composition in that bog was similar to what was observed in the wetter stands of black spruce moss stands and is typical of the regional plant composition.

Vegetation in the other areas of the proposed railway siding include black spruce stands and wetter stands already described above.

7.9.7 Special Status Plant Species

At the federal level, the *Species at Risk Act* (SARA) does not list any species that occur in this region of Manitoba. All the SARA listed plant species in Manitoba are south of Lake Winnipeg. In addition, there are no plant species listed under the Manitoba *Endangered Species Act* known in or near the Project Area (Manitoba Conservation, 2007d).

The Manitoba Conservation Data Centre (MBCDC) was contacted to gather any existing information on rare plants or communities in the Project Area. In correspondence dated June 15, 2007, URS (2008d) received a response that there are no known rare plants or communities in the Project Area (Manitoba Conservation, 2007e). However, one species, the few-flowered sedge

Source: Roche, 2008c

Figure 7.9-7 Pond in the Area of the Proposed Railway Siding

(*Carex pauciflora*) is listed as a species of conservation concern for the Mid-Boreal Lowland ecoregion (Roche, 2008a). The term "species of conservation concern" includes species that are rare, disjunct, or at risk throughout their range or in Manitoba and in need of further research. The few-flowered sedge (*Carex pauciflora*) is not listed under the Manitoba *Endangered Species Act* (MBESA) and has not been designated as 'special' by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC). Throughout its range, *C. pauciflora* grows in Sphagnum bogs and acidic peat, usually on open mats and is identifiable from late May to early September. Within the Minago area, it would be more likely to observe this species in partial conifer shade, within the black spruce moss stand. Associated species include *Sphagnum fuscum*, *S. capillifolium*, Labrador tea, black spruce, blueberry, leatherleaf, cloudberry and other sedges such as *Carex oligosperma* and *Eriophorum vaginatum* var *spissum*.

The vegetation field studies included surveys for any rare or endangered species as well as the few-flowered sedge (*Carex pauciflora*) at each vegetation sampling site. No rare or endangered species were observed (URS, 2008d, Roche, 2008a).

7.9.8 Invasive/Exotic Species

Invasive species observed in the area of Highway 6 include (URS, 2008d):

1) western willow aster (*Aster hesperius*),

2) milk-vetch (*Astragalus* sp.),
3) marsh ragwort (*Senecia congestus*),
4) Canada goldenrod (*Solidago canadensis*),
5) common dandelion (*Taraxacum officinale*),
6) alsike clover (*Trifolium hybridum*),
7) tufted vetch (*Vicia cracca*),
8) narrow-leaved hawkweed (*Hieracium umbellatum*),
9) ox-eye daisy (*Chrysanthemum leucanthemum*),
10) nodding beggarticks (*Bidens cernua*),
11) wild mint (*Mentha arvensis*), and
12) horsetail (*Equisetum* sp.).

Some of these species have already been dispersed to the transportation corridors within the Project Area and are thriving. The most abundant invasive species that have already colonized vast sections of trails at Minago include (URS, 2008d): horsetail, nodding beggarticks, wild mint, and western willow aster (refer to Photos in Appendix 7.9). All of these species are aggressive growers and can be detrimental to native plants. In the case of horsetail, various species (i.e., swamp and marsh horsetail) are naturally present in some locations beyond the trails and highway sides, but given the opportunity, would likely propagate into other areas. Therefore, the potential exists for these species, as well as others previously listed, to propagate further within the Project Area and impact native plants.

7.9.9 Traditional-Use Plants

The various benefits that Cree and other populations may be getting from plants have been compiled as part of numerous impact assessment studies that were conducted in the James Bay area in Northern Québec based on meetings, discussions and interviews with members of different native communities in 2002 and 2003.

Based on this information and the literature, there are about 50 vascular plants for which a traditional use (medicine, food or other) is known (Table 7.9-4) (Roche, 2008a). These plants were divided in three groups (trees, shrubs and herbaceous). Globally, plants are used for many things, particularly for feeding, tool production, lodging and traditional medicine. There seems to be a good correlation between the importance of a plant's use and its abundance in the environment. Most of the 50 vascular plants are abundant and located within the Minago Project area. However, none of these species is of conservation concern neither at the regional level nor at the provincial level and they are almost all very abundant in the region.

Table 7.9-4 List of Traditional-Use Plant Species Possibly Located in the Area

TREE SPECIES	SHRUB SPECIES
White birch (*Betula papyrifera*)	Sweet blueberry (*Vaccinium angustifolium*)
White spruce (*Picea glauca*)	Alpine bilberry (*Vaccinium uliginosum*)
Black spruce (*Picea mariana*)	Bog rosemary (*Andromeda glaucophylla*)
Larch (*Larix laricina*)	Green alder (*Alnus crispa*)
Balsam poplar (*Populus balsamifera*)	Leatherleaf (*Chamaedaphne calyculata*)
Trembling aspen (*Populus tremuloides*)	Pin cherry (*Prunus pensylvanica*)
Jack pine (*Pinus banksiana*)	Choke cherry (*Prunus virginiana*)
Eastern white cedar (*Thuja occidentalis*)	Creeping snowberry (*Gaultheria hispidula*)
HERBACEOUS SPECIES	Redosier dogwood (*Cornus stolonifera*)
Wild chives (*Allium schoenoprasum*)	Skunk currant (*Ribes glandulosum*)
Wild sarsaparilla (*Aralia nudicaulis*)	Swamp black currant (*Ribes lacustris*)
Purple avens (*Geum rivale*)	Canada gooseberry (*Ribes hirtellum*)
Cow parsnip (*Heracleum lanatum*)	Swamp laurel (*Kalmia polifolia*)
Bunchberry (*Cornus canadensis*)	Lambkill (*Kalmia angustifolia*)
Strawberry (*Fragaria virginiana*)	Labrador tea (*Ledum groenlandicum*)
Stiff club moss (*Lycopodium annotium*)	Cranberry (*Vaccinium oxycoccos*)
Common mint (*Mentha arvensis*)	Long-beaked willow (*Salix bebbina*)
Buckbean (*Menyanthes trifoliata*)	Shining willow (*Salix lucida*)
Meadow rue (*Thalictrum pubescens*)	Balsam willow (*Salix pyrifolia*)
Pitcher plant (*Sarracenia purpurea*)	Bush willow (*Salix humilis*)
Cattail (*Typha latifolia*)	Bog willow (*Salix pedicellaris*)
	Red raspberry (*Rubus idaeus*)
	Dwarf raspberry (*Rubus pubescens*)

Source: Roche, 2008a

7.9.10 Baseline Metals Analysis

Table 7.9-5 provides a statistical summary of metal analyses across all 45 vegetation samples (including the five duplicate samples), both wet and dry weights, for the mean, minimum, median, maximum, 75th percentile, and 95th percentile. For example, the values (in mg/kg) for the wet weight of mercury are: mean (0.011), minimum (0.002), median (0.006), maximum (0.109), 75th

(0.014), and 95th percentile (0.024) (URS, 2008d). As there is no guidelines for metal concentrations in plant tissue samples, this data provides background information (URS, 2008d).

Statistical summaries of some of the elements (Barium, Chromium, Cobalt, Copper, Nickel, and Strontium) in vegetation tissue samples are given in Appendix 2.9. Complete laboratory certified reports for metal analyses on plant samples are presented in Appendix L7.9. Information in Appendix L7.9 includes results for baseline metal analyses conducted on plants with potential for forage and/or subsistence use (i.e., bog cranberry-*Vaccinium oxycoccos* or green reindeer lichen-*Cladina mitis*) (URS, 2008d).

Overall, there was not a large degree of difference between each duplicate sample and the original. A Student's t-test was run for each duplicate pair and the average t-value was 0.41, which indicates that the values are not vastly different from one another.

7.9.11 Conclusions – Baseline Vegetation Survey

Most of the Project Area contains saturated soils, varying degrees of standing water during non-winter months, and hydrophytic vegetation. Subsequently, most of the vegetation in the Project Area is suited to survival in anoxic conditions. The majority of the Project Area would likely be classified as wetland, either treed or not. The driest part of the Project Area, which is also the highest point, is in the northwest corner. The relatively dry nature of this small area is manifested through the presence of slightly different species from the rest of the area (i.e., jack pine and pin cherry) (URS, 2008h).

The Project Area has a relatively uniform composition and does not have a substantial amount of vegetative diversity. No rare, threatened, endangered, or special-status plant species were found. However, due to the presence of invasive/exotic species along Highway 6, as well as some of the trails within the Project Area, the potential exists for dispersal of some of these species further within the Project Area.

Overall, the Project Area contains vegetation consisting of mostly evergreen trees (primarily black spruce and tamarack) of intermediate (>3-15 m) to dwarf (3 m) heights. Intermediate closed evergreen tree was the most dominant (34%) vegetation classification, followed by dwarf open evergreen tree (25%) (Table 7.9-2). Combined, these two classifications make up nearly two-thirds of the entire Project Area and can be referred to as black spruce moss stands and treed bogs or bogs, respectively. There is a relatively low level of vegetative biodiversity and there are not any vegetation types unique to the area or region. A small loss of vegetation would likely have a negligible influence on area wide vegetation functions and values.

Table 7.9-5 Statistical Summary of Metal Analyses in Vegetation

Average across all 45 samples	Moisture	Aluminum (Al)-Total*	Aluminum (Al)-Total*	Antimony (Sb)-Total*	Antimony (Sb)-Total*	Arsenic (As)-Total*	Arsenic (As)-Total*	Barium (Ba)-Total	Barium (Ba)-Total	Beryllium (Be)-Total*	Beryllium (Be)-Total*
Mean	54.95	51.93	26.60	0.063	0.013	0.215	0.067	45.519	19.939	0.380	0.127
Min	7.10	10.00	2.80	0.050	0.010	0.052	0.013	4.730	1.290	0.300	0.100
Median	53.60	32.00	14.95	0.050	0.010	0.080	0.030	30.300	14.900	0.300	0.100
Max	82.00	187.00	143.00	0.350	0.070	3.070	0.713	276.000	82.500	2.100	0.700
75th Percentile	62.6	69	23.925	0.050	0.010	0.167	0.041	58.500	26.900	0.300	0.100
95th Percentile	76.78	172	100.56	0.140	0.028	0.482	0.203	116.200	57.200	0.840	0.280

Average across all 45 samples	Bismuth (Bi)-Total*	Bismuth (Bi)-Total*	Cadmium (Cd)-Total*	Cadmium (Cd)-Total*	Calcium (Ca)-Total	Calcium (Ca)-Total	Chromium (Cr)-Total*	Chromium (Cr)-Total*	Cobalt (Co)-Total*	Cobalt (Co)-Total*	Copper (Cu)-Total	Copper (Cu)-Total	Lead (Pb)-Total*
Mean	0.380	0.035	0.238	0.110	8788.889	3604.644	0.666	0.176	0.256	0.072	2.417	1.136	0.346
Min	0.300	0.030	0.030	0.005	790.000	272.000	0.500	0.100	0.100	0.020	0.457	0.106	0.100
Median	0.300	0.030	0.077	0.034	7430.000	3330.000	0.500	0.130	0.100	0.020	2.290	0.959	0.200
Max	2.100	0.210	4.060	1.850	33600.000	9830.000	3.500	0.700	5.190	1.210	5.620	2.620	2.510
75th Percentile	0.300	0.030	0.133	0.061	9840.000	4250.000	0.500	0.190	0.120	0.052	3.450	1.640	0.300
95th Percentile	0.840	0.054	0.551	0.458	21320.000	7086.000	1.500	0.308	0.320	0.147	4.376	2.412	1.102

Average across all 45 samples	Lead (Pb)-Total*	Lithium (Li)-Total*	Lithium (Li)-Total*	Magnesium (Mg)-Total	Magnesium (Mg)-Total	Manganese (Mn)-Total	Manganese (Mn)-Total	Mercury (Hg)-Total*	Mercury (Hg)-Total	Molybdenum (Mo)-Total*	Molybdenum (Mo)-Total*	Nickel (Ni)-Total*	Nickel (Ni)-Total*
Mean	0.184	0.669	0.138	2321.956	888.289	823.549	291.789	0.023	0.011	0.439	0.146	0.660	0.168
Min	0.020	0.500	0.100	321.000	106.000	38.100	14.200	0.005	0.002	0.050	0.010	0.500	0.100
Median	0.092	0.500	0.100	1750.000	803.000	290.000	132.000	0.014	0.006	0.121	0.047	0.500	0.100
Max	2.330	3.500	0.700	8250.000	1990.000	14800.000	3450.000	0.118	0.109	5.030	1.840	3.500	0.860
75th Percentile	0.132	0.500	0.100	3040.000	1080.000	818.000	233.000	0.036	0.014	0.243	0.102	0.500	0.150
95th Percentile	0.617	1.500	0.300	5852.000	1794.000	1806.000	879.000	0.057	0.024	2.849	0.669	1.400	0.362

Average across all 45 samples	Selenium (Se)-Total*	Selenium (Se)-Total*	Strontium (Sr)-Total	Strontium (Sr)-Total	Thallium (Tl)-Total*	Thallium (Tl)-Total*	Tin (Sn)-Total*	Tin (Sn)-Total*	Uranium (U)-Total*	Uranium (U)-Total*	Vanadium (V)-Total*	Vanadium (V)-Total*	Zinc (Zn)-Total
Mean	1.267	0.255	25.175	10.851	0.038	0.014	0.253	0.064	0.013	0.003	0.633	0.140	85.947
Min	1.000	0.200	1.040	0.342	0.030	0.010	0.200	0.050	0.010	0.002	0.500	0.100	8.450
Median	1.000	0.200	15.800	7.380	0.030	0.010	0.200	0.050	0.010	0.002	0.500	0.100	48.900
Max	7.000	1.400	104.000	53.500	0.210	0.070	1.400	0.350	0.070	0.014	3.500	0.700	290.000
75th Percentile	1.000	0.200	31.700	12.900	0.030	0.010	0.200	0.050	0.010	0.002	0.500	0.100	113.000
95th Percentile	2.800	0.560	73.920	41.560	0.084	0.030	0.560	0.140	0.030	0.008	1.400	0.324	255.600

Average across all 45 samples	Zinc (Zn)-Total
Mean	40.161
Min	2.790
Median	22.000
Max	154.000
75th Percentile	52.400
95th Percentile	126.800

Note: Moisture is measured as a percent of total weight. All total metals values are listed twice: first is mg/kg dry weight and second is mg/kg wet weight.

*Represents a total metals estimated average value negligibly higher than the actual average value. This is because at least one of the samples for a given metal analysis had a value below a detectable limit (i.e., <0.20). For calculation purposes, these ordinal level data were given the same value as what they were less than (i.e., <0.20 became 0.20). Therefore, the true average sample value is negligibly less than what is presented. This table is for summary reference only, please refer to the lab report for original values.

Source: URS, 2008d

7.9.12 Effects Assessment Methodology

The objective of this assessment is to predict project and cumulative effects of the Minago Project on vegetation; to identify mitigation measures to both minimize adverse effects and associated impacts to vegetation and wildlife habitat; and to support sound project design.

7.9.13 Project Related Effects

Development of the project will involve the following new clearing or other vegetation disturbance, summarized in Table 7.9-6.

Table 7.9-6 Summary of Vegetation Disturbance

Designated Area	Area (ha)
Industrial Complex (Buildings)	4.2
Transportation Corridors and Access roads	40.0
Waste rock dumps	
Dolomite Waste Rock Dump	191.0
Country Rock Waste Rock Dump	301.4
Overburden Disposal Facility (ODF)	300.0
Pit Area	190.0
Tailings and Ultramafic Waste Rock Management Facility (TWRMF)	219.7
Polishing Pond	75.0
300-Person Camp	2.4
TOTAL	**1323.7**

At Minago, the types of disturbed sites will include flat sites in or to close to the natural muskeg (poorly drained/saturated and organic); flat sites that are poorly drained/saturated but have a lower organic matter and plant nutrient content than the muskeg sites (laydown areas), and which also may be compacted; rocky, well-drained sites with little or no organic matter, little or no plant nutrients, and low water holding capacity such as the waste rock dumps; and side slopes of waste rock dumps and the TWRMF with little or no organic matter, little or no plant nutrients, and low water holding capacity.

The affected vegetation areas do not involve species at risk. Any useful timber will be harvested or will be salvaged during clearing, and will be made available to the nearby communities for use as firewood. The forested areas will also be prepared to facilitate natural revegetation at mine closure.

The only permanent vegetation losses will be the areas occupied by the waste rock and overburden dumps, TWRMF and the pit area. The company will exercise reasonable efforts to revegetate the industrial area, once all buildings have been decommissioned, the waste rock dumps, and all access roads not required during the post closure period. After mine operations cease, the pit area will be flooded, tailings contained in the TWRMF will be submerged under 0.5 m of water, and the Polishing Pond will be left as wetland.

7.9.13.1 Impacts on Wetlands

From May to October, the final effluent will first be discharged in a vast treed bog before being released to the receiving streams as detailed in Sections 2.14 (Site Water Management) and 7.4 (Surface Water Hydrology). These bogs still have the capacity to store additional water by creating ponds.

A marsh will certainly be created where the final effluent will be discharged. However, it would be quite surprising to see such a significant transformation over the entire bog's surface (creation of ponds and reduction of the tree cover) given that:

- no ponds at all have been observed within these bogs;
- they cover significant areas and are parts of a vast complex of wetlands that are hydrologically connected together and form one of the most important ecosystem in the region.

Still, if a significant transformation of the bog's surface were to occur, it is important to note that it is widely accepted that open bogs with ponds represent more attractive habitats for many wildlife species such as waterfowl and amphibians. Ducks Unlimited Canada, as well as Québec's ministère du Développement durable, de l'Environnement et des Parcs (Department of Sustainable Development, Environment and Parks), has recognized this general concept and use it to evaluate the ecological value of a bog. Poulin (2002) has also proposed a set of criteria to assess a bog's ecological value, including the area covered by ponds.

A diffuser will be installed to reduce erosion at the point where the final effluent will be released in the bog. A perforated pipe will be installed perpendicularly to where the final effluent will be released. Rocks (riprap) will also be installed at this same location.

7.9.14 Cumulative Effects

Currently, there are no other projects in the vicinity of the Minago Nickel Property.

7.9.15 Mitigation Measures

Erosion and sedimentation caused by work related activities will be minimized by managing off and onsite runoff. Erosion and sedimentation control will involve:

- minimizing the disturbance to vegetation and limiting the area of clearing;
- installation of sediment control measures (silt fences, sediment traps, etc.) before starting work;
- regular inspection and maintenance of sediment control measures;
- minimizing the length of time that unstable erodible soils are exposed;
- conveying sediment-laden or turbid runoff into settling ponds or vegetated areas; and
- stabilizing erodible soils as soon as practical by seeding, revegetation or installing erosion control blankets.

The primary mitigation measures regarding vegetation involve land reclamation and revegetation of the Minago property to provide short- and long-term erosion control, to ensure that land use is compatible with surrounding lands, and to leave the area as a self-supporting ecosystem. The overall goal will be to prepare the site so that the vegetation returns to a state as near as possible to that in existence prior to mining activities by modifying site features where necessary and by facilitating 'natural' reestablishment of indigeneous vegetation and productive habitat for wildlife.

VNI will develop a Reclamation Plan during the operational phase for the Minago Project site to specify appropriate reclamation techniques for the different types of conditions identified. Reclamation techniques will include site preparation (such as scarification), planting or seeding techniques and best periods for planting/seeding, specification of suitable planting stock or seed mix(es) for revegetation, and specifications for fertilization, if required. The Reclamation Plan will also detail stockpiling techniques for muskeg and surface soils that will be removed during the construction and operation of site facilities to ensure their viability as top soils.

The identification and amelioration of physical environmental impediments to restoration will be part of Minago's reclamation plan. This includes ensuring low side slope angles for waste rock dumps (2.5H:1V); ripping/scarifying compacted surfaces prior to replanting/revegetating; recontouring and scarifying decommissioned roads and borrow pits, if necessary, to facilitate the reestablishment of native vegetation; and where possible, applying organic matter such as peat stockpiled in the initial construction phase to nutrient and organic matter deficient sites. Stockpiled top soil/peat will be spread, where available, to facilitate revegetation and to increase the organic matter content and water holding capacity of disturbed sites.

The revegetation program at Minago will include a research component to identify the most suitable local species and reclamation techniques for the range of disturbed sites that will need to be reclaimed and revegetated, including the reclamation of waste rock dumps. The research component will include field test plots established on representative disturbed site conditions to evaluate the vegetation's rate of establishment, growth, and nutrient and metal status as well as its suitability as wildlife habitat. Minago's Reclamation Plan will be based on the results of the research component and will incorporate a progressive reclamation strategy for disturbed areas that will no longer be used for site operations.

Whenever possible, local, native planting stock and seed mixes will be used at Minago to ensure a high success rate of the revegetation program and compatibility with surrounding lands. Freshly revegetated or reseeded sites will also be protected from further disturbance by humans by posting signs and/or restricting access where possible for example with soil or rock roadblocks. Restricted access will allow seedlings to become established.

7.9.15.1 Currently Established and Potential Revegation Species

To identify potential, local and native revegetation species, the currently established shrub and vascular herb strata were reviewed in light of succession studies. Succession studies reported in the literature have identified pioneer vegetation species and their seed dispersal capability, reproductive capabilities, and timeframes for establishment. The currently established shrubs and herbs in the dominant tree and shrub units are summarized in the next Section.

7.9.15.1.1 Currently Established Shrubs and Herbs in the Tree and Shrub Units

The currently established shrubs and herbs in the domitant tree and shrub units are summarized below based on the vegetation baseline studies conducted at Minago.

In the Intermediate Closed Evergreen Tree (IB1c) unit (Table 7.9-7), encountered on 34% of the Minago Project site, the shrub stratum was composed of diamond leaf willow (*Salix planifolia*), green alder (*Alnus crispa*), and small paper birch (*Betula papyrifera*) found primarily atop the hummocks. The herb stratum was fairly diverse, but was dominated by sedges (*Carex* sp.), bluejoint reedgrass (*Calamagrostis canadensis*), and arrow-leaved coltsfoot (*Petasites sagittatus*) (URS, 2008d).

In the Dwarf Open Evergreen Tree (IB2e) unit (Table 7.9-7), encountered on 25% of the site, the shrub stratum was dominated by shrub birch (*Betula glandulosa*), bog rosemary (*Andromeda polifolia*), and small bog cranberry (*Vaccinium oxycoccos*). The herb stratum was dominated by sedges (*Carex* sp.) and buckbean (*Menyanthes trifoliata*) (URS, 2008d).

In the Dwarf Closed Evergreen Tree (IB1e) unit (Table 7.9-7), encountered on 14% of the site and located on poorly-drained soils, the shrub stratum was dominated by shrub birch (*Betula glandulosa*), bog rosemary (*Andromeda polifolia*), and small bog cranberry (*Vaccinium oxycoccos*). Sedges (*Carex* sp.) made up most of the herb layer (URS, 2008d).

In the Intermediate Open Evergreen Tree (IB2c) unit (Table 7.9-7), encountered on 7% of the site, the shrub stratum was dominated by shrub birch (*Betula glandulosa*), Labrador tea (*Ledum groenlandicum*), and diamond leaf willow (*Salix planifolia*). The herb stratum was dominated by sedges (*Carex* sp.) and buckbean (*Menyanthes trifoliata*) (URS, 2008d).

In the Intermediate Open Deciduous Shrub (IIA2c) unit (Table 7.9-7), encountered on 8% of the site and located on poorly-drained soils, the dominant shrubs were shrub birch (*Betula glandulosa*) and tall blueberry willow (*Salix myrtillifolia* var. *cordata*). The herb stratum was dominated by swamp horsetail (*Equisetum fluviatile*) and bog sedge (*Carex magellanica*) (URS, 2008d).

In the Intermediate Sparse Deciduous Shrub (IIA3c) (Table 7.9-7), encountered on 6% of the site and located on very poorly-drained soils, the dominant plant in the shrub stratum was myrtle-leaved willow (*Salix myrtillfolia*). The herb stratum was dominated by beaked sedge (*Carex utriculata*) and water sedge (*Carex aquatilis*) (URS, 2008d).

7.9.15.1.2 Potential Revegetation Species

Based on the review of currently established shrub species in the previous Section, green alder (*Alnus crispa*), willows (*Salix* spp.), and potentially paper birch (*Betula papyrifera*) and/or shrub birch (*Betula glandulosa*) appear to be good candidates for successful revegetation at Minago (Table 7.9-7). All of these species have been successfully used or recommended at other sites for the purposes of reclamation and revegetation (Densmore et al., 2000; Smyth and Butler, 2004; Geographic Dynamics Corp., 2002; Strathcona County, 2008).

Out of these potential revegetation species, green alder and willows will be used for the reclamation program at Minago. Green alder and willows are described in more detail in the next sections due to their extensive and successful use.

It is planned to plant green alder seedlings throughout the Minago site to result in an approximate density of 0.5 alder per m^2 and willows in islands amongst the alders to facilitate their establishment and seed dispersal as soon as possible (progressive revegetation). It is anticipated that there will be approximately one willow island per hectare consisting of 50 stems. A custom seed mix will also be developed or obtained for Minago to seed small areas prone to erosion or areas for which revegetation with shrubs is not suitable (e.g. shoulders of access roads that will remain trafficable).

*Alnus crispa (*Green Alder*)*

Alnus crispa (= *Alnus viridis* ssp. *crispa*), a common alder species at Minago, is useful for revegetation projects. Vigorous growth on harsh sites, their ability to fix nitrogen, easy seed collection, and simple propagation make alder the species of choice for many revegetation projects (Densmore et al., 2000).

Table 7.9-7 Potential Revegetation Species based on Currently Established Vegetation

VEGETATION CLASSIFICATION	CURRENT SITE COVERAGE AT MINAGO	CURRENTLY DOMINANT SHRUBS	CURRENTLY DOMINANT HERBS
Intermediate Closed Evergreen Tree (IB1c)	34%	green alder (*Alnus crispa*), paper birch (*Betula papyrifera*)	bluejoint reedgrass (*Calamagrostis canadensis*)
Dwarf Open Evergreen Tree (IB2e)	25%	shrub birch (*Betula glandulosa*)	sedges (*Carex* sp.)
Dwarf Closed Evergreen Tree (IB1e)	14%	shrub birch (*Betula glandulosa*)	sedges (*Carex* sp.)
Intermediate Open Deciduous Shrub (IIA2c)	8%	shrub birch (*Betula glandulosa*)	swamp horsetail (*Equisetum fluviatile*)
Intermediate Open Evergreen Tree (IB2c)	7%	shrub birch (*Betula glandulosa*)	sedges (*Carex* sp.)
Intermediate Closed Evergreen Tree (IB1c)	34%	diamond leaf willow (*Salix planifolia*)	sedges (*Carex* sp.)
Intermediate Open Evergreen Tree (IB2c)	7%	diamond leaf willow (*Salix planifolia*)	sedges (*Carex* sp.)
Intermediate Open Deciduous Shrub (IIA2c)	8%	tall blueberry willow (*Salix myrtillifolia* var. *cordata*)	bog sedge (*Carex magellanica*)
Intermediate Sparse Deciduous Shrub (IIA3c)	6%	myrtle-leaved willow (*Salix myrtillfolia)*	beaked sedge (Carex utriculata) and water sedge (Carex aquatilis)

Planting container grown seedlings is typically the most efficient, because on disturbed sites with very poor soils, alders tend to have trouble getting started from seed, but will grow well once they are established (Densmore et al., 2000).

To obtain green alder planting stock for Minago, potential nurseries in Manitoba, Saskatechwan, and Alberta will be contacted. VNI will collect green alder cones, if no suitable planting stock is available for the Minago site from potential suppliers. The collected cones will be kept dry and warm to ensure complete drying of the seeds. Seeds will then be collected from the dried cones, kept in sealed plastic bags and stored in a freezer until use. Alders form root nodules that contain the mircoorganism *Frankia* sp., which fix nitrogen, and convert it to a form of nitrogen usable by plants.

If treated and planted appropriately, survival rates of alders are usually very high (> 95%) after 5 years for container grown alder seedlings, with a growth of 1 m in 3 years (Densmore et al., 2000).

Salix spp. (Willows)

Willows typically produce numerous seeds, which are dispersed over kilometres by wind, and they will establish naturally from seed on all disturbed sites suitable for willow growth (Densmore et al., 2000).

Willows (*Salix* spp.), when grown alongside alders, will use some of the nitrogen fixed by the alders, which promotes good growth of willows on soils where soil nitrogen is low.

To speed up the restoration process at Minago, willows will be planted alongside green alders in clumps (vegetation islands) on the disturbed sites. To protect the genetic integrity of the Minago Project site, willow cuttings will be collected from the site and its vicinity.

Most willows are adapted to root rapidly after stems are buried by flooding and have dormant root buds all along the stems. These buds, called preformed root initials, are formed in each year's new shoot growth and are covered by wood in subsequent years. As not all willows root readily from root initials, only willows will be selected for the reclamation at Minago that will grow readily from root initials and are acclimatized to the site conditions. Cuttings will be 1.0-2.5 cm in diameter at the base and 25-45 cm in length. Each cutting will at least have one leaf node or bud. The node is the place where shoots originate, and without a node, the cutting will not grow.

The revegetation program at Minago will mainly rely on dormant willow cuttings. Dormant willow cuttings are typically preferred for revegetation because they have higher carbohydrate reserves and can be stored frozen for long periods of time. Cuttings can be stored in a freezer or under snow and sawdust (Densmore et al., 2000). Once the air temperature rises above freezing in the spring, the cuttings will be planted as soon as possible. If not planted, the quality of the cuttings will deteriorate as melting snow will thaw the cuttings after which the cuttings will start using the stored carbohydrates, which they will also need for establishing themselves on a disturbed site.

It is anticipated that willow cuttings will be planted in shallow holes at an approximate angle of 45^{o}. The planting holes will be deep enough to bury the cuttings and allow 5-8 cm of the cuttings to protrude above the soil surface. Willow cuttings will be fertilized with a slow release fertilizer or fertilizer tablets designed for trees and shrubs. The fertilizer will be placed at the bottom of the hole, but will not touch the cutting. Each planted cutting will be watered, if possible.

Typically, willow cuttings root in 1-3 weeks. Growth rates of 0.5 m per year are considered good. Moose and snowshoe hares often browse planted willows (Densmore et al., 2000).

Custom Seed Mix

A custom seed mix will be developed or obtained for the Minago site to seed small areas prone to erosion or areas for which revegetation with shrubs is not suitable (e.g. shoulders of access roads that will remain trafficable). An effort will be made to source local and native seed mixes. Due to the remoteness of the site, suitable seed mixes for the climatic and soil conditions at the Minago site may not be commercially available. In case that suitable seed mixes cannot be easily sourced by VNI, the company may to resort to an 'autumn seed blitz technique' (Densmore et al., 2000) to collect local native seeds for cultivation and propagation.

The autumn blitz technique involves harvesting a variety of seeds near the disturbed area and may also involve sowing them immediately on the disturbed areas. In the autumn seed blitz technique, seeds are collected from a variety of plants that are ripe. Seeds must be dry on the plant. Whole seed heads may be collected for later separation of individual seeds from the seed heads.

By swamping a disturbed site with seeds from a variety of native species, prevailing site conditions will determine which species will survive. This technique usually provides good cover and high species diversity, especially if sown seeds are raked into the soil and fertilized to enhance seed germination (Densmore et al., 2000).

7.9.16 Monitoring and Follow-up

The revegetated areas will be subject to scheduled periodic inspections for the first five years in order to track the revegetation success and to make adjustments to the program as required. Success of the revegetation program will be determined by measuring a number of aspects including growth, survival, density and diversity of perennial species, metal uptake in vegetation, and the inspection of native plant invasion. Monitoring locations will include randomly located plots within areas representative of the reclaimed lands. A number of transects will also be established permanently across selected disturbed sites to assess native species ingress. The monitoring will be continued until the ecosystem has been self-regulating for some period of time.

Monitoring reports will be submitted to the regulatory agencies and communities of interest as required to obtain feedback on the success of the reclamation program.

7.9.17 Summary of Effects

Since plant communities and species in the Project Area are quite abundant and common both at the regional and local levels, they are not of conservation concern. Moreover, no special status plant species were observed in the vicinity of the Project Area. Therefore, the effects of site clearing are considered to be adverse, low magnitude, site-specific and long-term. The likelihood of that effect to occur as predicted is high given the baseline data that has been gathered as part of this project. These effects are considereed to be reversible since a Reclamation Plan will be implemented and disturbed surfaces will be revegetated with indigenous species (green alder and willows). The only permanent losses will be the areas occupied by the TWRMF as well as the pit area, totaling about 410 ha and representing about 30% of all cleared surfaces. These will be left as flooded areas or lakes. The Polishing Pond will be left as wetland.

The impact of seasonally discharging the final effluent in a bog before it reaches the Oakley Creek or the Minago River are considered to be neutral, low magnitude, site-specific and long-term. Indeed, even if the bog's water inflow is increased and thus it was to modify the surface vegetation, such effects are considered to be positive for wildlife since ponds are considered as high quality habitat.

7.10 Wildlife

This subsection summarizes the 2007 and 2008 wildlife survey programs completed at and surrounding the Minago Property. URS Canada Inc. (URS, 2008e) conducted a spring survey in 2007 and a winter survey in 2008 and Roche Consulting Group (Roche, 2008a) conducted a wildlife opportunistic observation program from May 6-9, 2008.

These wildlife surveys, excluding assessments of fish habitat and related results are presented and discussed in this Section. Fish habitat and abundance in watercourses surrounding the Minago Property are presented and discussed separately in Section 7.8.

The spring 2007 wildlife survey consisted of a qualitative presence/absence terrestrial survey at the Minago Project site and surrounding areas and opportunistic observations made throughout an eight-day fisheries and wildlife field survey. The 2008 winter wildlife survey consisted of an aerial survey of a 16 by 18 km^2 area surrounding the Minago Project site, terrestrial transects, and helicopter transects along winter roads. The main objective of August 2008 wildlife assessment program was to document the presence of large and small mammal species as well as of bird species.

A photographic record of the 2007 and 2008 wildlife surveys (URS, 2008e) is presented in Appendix 7.10.

7.10.1 Preliminary Data Collection

To assist in the identification of wildlife habitat, distribution, and seasonal presence/absence, and the potential presence of special status wildlife species, existing documents and data were reviewed for background information on the project area prior to the spring 2007 and winter 2008 wildlife field investigations. Documentation of wildlife in the project vicinity is limited due to its distance from population centres and limited use by hunters or trappers. Data reviewed included the following:

- **Map and Aerial Photo Documentation:**
  - 1:50,000 Topographic Maps (Limestone Bay, Gladish Lake, Hill Lake, William Lake, and Hargrave River) (Manitoba Conservation, 2007a);
  - Topoweb Canada: Manitoba (Softmap, 2007);
  - Minago Region Orthorectified Aerial Photograph (ER, 2007);
  - Google Earth Pro Satellite Photograph (Google Earth Pro, 2008);
  - Forest Resources Management-Forest Inventory Maps (Manitoba Conservation, 2000a);
  - Land Use/Land Cover Maps (Manitoba Conservation, 1989); and
  - Ecological Areas (Government of Canada, 1996).

➢ **Documented Habitat Utilization:**

- Plants of the Western Boreal Forest and Aspen Parkland (Johnson Et Al., 1995);
- The Atlas of Canada (Natural Resources Of Canada, 2007);
- Functional Profile of Black Spruce Wetlands in Alaska (Post, 1996);
- Ecology of Eastern Forests (Kricher and Morrison, 1988); and
- Eastern Trees (Petrides, 1988).

➢ **Special Status Wildlife Species:**

- MBCDC Species of Conservation Concern (Manitoba Conservation, 2007b);
- Phone Conversation with Cam Elliot (Elliot, 2008);
- Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada (Canadian Wildlife Service, 2004);
- Species at Risk in Manitoba (Environment Canada, 2007b); and
- Species listed under the Manitoba *Endangered Species Act* (Manitoba Conservation, 2007).

➢ **Documented Wildlife Distribution and Field Guides:**

- Mammals of North America (Reid, 2006);
- Mammal Tracks and Signs (Elbroch, 2003);
- The Sibley Guide to Birds (Sibley, 2000);
- The Sibley Guide to Bird Life and Behavior (Sibley, 2001);
- Warblers (Dunn And Garett, 1997);
- Birds of North America (Kaufman, 2000);
- Birds of North America, Eastern Region (Alsop, 2001);
- Guide to Birds of North America (Thayer, 2006);
- Bird Tracks and Sign (Elbroch And Marks, 2001); and
- The Amphibians and Reptiles of Manitoba (Preston, 1982).

7.10.2 2007 Spring Wildlife Survey – Data Collection

The wildlife habitat and opportunistic wildlife species survey was conducted by URS over a six-day period between May 31 and June 5, 2007 in conjunction with a survey of fisheries resources. This initial survey was followed by a two-day qualitative presence/absence terrestrial species survey. The 2007 spring wildlife field study was led by Bill Kidder (Wetland and Wildlife Scientist, URS) and assisted by Dr. Rob Nielsen (Fish and Wildlife Scientist, URS) and Ken Budd (Field Assistant, Norway House Cree First Nations).

Most of the wildlife habitat and opportunistic wildlife species survey occurred in the immediate vicinity of the Minago Property, including the riparian habitat of Oakley Creek. However, habitat and wildlife observations were also made during fisheries surveys of the Minago and William Rivers.

Existing habitat and fish distribution reports, aerial photographs, and topographic maps were used to create maps, which helped determine where field surveys should occur. Topographic maps of the area were downloaded from Topoweb Canada: Manitoba (Softmap 2007), converted to a PathAway 4.0 (Muskoka Tech 2007) file format and loaded onto a Palm Treo 680 PDA. The PathAway mapping application on the Treo 680 was used in conjunction with an EMTAC mini Bluetooth GPS unit to locate positions in the field and record their coordinates.

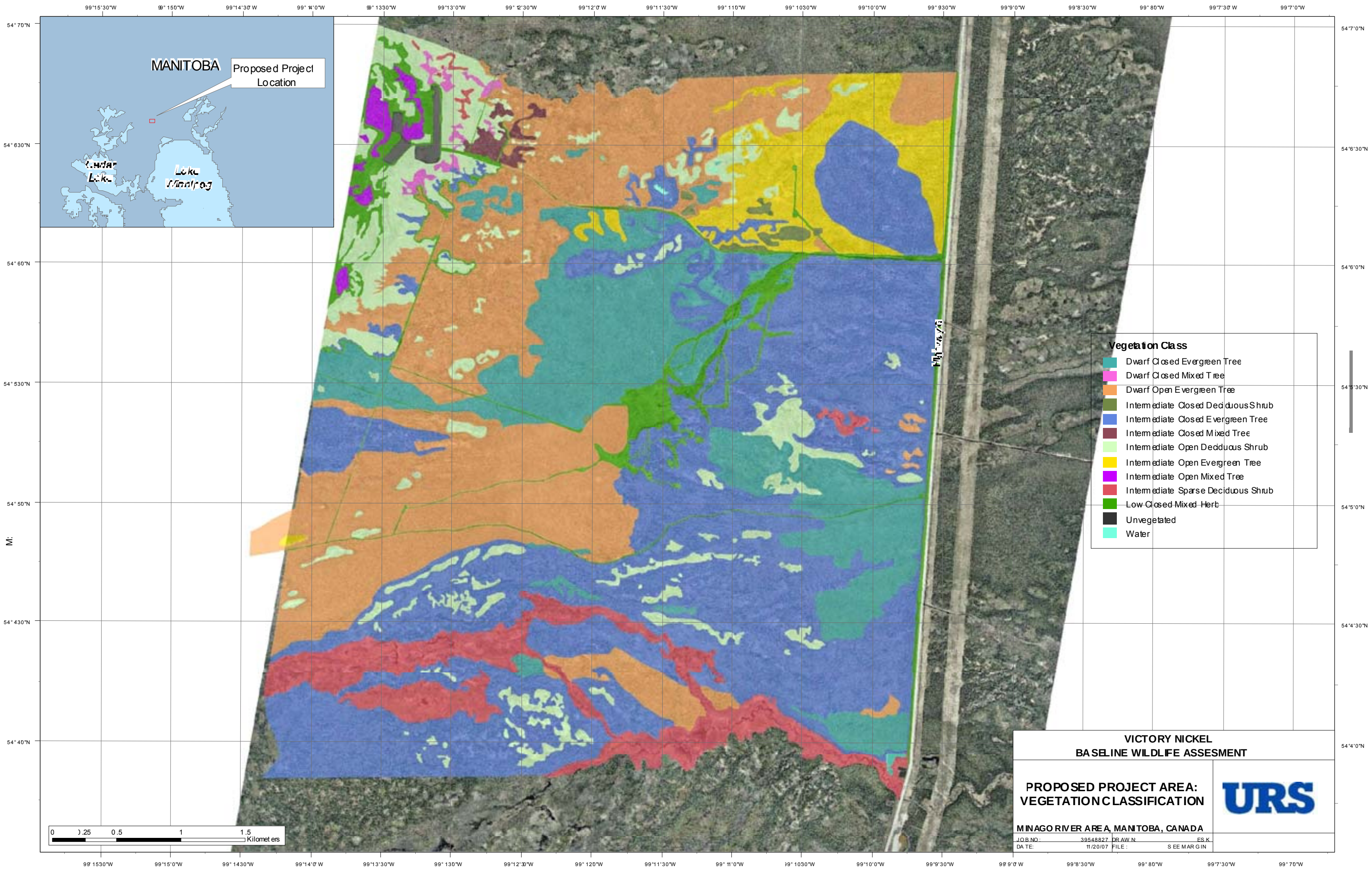
The wildlife survey began with a preliminary general helicopter over-flight of the Minago Project area and the Minago and William River watersheds in the vicinity of the project site. Oakley Creek was over-flown to its confluence with William River and Minago River was over-flown for approximately 10 kilometres east and west of Highway 6. During the aerial survey, notes were taken on aerial photographs of the project area and the coordinates of specific types of habitat and sightings of wildlife were marked as points with the PDA/GPS combination.

Wildlife Habitat Assessment

The field crew attempted to reach each habitat type observed during the preliminary aerial survey and make general observations of the plant communities for later incorporation into vegetation mapping.

Vegetation in the wildlife habitat surrounding the Minago Project site is shown in Figure 7.10-1. It should be noted that the vegetation mapping in Figure 7.10-1 displays two types of unvegetated areas. The labelled unvegetated area in the northwest corner of the figure represents landing strips of exposed limestone and mineral soil. A light olive-green was used to mark the more heavily used winter roads in the project area, the Highway 6 roadside ditch and a sinuous road/firebreak south of the landing strips. Most of the winter roads were vegetated with herbaceous vegetation or emergent marsh vegetation. The roadside ditch was vegetated primarily with shrubs, grasses, and herbaceous vegetation, and the areas surrounding the project access road and roads to drill sites on the property were primarily composed of unvegetated peat muck formed by tracked vehicles driving over the roads in the spring.

The intermediate open deciduous shrub vegetation shown in Figure 7.10-1 actually represents two types of wildlife habitat. Most of the intermediate open deciduous shrub habitat in the northwest corner of the Figure, west of the firebreak/road and in the vicinity of the landing strips is early seral bogs or fens. The many patches of intermediate open deciduous shrub habitat distributed over



Source: URS (2008e)

Figure 7.10-1 Vegetation Classification in the Vicinity of the Minago Project

the remainder of the project area are located in areas of muskeg, bogs, or fens. Often the centre of these patches is an open bog containing large areas of standing water during the spring. Many of these contain clumps of dead spruce trees that provide snag habitat. Also, many of these areas are surrounded by rings of taller black spruce and tamarack, with the tamarack (*Larix laricina*) closest to the open area. There were also a number of thaw lakes (small cave-in ponds) located in dwarf open evergreen tree habitat just north of the winter road running west from the end of the west-east access road to the landing strips. These shallow ponds were surrounded by taller black spruce and tamarack, similar to those surrounding the bog habitats. They also had a yellowish layer of precipitates suspended over their substrates.

A final habitat feature (not shown in Figure 7.10-1) is a series of narrow east-west ridges located south of the access road, west of Highway 6, east of UTM Easting 0488325, and north of UTM Northing 5993597. These ridges were elevated a few metres above the surrounding terrain and are slightly drier. They contained the tallest conifers present at the Minago Property. Generally, the north sides of the ridges were dominated by tamarack and the south sides dominated by black spruce. The color differences between the two tree species and greater heights of the trees give the ridges a three dimensional effect in aerial photographs that does not accurately reflect the slight elevation difference.

2007 Wildlife Survey

The spring 2007 wildlife survey focused on migratory birds, amphibians, and other species best observed in late spring and early summer. The field crew recorded incidental observations of wildlife during terrestrial surveys, during a canoe survey of Oakley Creek and its riparian habitat south of the project area, fish collection stations on the William and Minago Rivers in the vicinity of Highway 6 and William River above and below its confluence with Oakley Creek.

Wildlife surveys were restricted by access problems throughout the project area and vicinity due to swampy conditions. Hence, surveys in terrestrial habitat within the project area were primarily confined to the project area access roads traversable by ARGO, the areas immediately accessible by foot near Highway 6, winter roads that were not churned up by tracked vehicles, and short traverses on foot from locations along the access roads where it was possible to travel on foot.

Survey crews were able to travel by ARGO and truck along several fire roads and transmission line corridors in the vicinity of the Minago River for short distances and along a road paralleling the William River upstream of Highway 6 to its confluence with the outlet stream of Little Limestone Lake. An attempt was made to access the lower William River by an ARGO east along a transmission line access road, but it was only possible to travel a few kilometres before reaching impassable areas of bog and fen habitat. Crews found the presence of northern pitcher plants (*Sarracenia purpurea*) a reliable indicator of wetlands as such the ARGO could not successfully cross. The pitcher plant is a carnivorous plant that prefers highly acidic and poorly drained bogs, a sure indication of the deep peat deposits.

The qualitative presence/absence terrestrial species survey was conducted by the URS field crew on June 6 and 7, 2007. On the first day, morning and mid-day surveys were conducted, and on the second day a survey was conducted from mid-day to late evening. The survey was conducted by driving project area accessible by ARGO and stopping at random sampling points to make observations in as many habitat types as possible. The locations of visual or auditory observations of wildlife and tracks while driving were recorded. Thirty (30) minutes were spent listening to bird, amphibian, and other wildlife calls and using binoculars to scan vegetation in the vicinity for birds and other wildlife. This was followed by short transects on foot away from the ARGO to look for tracks, nests, scats, and other signs while stopping frequently to listen and scan the area with binoculars to observe any wildlife present. Transects on foot varied between 100 and approximately 400 metres away from the ARGO. In most cases, a slightly different route was used to walk back to the access road and the ARGO to maximize the area observed. In every case, the two URS wildlife biologists and field assistants walked separate transects to maximize opportunistic sightings. All observations were noted and locations placed on either an aerial photograph or their coordinates were recorded on a PDA.

7.10.3 2008 Winter Wildlife Survey

Collection of wildlife field data for the winter survey took place between January 15 and 18, 2008. The winter wildlife field study was led by Dr. Rob Nielsen (Fish and Wildlife Scientist, URS) and assisted by Jonathan Anderson (Field Assistant, Victory Nickel).

The winter wildlife survey consisted of an aerial transect wildlife survey and a terrestrial transect wildlife survey. The aerial survey included the Minago Project area and extended out to encompass an 18 km by 16 km (288 square kilometres) block of land on both sides of Highway 6 that surrounded the project area. The terrestrial transect survey consisted of transects of winter roads by truck as far as the roads were drivable. Roads were generally drivable by truck to active drill sites. Beyond areas of activity, several feet of wind blown snow covered the winter roads. These sections of winter roads were traversed by ski and snowshoe. A few transects of wider winter roads were completed from a helicopter by flying low enough to observe tracks.

2008 Aerial Wildlife Survey

On January 15 and 18, 2008 a Robinson 44 helicopter was used to conduct an aerial survey of the Minago Project area. Surveys began each day at approximately 10 AM (CST). Observations of animals on the left side and front were made by the pilot and Jonathan Anderson, while observations of animals on the right side and front were made by Rob Nielsen. Dr. Nielsen recorded all sightings and marked their locations with the PDA/GPS. Aerial surveys were modeled after literature winter survey aerial transect methodologies for moose and caribou in semi-open canopy (Gasaway et al., 1986, Parker 1973, Thompson and Fisher, 1979). Both surveys were conducted on clear days with good visibility, with snowfall the previous evening covering tracks and signs from the day before.

The helicopter was flown at a speed and height above the ground that allowed opportunity to observe all eastern moose (*Alces alces americana*) and woodland caribou present within approximately 0.5 km to each side. Survey time was approximately 1.7 minutes per km^2. North-south transects began at the north end of the survey area and proceeded south in a grid pattern with a spacing of 0.8 km between transects. Transects were flown at approximately 100 km per hour and 100 metres above ground level. Flight speed was increased or decreased depending upon how open the canopy was and flight speed was greatly reduced over the few regions where the canopy became close enough to interfere with observations. Observations of wildlife from the winter aerial surveys are presented in Figure 7.10-2.

2008 Terrestrial Transect Wildlife Survey

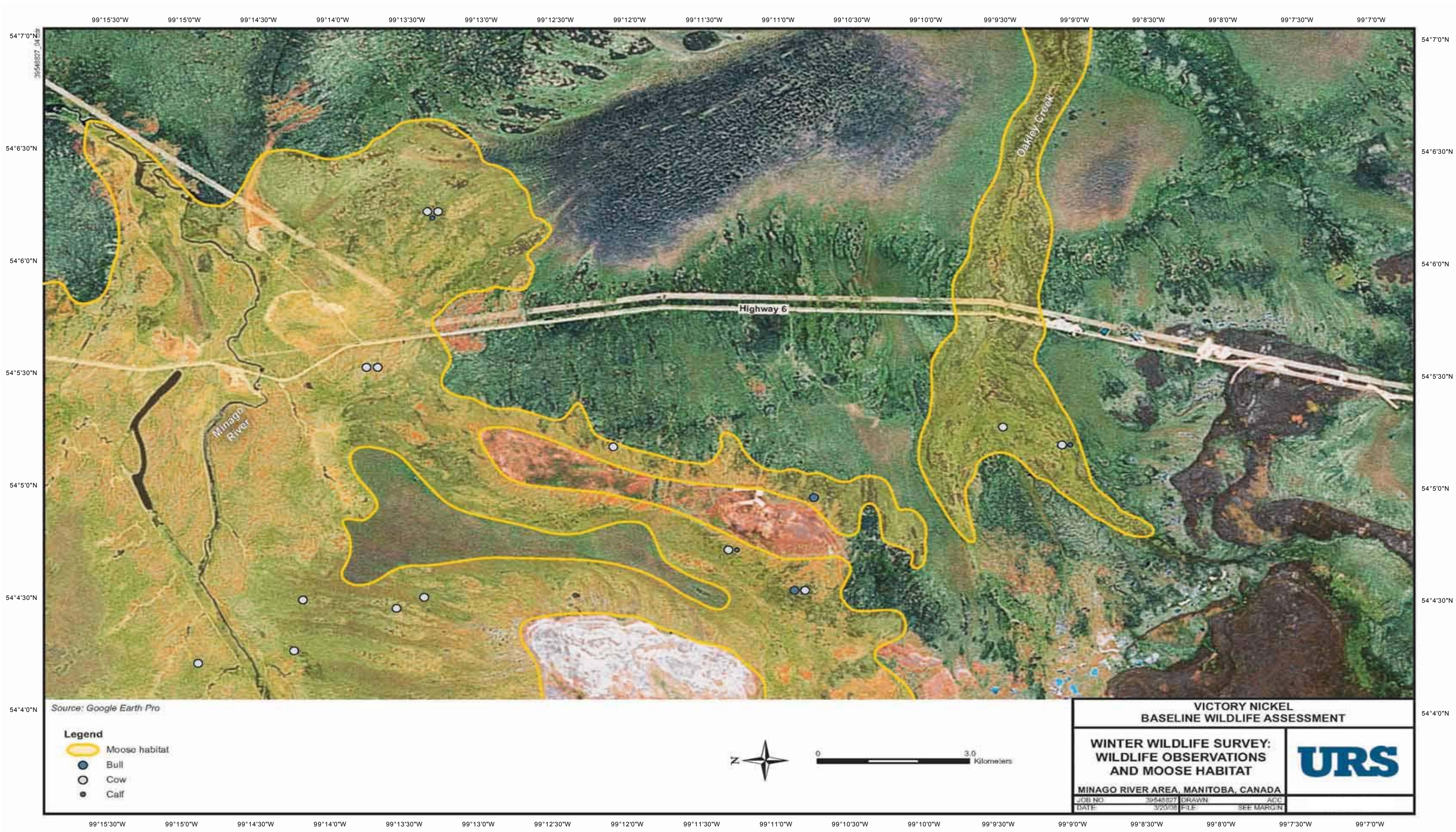
Terrestrial transects of the Minago Project area were conducted from January 15 to 17, 2008. Initial transects on January 15 were made by slowly driving a truck on the project area access road and winter roads in active use by drillers in the evening after completing the initial helicopter aerial survey. The snow on these roads was tightly packed to avoid any danger of becoming stuck in freezing weather by deep snowdrifts that crossed un-traveled winter roads. The initial road transects were made to determine what areas could be reached to begin transects by cross country ski and snowshoe. The sides of the roads were closely observed while driving to determine the habitats and areas of the project area most heavily used by wildlife. Since the winter roads had to be travelled on January 16 and 17, 2008 to reach starting points for ski/snowshoe transects, the truck transects were repeated on these days.

Transects surveyed by means of ski/snowshoe (ski/snowshoe transects) were selected to travel quietly through as many different habitat types as possible and to access regions of the project area away from drilling activity. During these transects, tracks, beds, and scat were identified, photographed next to an object for size reference, and recorded. Any visual or auditory observations of wildlife were also recorded. Several areas originally intended for traverses could not be skied during the time available, so these areas were over-flown by helicopter on January 18, 2008. It was possible to fly relatively close to the ground because the traverses were on wide winter roads. All transects are presented with letter designations in Figure 7.10-3 by type (truck, ski, helicopter). The distances of the traverses in km were:

Truck:

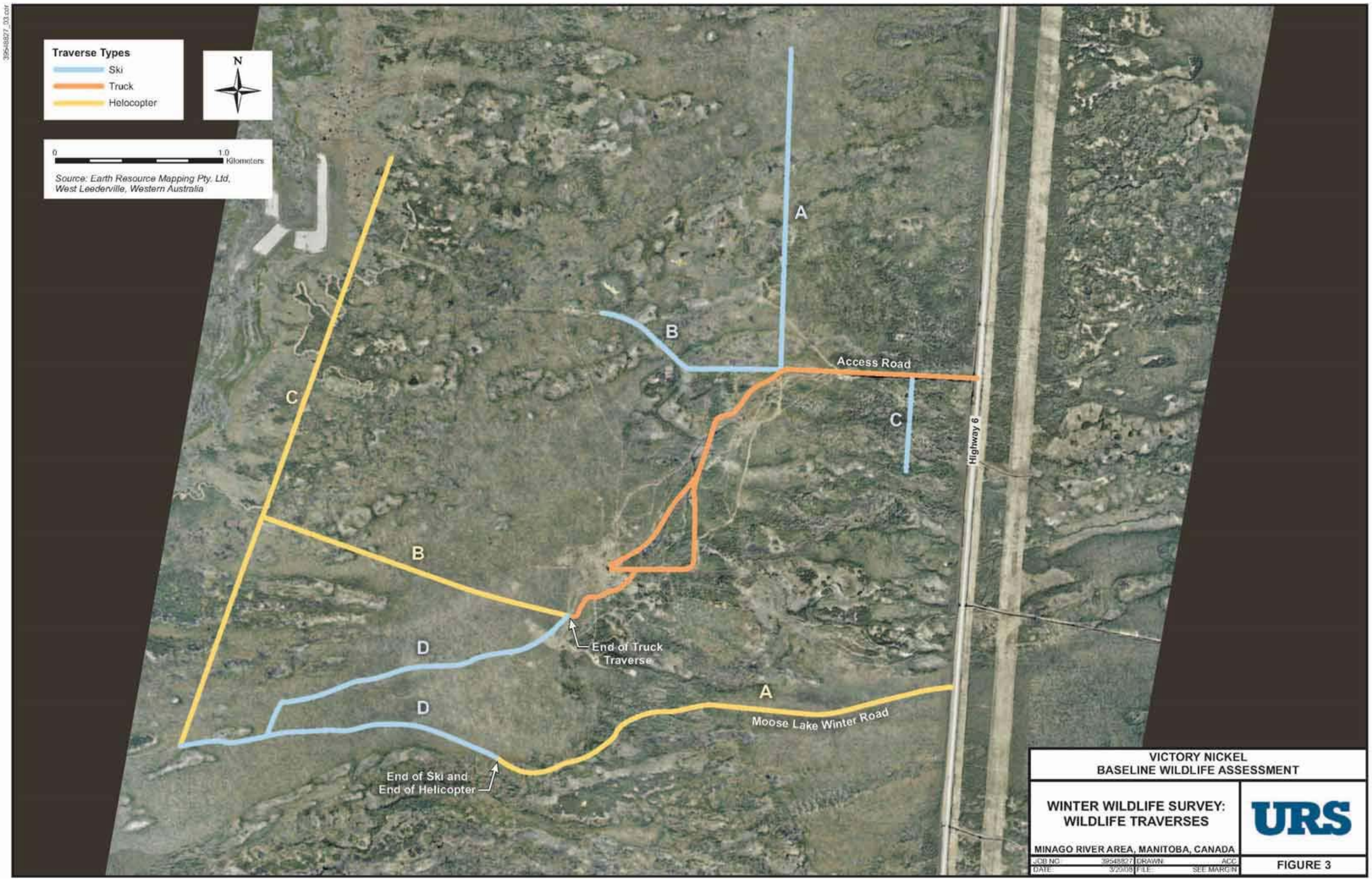
- Access Road 1.2 km
- Roads to Drill Sites 4.0 km

- Total Distance 5.2 km



Source: URS (2008e)

Figure 7.10-2 2008 Winter Wildlife Survey Observations



SOURCE: URS (2008E)

FIGURE 7.10-3 WILDLIFE TRAVERSES IN 2007 WINTER WILDLIFE SURVEY

Ski:

- Ski Traverse A 2.0 km
- Ski Traverse B 2.0 km
- Ski Traverse C 0.7 km
- Ski Traverse D 5.1 km
- Total Distance 9.8 km

Helicopter:

- Helicopter Traverse A 3.5 km
- Helicopter Traverse B 2.0 km
- Helicopter Traverse C 4.0 km
- Total Distance 9.5 km

7.10.4 May 2008 Wildlife Survey

The May 2008 wildlife survey by Roche was purely opportunistic. No specific survey was carried out to document the presence of wildlife.

7.10.5 Wildlife Survey Results

7.10.5.1 Birds

A list of birds with a potential to occur in the vicinity of the Minago Project area is presented in Table 7.10-1 along with residence timing (Winter (W), Summer (S), or Resident (R) throughout the year). Species that were observed by URS (2008e) and Roche (2008a) to occur in the project area are noted in this table. Few birds were observed during the winter wildlife survey. The most commonly observed species during the winter survey was sharp-tailed grouse (*Tympanuchus phasianellus*), with some observations of ravens (*Corvus corax*) along Highway 6 and gray jays (*Perisoreus canadensis*) in intermediate closed canopy black spruce forest at the project site survey area. During helicopter over-flights of the project area, flocks of sharp-tailed grouse frequently took off when disturbed by the helicopter. These flocks of grouse were almost always sighted in areas of dwarf open evergreen habitat (tamarack and black spruce) with widely spaced trees and abundant low growing deciduous shrubs. Although sharp-tailed grouse were not observed during truck and ski traverses (Figure 7.10-3), their distinctive tracks were observed throughout Ski Traverse D, which crossed similar habitat, but with more closely spaced trees, and along portions of Ski Traverses A and B, which crossed patches of intermediate closed deciduous shrub habitat. These are also the habitats that sharp-tailed grouse were found to be abundant in during spring surveys.

Other than sharp-tailed grouse, most birds observed within the Minago Project area during 2007 spring surveys were shorebirds (Table 7.10-1) foraging in the deeply churned trails of muck in-

Table 7.10-1 Birds Occurring in the Vicinity of the Minago Project Area

Scientific Name	Common Name	Occurrence (R/S/W)	Observed by URS (2008e)	Observed by Roche (2008a)
Gaviidae: Loons				
Gavia immer	Common Loon	S		X
Podicipedidae: Grebes				
Podiceps auritus	Horned Grebe	S		
Podilymbus podiceps	Pied-billed Grebe	S		
Ardeidae: Herons				
Ardea herodias	Great Blue Heron	S		
Botaurus lentiginosus	American Bittern	S		X
Anatidae: Waterfowl				
Aix sponsa	Wood Duck	S		
Anas acuta	Northern Pintail	S		X
Anas americana	American Wigeon	R		
Anas clypeata	Northern Shoveler	S		
Anas crecca	Green-winged Teal	S		
Anas discors	Blue-winged Teal	S		
Anas platyrhynchos	Mallard	S		X
Anas strepera	Gadwall	S		
Aythya affinis	Lesser Scaup	S		X
Aythya collaris	Ring-necked Duck	S		X
Aythya valisineria	Canvasback	S		X
Branta canadensis	Canada Goose	S		X
Bucephala albeola	Bufflehead	S		
Bucephala clangula	Common Goldeneye	S		X
Cygnus columbianus	Tundra Swan	S		X
Lophodytes cucullatus	Hooded Merganser	S		
Mergus merganser	Common Merganser	S		X
Mergus serrator	Red-breasted Mergans	S		X
Oxyura jamaicensis	Ruddy Duck	S		
Accipitridae: Hawks and Eagles				
Accipiter gentilis	Northern Goshawk	R		
Accipiter striatus	Sharp-shinned Hawk	S		
Buteo jamaicensis	Red-tailed Hawk	S		X
Buteo platypterus	Broad-winged Hawk	S		
Circus cyaneus	Northern Harrier	S	X	
Haliaeetus leucocephalus	Bald Eagle	S		X
Pandion haliaetus	Osprey	S		X
Falconidae: Falcons				
Falco columbarius	Merlin	S		
Falco rusticolus	Gyrfalcon	W		
Falco sparverius	American Kestrel	S	X	
Phasianidae: Grouse				
Bonasa umbellus	Ruffed Grouse	R		X
Falcipennis canadensis	Spruce Grouse	R		X
Tympanuchus phasianellus	Sharp-tailed Grouse	R	X	
Rallidae: Rails				
Fulica americana	American Coot	S		
Porzana carolina	Sora	S		
Gruidae: Cranes				
Grus canadensis	Sandhill Crane	S	X	
Scolpacidae: Shorebirds				
Actitis macularius	Spotted Sandpiper	S		X
Bartramia longicauda	Upland Sandpiper	S		
Gallinago gallinago	Common Snipe	S	X	

Table 7.10-1 (Cont.'d) Birds Occurring in the Vicinity of the Minago Project Area

Scientific Name	Common Name	Occurrence (R/S/W)	Observed by URS (2008e)	Observed by Roche (2008a)
Limosa fedoa	Marble Godwit			
Numenius americanus	Long-billed Curlew	S		
Tringa flavipes	Lesser Yellowlegs	S	X	
Tringa melanoleuca	Greater Yellowlegs	S	X	
Tringa solitaria	Solitary Sandpiper	S	X	
Charadriidae: Plovers				
Charadrius vociferus	Killdeer	S	X	
Laridae: Gulls				
Larus delawarensis	Ring-billed Gull	S	X	
Larus philadelphia	Bonaparte's Gull	S	X	
Larus pipixcan	Franklin's Gull	S		
Strigidae: Owls				
Aegolius acadicus	Northern Saw-whet Owl	R	X	
Asio flammeus	Short-eared Owl	S		
Asio otus	Long-eared Owl	R		
Bubo scandiacus	Snowy Owl	W		
Bubo virginianus	Great Horned Owl	R		
Strix varia	Barred Owl	R		
Strix nebulosa	Great Gray Owl	R		
Surnia ulula	Northern Hawk Owl	R	X	
Caprimulgidae: Swifts and Nighthawks				
Chordeiles minor	Common Nighthawk	S		
Alcedinidae: Kingfishers				
Ceryle alcyon	Belted Kingfisher	S	X	
Picidae: Woodpeckers				
Colaptes auratus	Northern Flicker	S	X	
Dryocopus pileatus	Pileated Woodpecker	R		X
Picoides arcticus	Black-backed Woodpecker	R		
Picoides dorsalis	American Three-toed Woodpecker	R		
Picoides pubescens	Downy Woodpecker	R		
Picoides villosus	Hairy Woodpecker	R		
Sphyrapicus varius	Yellow-bellied Sapsucker	S		
Tyrannidae: Flycatchers				
Contopus cooperi	Olive-sided Flycatcher	S		
Empidonax alnorum	Alder Flycatcher	S		
Empidonax flaviventris	Yellow-bellied Flycatcher	S		
Empidonax minimus	Least Flycatcher	S	X	
Sayornis phoebe	Eastern Phoebe	S	X	
Tyrannus tyrannus	Eastern Kingbird	S		
Vireonidae: Vireos				
Vireo gilvus	Warbling Vireo	S		
Vireo olivaceus	Red-eyed Vireo	S	X	
Vireo philadelphicus	Philadelphia Vireo	S		
Vireo solitarius	Blue-headed Vireo	S		
Corvidae: Jays				
Corvus brachyrhynchos	American Crow	S		X
Corvus corax	Common Raven	R	X	
Cyanocitta cristata	Blue Jay	R		
Perisoreus canadensis	Gray Jay	R	X	
Pica hudsonia	Black-billed Magpie	R		X

Table 7.10-1 (Cont.'d) Birds Occurring in the Vicinity of the Minago Project Area

Scientific Name	Common Name	Occurrence (R/S/W)	Observed by URS (2008e)	Observed by Roche (2008a)
Hirundinidae: Swallows				
Hirundo rustica	Barn Swallow	S		X
Petrochelidon pyrrhonota	Cliff Swallow	S		X
Tachycineta bicolor	Tree Swallow	S		
Paridae: Chickadees				
Poecile atricapillus	Black-capped Chickadee	R	X	
Poecile hudsonica	Boreal Chickadee	R		
Sittidae: Nuthatches				
Sitta canadensis	Red-breasted Nuthatch	R		
Certhiidae: Creepers				
Certhia americana	Brown Creeper	S		
Troglodytidae: Wrens				
Cistothorus platensis	Sedge Wren	S		
Troglodytes troglodytes	Winter Wren	S		
Regulidae: Kinglets				
Regulus calendula	Ruby-crowned Kinglet	S		
Turdidae: Thrushes				
Catharus guttatus	Hermit Thrush	S		
Catharus ustulatus	Swainson's Thrush	S		
Sialia sialis	Eastern Bluebird	S		
Turdus migratorius	American Robin	S		X
Motacillidae: Pipits				
Anthus spragueii	Sprague's Pipit	S		
Bombycillidae: Waxwings				
Bombycilla cedrorum	Cedar Waxwing	S		
Bombycilla garrulus	Bohemian Waxwing			
Parulidae: Wood-Warblers				
Dendroica castanea	Bay-breasted Warbler	S		
Dendroica coronata	Yellow-rumped Warbler	S		
Dendroica magnolia	Magnolia Warbler	S		
Dendroica palmarum	Palm Warbler	S		
Dendroica petechia	Yellow Warbler	S		
Dendroica tigrina	Cape May Warbler	S		
Dendroica virens	Black-throated Green Warbler	S		
Geothlypis trichas	Common Yellowthroat	S		
Mniotilta varia	Black-and-white Warbler	S		
Oporornis agilis	Connecticut Warbler	S		
Oporornis philadelphia	Mourning Warbler	S		
Seiurus aurocapilla	Ovenbird	S		
Seiurus noveboracensi	Northern Waterthrush	S		
Setophaga ruticilla	American Redstart	S		
Vermivora celata	Orange-crowned Warbler	S		
Vermivora peregrina	Tennessee Warbler	S		
Wilsonia canadensis	Canada Warbler	S		
Cardinalidae: Cardinals and Grosbeaks				
Pheucticus ludovicianus	Rose-breasted Grosbeak	R		
Emberizidae: Sparrows				
Ammodramus leconteii	Le Conte's Sparrow	S		
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	S	X	
Calcarius ornatus	Chestnut-collared Longspur	S		
Junco hyemalis	Dark-eyed Junco	S		

Table 7.10-1 (Cont.'d) Birds Occurring in the Vicinity of the Minago Project

Scientific Name	Common Name	Occurrence (R/S/W)	Observed by	
			URS (2008e)	Roche (2008a)
Melospiza georgiana	Swamp Sparrow	S		
Melospiza lincolnii	Lincoln's Sparrow	S		
Melospiza melodia	Song Sparrow	S		
Passerculus sandwichensis	Savannah Sparrow	S		
Plectrophenax nivalis	Snow Bunting	W		X
Pooecetes gramineus	Vesper Sparrow	S		
Spizella pallida	Clay-colored Sparrow	S		
Spizella passerina	Chipping Sparrow	S		
Zonotrichia albicollis	White-throated Sparrow	S		
Icteridae: Icterids				
Agelaius phoeniceus	Red-winged Blackbird	S	X	
Euphagus carolinus	Rusty Blackbird	S		
Quiscalus quiscula	Common Grackle	S		
Fringillidae: Finches				
Carduelis pinus	Pine Siskin	S		
Carduelis tristis	American Goldfinch	S		
Carpodacus purpureus	Purple Finch	S		
Coccothraustes vespertinus	Evening Grosbeak	R		
Loxia curvirostra	Red Crossbill	R		
Loxia leucoptera	White-winged Crossbill	R		

Source: URS (2008e)

Notes: Ocurrence data from Sibley (2000 & 2001), Thayer (2001), Ebroch and Marks (2001)
Timing: S = Summer Resident
W = Winter Resident
R = Resident throughout the year
Observed: Birds and tracks observed or birds heard calling within the Minago Project Area.

and-along the many access roads to drilling sites. Much of this area actually traversed through intermediate and dwarf closed evergreen forest habitat dominated by black spruce and tamarack, but the wide swaths of muck left by tracked vehicles provided a feast for shorebirds. Killdeer (*Charadrius vociferus*), common snipe (*Gallinago gallinago*), solitary sandpiper (*Tringa solitaria*), lesser yellowlegs (*Tringa flavipes*), and greater yellowlegs (*Tringa melanoleuca*) were quite common in these areas and were almost completely undisturbed by the noise generated by the ARGO. Yellowlegs of both species were common enough to almost be referred to as an "incontinence of yellowlegs," the old English term for flocks of yellowlegs. Although no attempt was made to find the nests, on two occasions, solitary sandpipers appeared to be defending their nests. This occurred near ponds and bogs that were surrounded by rings of taller black spruce trees. Shorebirds were most frequently encountered along the drill roads, but were also observed near ponds and bogs. Killdeer were also observed frequently when traversing areas of dwarf open evergreen tree habitat with widely spaced trees and abundant herbaceous groundcover. Sandhill crane (*Grus canadensis*) tracks were observed in the muck along one of the drill site access roads. On one occasion, a group of Bonaparte's gulls (*Larus philadelphia*) was observed mobbing a raven while flying across the project site. This may not indicate actual use of the project site, but it is highly likely that they are using habitat within a few kilometres of the project site. A northern harrier (*Circus cyaneus*) was also observed hunting over open habitat in the vicinity of the drilling sites.

Very few forest interior birds typical of boreal forest were heard or seen at the Minago Project site. Most birds were heard calling in the strip of deciduous forest that bordered the roadside ditch along Highway 6 or in similar habitat that bordered the access road. Whenever URS field crews traversed closed canopy habitat, few birds were seen or heard. Other than observations of shorebirds and sharp-tailed grouse this lack of bird observations also held true for dwarf open evergreen tree and intermediate open deciduous shrub and bog habitats within the project area. A few northern saw-whet owls (*Aegolius acadicus*), northern hawk owls (*Surnia ulula*), black-capped chickadees (*Poecile atricapilla*), and red-eyed vireos (*Vireo flavoviridis*) were heard calling, but mostly in the vicinity of mixed or deciduous forest habitat.

A wider variety of birds was observed and heard during surveys of the riparian habitat of the William River, Minago River, and Oakley Creek. Oakley Creek was surrounded by a floodplain dominated by intermediate sparse deciduous shrub. Along the creek, this habitat actually could be more accurately described as dense willow (*Salix* spp.) and red osier dogwood (*Cornus sericea*) thickets with occasional open areas of herbaceous vegetation and emergent wetlands. Birds associated with shrub and wetland vegetation were common along the creek, including eastern phoebe (*Sayornis phoebe*), least flycatcher (*Empidonax minimus*), Nelson's sharp-tailed sparrow (*Ammodramus nelsoni*), and white throated sparrow (*Zonothrichia albicollis*).

Aquatic, shore, and wetland birds that were observed along the Oakley Creek beaver ponds and the William and Minago Rivers include the Common loon (*Gavia immer*), spotted sandpiper (*Actitis macularius*), American bittern (*Botaurus lentiginosus*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), canvasback (*Aythya valisineria*), lesser scaup (*Aythya affinis*), common merganser (*Mergus merganser*), Red-winged blackbird (*Agelaius phoeniceus*), belted kingfisher (*Ceryle alyon*), barn swallows (*Hirundo rustica*), and, in the vicinity of the Minago River Bridge on Highway 6, cliff swallows (*Petrochelidon pyrrhonota*) were commonly observed flying over the water feeding on hatches of aquatic insects.

Bald eagles (*Haliaeetus leucocephalu*s) were observed during spring helicopter over-flights of Oakley Creek and the William River east of Highway 6. American kestrel (*Falco sparverius*), common raven (*Corvus corax*), American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), and black-billed magpie (*Pica hudsonia*) were observed along Highway 6 between the William and the Minago Rivers.

Spruce grouse (*Falcipennis canadensis*), ruffed grouse (*Bonasa umbellus*), and pileated woodpecker (*Dryocopus pileatus*) were observed in forested habitat along the Williams and Minago Rivers.

7.10.5.2 Mammals

A list of mammals with a potential to occur in the vicinity of the Minago Project area is presented in Table 7.10-2. Species that were observed by URS (2008e) and/or Roche (2008a) to occur in the project area are noted in this Table.

7.10.5.2.1 Small Mammals

The only small mammals observed during wildlife surveys at the Minago Project site were muskrat (*Ondatra zibethicus*) in the roadside ditch and in the beaver ponds of Oakley Creek and snowshoe hare tracks recorded during winter survey transects. Although technically not considered small mammals (which are usually lagomorphs, rodents, and Insectivores) a few little brown myotis (*Myotis lucifugus*) bats were observed flying overhead along the roadside ditches at twilight. Beavers and beaver dams were also observed in ditches and streams.

The closest documented bat hibernacula to the Minago Project site are ten limestone caves in the Grand Rapids uplands, with the closest cave (Dale's Cave) approximately 16 km from the project area (Bilecki, 2003). These caves provide hibernacula for little brown myotis, northern long-eared myotis (*Myotis septentrionalis*), and possibly big brown bat (*Eptesicus fuscus*). Three other species of bats that may be summer visitors to the project area are listed in Table 7.10-2. No caves were observed in the Minago Project Area.

In addition to fifteen beaver ponds observed during a survey of Oakley Creek, beaver activity was observed in the roadside ditch along Highway 6 and in short surface drainages that did not have surface connections to any streams draining the project area or that drained into the Highway 6 roadside ditch. One such drainage that flows into the Highway 6 roadside ditch near the entrance of Minago's main access road was dammed approximately 100 m from Highway 6.

Other than the tunnels of voles and lemmings observed in sedges during the spring and in the snow during the winter, no other signs of small mammals were observed. This includes red squirrels and chipmunks. Through the entire eight days of spring surveys and four days of winter surveys there was no visual or auditory evidence of squirrels and chipmunks at the Minago Project site. No small mammals or their tracks were observed during the 2008 winter survey (URS, 2008e). It is highly unusual to not observe red squirrels in black spruce forests (URS, 2008e). There is no readily available answer for the absence of red squirrels from the project site. Perhaps the black spruce trees in the project area produced poor seed crops or arboreal fungi and lichens were relatively scarce in the black spruce wetlands of the project area.

A few small mammals were observed outside of the project area during fisheries surveys of the Minago and William Rivers. The small mammals observed during these surveys were least chipmunk (*Tamias minimus*), snowshoe hare (*Lepus americanus*), and red squirrel (*Tamiasciurus hudsonicus*).

Table 7.10-2 Mammals Occurring in the Vicinity of the Minago Project Area

Scientific Name	Common Name	Observed by	
		URS (2008e)	Roche (2008a)
Soricimorpha: Shrews and Moles			
Sorex arcticus	Arctic Shrew		
Sorex cinereus	Masked Shrew		
Sorex hoyi	Pygmy Shrew		
Sorex palustris	American Water Shrew		
Chiroptera: Bats			
Eptesicus fuscus	Big Brown Bat		
Lasionycteris noctivagans	Silver-haired Bat		
Lasiurus borealis	Eastern Red Bat		
Lasiurus cinereus	Hoary Bat		
Myotis lucifugus	Little Brown Myotis	X	
Myotis septentrionalis	Northern Long-eared Myotis		
Lagomorpha: Rabbits and Hares			
Lepus americanus	Snowshoe Hare	T	X
Rodentia: Rodents			
Castor canadensis	American Beaver	X	
Clethrionomys gapperi	Southern Red-backed Vole		
Phenacomys ungava	Eastern Heather Vole		
Microtus pennsylvanicus	Meadow Vole		
Synaptomys borealis	Northern Bog Lemming		
Peromyscus maniculatus	Deer Mouse		
Zapus hudsonius	Meadow Jumping Mouse		
Ondatra zibethicus	Muskrat	X	
Glaucomys sabrinus	Northern Flying Squirrel		
Tamias minimus	Least Chipmunk		X
Tamiasciurus hudsonicus	Red Squirrel		X
Erethizon dorsatum	North American Porcupine		
Carnivora: Carnivores			
Lynx canadensis	Canada Lynx	T	
Canis latrans	Coyote	T	
Canis lupus	Gray Wolf		
Vulpes vulpes	Red Fox		X
Ursus americanus	American Black Bear	T	
Gulo gulo	Wolverine		
Lontra canadensis	Northern River Otter	T	
Martes americana	American Marten	T	
Martes pennanti	Fisher	T	
Mephitis mephitis	Striped Skunk		
Mustela erminea	Ermine	T	
Mustela nivalis	Least Weasel		
Mustela vison	American Mink	T	
Artiodactyla: Even-toed Ungulates			
Alces alces americana	Eastern Moose	XT	
Odocoileus virginianus	White-tailed Deer		X
Rangifer tarandus caribou	Woodland Caribou		

Source: URS (2008e)

Notes: Occurrrence data from Reid (2006) and Elbroch and Marks (2003)
Observed: X=Mammals visually observed within project site
T=Tracks observed within project site

7.10.5.2.2 Carnivores

Tracks of river otter (*Lontra canadensis*) and mink (*Mustela vison*) were observed along Oakley Creek during 2007 spring surveys (URS, 2008e). In addition, during spring surveys the carcass of a young river otter was observed near one of the Oakley Creek beaver ponds. Tracks and scat of black bear (*Ursus americanus*) were also observed during spring surveys throughout much of the Minago Project area and vicinity. This is not surprising considering the fact that black bear are habitat generalists. A red fox was observed crossing Highway 6 between Oakley Creek and the William River. No other carnivores were observed during spring wildlife surveys.

No carnivore tracks were observed during winter aerial surveys of the project site and a 288 square kilometres block of wildland with the proposed project approximately in the middle of the survey area. However, a set of fisher (*Martes pennanti*) tracks was observed on Ski Traverse A, a set of coyote (*Canis latrans*) tracks was observed on Ski Traverse D of Moose Lake Winter Road, and a set of Lynx (*Lynx canadensis*) tracks was observed along the road traverse of the main drilling access road, just before it forked into two well traveled roads. Two sets of American marten (*Martes americana*) tracks were observed during the Ski Traverse A, along with three sets of ermine (*Mustela erminea*) tracks. A set of marten tracks and a set of ermine tracks were also observed on Ski Traverse C. Four sets of ermine tracks and two sets of marten tracks were observed along Ski Traverse D and a single set of marten tracks was observed on Ski Traverse B. Lynx tracks were found along a closed evergreen forest, while the marten and ermine tracks were found in forests of all seral stages and closure. The fisher tracks were in an area of intermediate open evergreen forest habitat. It seems likely that marten and ermine are found throughout all forested habitats of the project area. The lynx tracks were found in close proximity to the highest density of snowshoe hare tracks, so it is possible that the lynx may have been attracted to the area of highest hare population.

The generalist nature of marten in the project area may be due to the almost total lack of red squirrels observed at the project site. Where red squirrels are scarce, American marten have been documented to forage on voles (often red-backed), lemmings, and snowshoe hares (Post, 1996). There appears to be moderate numbers of marten and ermine within the project area and other carnivores occur in the project area. Apparently there are enough carnivore furbearers present in the project area to provide a reasonable level of income for a trapper when fur prices are high.

7.10.5.2.3 Ungulates

Moose were the only ungulate documented to occur within the project area during the 2007 spring and 2008 winter surveys conducted by URS biologists (URS, 2008e). During 2007 spring surveys, three sets of ungulate tracks were observed along the roads to the drilling sites. On two occasions, these tracks were tentatively identified as being those of a woodland caribou and the other set was considered to be from a moose. However, it was difficult to make a positive identification because the tracks were in deep muck. Measurements of the track pattern and stride were taken and later compared to information in Elbroch (2003). The tracks were then positively identified as moose tracks, rather than caribou tracks. No scat from ungulates was observed during any surveys of the project area (URS, 2008e). A single moose was observed at the edge of a small bog surrounded by dwarf closed evergreen tree (black spruce) habitat during a spring survey helicopter over-flight of the area. The bog where the moose was sighted is located approximately 0.8 km southwest of the four-way junction of the access road that is located about 1.9 km west of Highway 6.

Several moose were observed during spring helicopter over-flights of Oakley Creek and the William River east of Highway 6. Moose tracks were also common along the riverbanks of the William River during fisheries surveys. Several sets of white-tailed deer (*Odocoileus virginianus*) tracks were also observed along the William River near the confluence of Oakley Creek. This was the only survey location where white-tailed deer signs were found. No caribou or their tracks or signs were observed during any of the spring or winter wildlife surveys.

Figure 7.10-2 presents the results of the 2008 winter aerial wildlife survey. Two cow moose and one calf moose were observed along Oakley creek upstream of a tributary coming entering from the north at the border between riparian intermediate deciduous shrub floodplain habitat, dominated by willows and red osier dogwood, and intermediate closed black spruce forest.

Five moose were sighted along the western edge of the Minago Project area, with at least one bull within the area. These sightings consisted of a cow with calf, a single bull, and a cow and bull together. All of these sightings were at the border of an old wildfire and open-to-closed intermediate coniferous forest. The burned over habitat consisted primarily of intermediate open deciduous shrub (willows) at an appropriate seral stage for moose browse. An additional 10 cow moose and a calf were observed in a burned over area primarily located north of the Minago Project area and south of the Minago River. This included 2 cows and a calf that were east of Highway 6 approximately 2.1 km from where the transmission line corridor turns northeast and away from Highway 6. These moose were all observed near the border between post-fire regenerating intermediate open deciduous shrub habitat and black spruce trees. The black spruce trees were either patches of close intermediate black spruce forest or, in the more open part of the old burn, were rings of surviving black spruce trees that surrounded thaw lakes and beaver ponds.

A total of 14 cows, 3 calves, and 2 bull moose were observed during the 2008 winter aerial survey. All of the moose were observed at the border between dense stands of shrub forage habitat and tree cover. Although no moose were observed, there were a fair number of moose tracks and at least one bed observed along the borders of the open areas of bog and intermediate open deciduous shrub habitat and intermediate closed evergreen tree habitat between the Moose Lake Winter Road and Oakley Creek to the south. Although the later seral stage of the shrubs in this habitat apparently is not as preferred a forage source as shrub habitat in the burned-over areas or riparian areas along Oakley Creek, it apparently forms a secondary winter habitat for moose in the project vicinity.

No moose tracks were observed along Helicopter Traverse A of the Moose Lake Road, the truck traverses or Ski Traverses A, B, and C. Moose tracks were observed west of the junction of the Y in Ski Traverse D and then along the entire length of Helicopter Traverse C. Moose tracks were also observed along the western 300 m of Helicopter traverse B.

7.10.5.2.4 Reptiles and Amphibians

Lists of amphibians and reptiles with a potential to occur in the vicinity of the Minago Project area are presented in Tables 7.10-3 and 7.10-4. Species that were observed by URS (2008e) to occur in the project area are noted in this table.

Table 7.10-3 Amphibians Potentially Occurring in the Vicinity of the Minago Project

Scientific Name	Common Name	Observed by URS (2008e)
Bufonidae: Toads		
Bufo americanus americanus	Eastern American Toad	
Bufo americanus hemiophrys	Canadian Toad	
Hylidae: Tree and Chorus Frogs		
Hyla crucifer crucifer	Northern Spring Peeper	X
Pseudacris triseriata maculata	Boreal Chorus Frog	X
Ranidae: True Frogs		
Rana sylvatica	Wood Frog	X
Rana pipiens	Leopard Frog	X

Source: URS (2008e)

Notes: Occurrence data from Preston (1982).
Observed: Adult wood frogs were observed and the calls of the other species were recorded.

Table 7.10-4 Reptiles Potentially Occurring in the Vicinity of the Minago Project Area

Scientific Name	Common Name	Observed by URS (2008e)
Columbridae: Snakes		
Thamnophis sirtalis parietalis	red-sided garter snake	X

Source: URS (2008e)

Note: Occurrence data from Preston (1982)

The project vicinity is near the extreme northern range of reptiles and most amphibians. The only reptile that occurs in the project area is the red-sided garter snake (*Thamnophis sirtalis parietalis*), documented by a single individual observed on beaver dam 10 (Table 7.8-3) along Oakley Creek when it was surveyed for the Fisheries Resource Inventory Report. The garter snake primarily feeds on fish and amphibians, so it is likely that it primarily occurs in close proximity to those forage species. Considering the fact that the project area consists of a forested black spruce wetland, it probably includes all but the most closed canopy forest habitats (URS, 2008e). The closest reported instance of any other reptile species is a single documented occurrence of a western painted turtle (*Chrysemys picta belli*) at Grand Rapids, Manitoba.

Northern spring peepers (*Hyla crucifer crucifer*) and boreal chorus frogs (*Pseudacris triseriata maculata*) were often heard calling from muskeg ponds and wetlands throughout the Minago Project area and a leopard frog (*Rana pipiens*) was observed in the roadside ditch along Highway 6. Several wood frogs (*Rana sylvatica*) were observed in the riparian habitat of Oakley Creek and along the banks of the William River. No toads were observed during wildlife or fisheries surveys (URS 2008b, 2008e), but the project area and vicinity are located at the interface between the distributions of the eastern American toad (*Bufo americanus americanus*) and the Canadian toad (*Bufo americanus hemiophrys*). The Canadian toad is primarily a resident of prairie ponds, so it is likely that most toads occurring in the project area are either American toads or hybrids between the two subspecies.

7.10.5.2.5 Anecdotal Observations

Telephone conversations with biologists and conservation agents at both the Northeastern and Northwestern Regional Offices of Manitoba Conservation indicated that the vicinity of the Minago Project area is not heavily utilized by sportsmen, due to difficult access and poor hunting/fishing success. Agency biologists and conservation agents mentioned driving past it on a regular basis on Highway 6, but concentrating their wildlife monitoring activities in other areas of their regions that have larger populations of game animals. Their description of the site was primarily based on observations they made while driving on Highway 6. The descriptions varied, depending upon where they thought the project was located from descriptions of the project location given over the phone. The most frequent description was jack pine (*Pinus banksiana*) forest that experiences frequent fires because it is so dry. The proposed project is named after the Minago River, located to the north of mine, a region of limestone highlands that are indeed dry and experience frequent wildfires. However, jack pines are completely absent from the area of proposed mine activity at the Minago Project location and the entire project area in the immediate vicinity of the proposed mine activity was composed of black spruce (*Picea mariana*) wetlands, bogs, fens, and shrub wetlands (URS, 2008e).

Mr. Jonathan Anderson (2008), who operates a winter trap line within the project area, primarily traps American marten (*Martes americana*) and other species along winter roads. Mr. Anderson stated that he does not trap beaver (*Castor canadensis*) on Oakley Creek because the value of their pelts is currently depressed and the creek no longer freezes solid enough to be safe to use as a winter travel route.

7.10.6 May 2008 Opportunistic Wildlife Observations

Roche (2008a) compiled data about when and where wildlife was encountered as part of its May 6-9, 2008 activities. Roche (2008a) observed a total of 3 mammals and 19 birds (Table 7.10-5).

Table 7.10-5 Opportunistic Wildlife Observations – May 2008

Common Name	Latin Name	Habitat
Mammals		
American Beaver	*Castor canadensis*	Creeks, lakes, marshes and calm rivers. Prefers aspen stands but can adapt to young balsam fir and alder stands. Inhabits woodlands and prairies. Covers an area of 2,6 to 5,2 km^2
Moose	*Alces alces*	Mixed stands, especially balsam fir stands with yellow or white birches. Openings, burns, logged areas, alder stands, swamps and ponds. Covers an area of 5 to 10 km^2
River Otter	*Lutra canadensis*	Lakes, rivers, marshes and bay as well as tundra lakes and streams, at the northern tree limit.
Birds		
Bald Eagle	*Haliaeetus leucocephalus*	Nearby water bodies; large rivers, lakes, sea coasts and surrounding areas. During the migration, in the mountains.
Canada Goose	*Branta canadensis*	Large areas such as prairies, Arctic plains and rocky areas. Nearby lakes, ponds, bay and major streams. Feed in the tundra and in fields colonized by herbs.
Common Goldeneye	*Bucephala clangula*	Nest on lakes in wooded areas and on ponds in bogs. Sea coast, estuaries, lakes and freshwater rivers.
Common Merganser	*Mergus merganser*	Forested lakes, rivers and ponds. During the winter, lakes and rivers, rarely in salt water.
Common Raven	*Corvus corax*	Boreal forest, mountains, Arctic coasts and woodlands. Nest along cliffs of within trees. Lakes, rivers and sea coast. Along roads and in dumps.
Greater Yellowlegs	*Tringa melanoleuca*	During migration, ponds, swamps, shallow lakes, calm streams. Along coasts, salt marshes, barrier ponds, mud flat, bay. Nest in bogs, ponds, lakes, open forests.
Mallard	*Anas platyrhynchos*	Varied habitats; marshes swamps, ponds, small and large lakes, calm rivers. Sometimes along the coast. Can feed in crop fields.
Northern Pintail	*Anas acuta*	Shallow freshwater water bodies, small and large marshes, ponds, lakes, steppe. While not nesting, may also frequent salt water areas.
Osprey	*Pandion haliaetus*	Rivers, lakes, estuaries, coasts, bay.
Piper sp.	--	Riverbanks, beaches, mud flat, marshes, ponds.
Red-breasted Merganser	*Mergus serrator*	Freshwater and salt water. During winter, prefer salt water. While nesting, bay, lagoons, estuaries, lakes and rivers.
Red-tailed Hawk	*Buteo jamaicensis*	Woodlands, open areas, groves, mountains, plains. While nesting, areas where trees were planted and rock outcrops.
Ring-billed Gull	*Larus delawarensis*	Shores, islands, lakes, rivers, ponds, dumps, fields, crops.
Ring-necked Duck	*Aythya collaris*	Shallow freshwater, forested lakes, marshes, Sedge prairies, bogs, estuaries influences by tides. While migrating, rivers, large lakes, swampy shores. Rarely in salt water.
Sandhill Crane	*Grus canadensis*	While nesting, marshes, bogs, large Arctic river valleys, swampy tundra, and steppe. While migrating, fields, marshes, shallow lakes.
Seagull	--	Lakes, coasts, estuaries.
Snow bunting	*Plectrophenax nivalis*	In the Arctic, rocky areas such as shores, outcrops, cliffs and tundra. While migrating, fields, shores and along roads.
Swan sp.	--	Ponds, lagoons and lakes.
Tundra Swan	*Cygnus columbianus*	Tundra, lakes, large rivers, swamps, bay, estuaries, flooded fields.

Source: Roche (2008a)

7.10.7 Effects Assessment Methodology

The scope of the environmental effects assessment includes:

- identification of key wildlife issues within the Project Study Area;
- identification of valued ecological and cultural components (VECCs) to focus the assessment;
- an analysis of potential environmental effects including cumulative effects;
- identification of mitigation measures; and
- determination regarding the significance and likelihood of potential residual effects.

Each of these topics is discussed in more detail in the following sections.

Key Issues

Based on the proposed project facilities and design, consultation with regulators and other deemed experts and the local land users, a number of key issues were defined to focus the wildlife assessment on relevant project effects, and to assess the project's contribution to cumulative effects in the area. The potential project effects on wildlife may include the following key issues:

- **Habitat availability** — impacted either directly by habitat loss or alteration, or indirectly by sensory disturbance (such as noise and human activity) and reduced patch size (e.g., increased habitat fragmentation). Potential project effects are related to clearing and removal of habitat in the mine site area, clearing and construction of transportation corridors, and human use activities associated with both facilities (open pit blasting, ore crushing and road transport).

- **Disruption to movement patterns** — resulting from increased habitat/landscape fragmentation (e.g., increased density of access corridors) or higher road use levels limiting daily or seasonal wildlife travel. The mine transportation corridors and PTH 6 will be used to haul concentrate and Frac Sand on a regular basis.

- **Mortality risk** — increased mortality resulting directly from site development, vehicle collisions (i.e., mine traffic), increased hunting/poaching, or lethal control of problem wildlife.

Of these key issues, the potential for increased wildlife mortality rates due to increased road access and human use is of particular concern.

Biodiversity Approach

Consideration of potential effects on biodiversity has only recently been integrated into the environmental impact assessment process. Biological diversity, or biodiversity, is defined as the variety and variability of life, and it includes the diversity of genes, species, ecosystems and landscapes. Effects on biodiversity may be assessed at various levels of biological organization. For purposes of most impact assessments, effects can be investigated at three levels, including:

- **Species level** – refers to the number and variety of animal species and their abundance.
- **Community/ecosystem level** – refers to the interrelationships between species and their habitats, focusing on the ecological units that sustain species.
- **Landscape level** - refers to the ability of the landscape to operate as a sustainable, integrated ecological unit, and is affected by regional processes such as habitat fragmentation.

For this assessment, potential project effects on wildlife biodiversity at the species level are evaluated in the context of habitat availability and mortality risk. Additionally, the assessment of potential project effects on selected vegetation VECCs (i.e., ecosystem communities of conservation concern, wetlands) (Section 7.9: Vegetation) addresses biodiversity at the community and ecosystem level, and can be indirectly related back to wildlife biodiversity considerations. At the landscape level, potential effects on biodiversity were assessed by considering regional habitat fragmentation and possible disruptions to wildlife movement patterns for wide-ranging species.

7.10.7.1 Study Area

For the purposes of this assessment, two study areas are identified — a Local Study Area (LSA), and a Regional Study Area (RSA).

Local Study Area

The LSA encompasses all of the proposed project components where activities associated with construction and commissioning, operation, decommissioning as well as accidents and malfunctions could result in environmental effects on wildlife and wildlife habitat.

Delineation of the LSA is specifically intended to assess the direct impacts of the proposed project on habitat availability (i.e., through habitat alteration or removal). In addition, the LSA will be the focus of qualitative discussion on other potential direct or indirect impacts of the proposed development (e.g., sensory disturbance, mortality risk, contaminants). The LSA is defined by a potential disturbance footprint for direct effects on wildlife and habitat, buffered by zones of influence for indirect effects on wildlife and habitat due to noise and human disturbance. The disturbance footprint is conservatively defined as the total areas of VNI claims that will be directly affected by project facilities.

The actual disturbance footprint will comprise areas of clearing and development within these claim boundaries. However, the area as defined allows for potential movement or expansion of project components within that area, without changing the conclusions of the effects assessment.

Wildlife field assessments were conducted in detail within the LSA.

Regional Study Area

The RSA provides context for effects findings in the LSA by describing wildlife and wildlife habitat availability over a larger area surrounding the LSA. In addition, the RSA sets the spatial boundaries for the review of existing local knowledge in the area. Within the RSA, wildlife and wildlife habitat are tabulated using existing knowledge for the area by both URS and Roche Ltd. The RSA boundary is defined by the existing watershed boundaries, and provides an appropriate spatial scale to assess natural processes including potential constraints to animal movement.

For the purposes of this assessment, eight wildlife VECCs have been selected to represent the larger assemblage of wildlife species known to occur within the LSA and RSA. Wildlife VECCs have been defined for the project environmental assessment based on the following criteria:

- conservation status (e.g., *Species at Risk Act*), known presence and relative abundance in the area;
- ability of a species to be used as an indicator species for a broader number of species (keystone species);
- socio-economic and regional importance;
- review of the Biophysical Assessment Workplan submitted to regulators;
- findings of field investigations; and
- review and input from the project Technical Committee meetings.

Based on these criteria, the seven selected VECCs (Table 7.10-6) include:

- William Caribou Herd (*Rangifer tarandus caribou*);
- Moose (*Alces alces*);
- Black bear (*Ursus americanus*);
- Lynx (*Felis lynx*);
- Beaver (*Castor canadensis*);
- American marten (*Martes americana*); and
- Song bird community.

These VECCs were used to direct the impact assessment of habitat availability for the project and to focus the review of existing knowledge in the area.

Table 7.10-6 Selected Wildlife VECCs

Selected VECC	Rationale for Selection	Linkage to EAP Report Guidelines or other regulatory drivers	Baseline Data
Moose	• Identified in a regional context as a territorial significant moose population in Manitoba • Species of social and economic significance • Potential to sustain project impacts	• Requirements to integrate traditional knowledge and to address social and economic issues • EIS Workplan	• Field Data • MB Key Wildlife Habitat
Caribou	• The William Caribou herd is of social and economic importance • Sensitive to disturbance	• Baseline Assessment Workplan • Listed as a species of special concern	• Field Data • Terrestrial lichen model • Telemetry and survey point location data
Black bear	• Species of social and economic significance • Sensitive to disturbance • Potential to sustain project impacts	• Requirements to integrate traditional knowledge and to address social and economic issues	• Project ecosystem mapping • Field Data
Lynx	• Species of social and economic significance • Potential to sustain project impacts	• Requirements to integrate traditional knowledge and to address social and economic issues	• Field Data • Project ecosystem mapping
American marten	• Species of social and economic significance • Potential to sustain project impacts	• Requirements to integrate traditional knowledge and to address social and economic issues	• Field Data • Project ecosystem mapping
Song bird community	• Sensitive to disturbance • Potential to sustain project impacts	• Includes species listed by COSEWIC (2005) and in the *Migratory Birds Convention Act*	• Project ecosystem mapping • Bird habitat indices provided from applicable studies
Beaver	• Occurrences in the LSA • Potential to sustain project impacts • Representative of other mammal species that utilize wetland habitats • Species of social and cultural significance	• Requirements to integrate traditional knowledge address social and economic issues	• Project ecosystem mapping • Aerial survey to detect presence of beaver lodges and dam locations in the LSA

7.10.7.2 Temporal Boundaries

Based on the range of potential effects on wildlife, three assessment scenarios were used:

- **Baseline:** Represents conditions for wildlife species prior to any development activities under the proposed project. Seasonal habitat use for baseline conditions was characterized based on habitat conditions in 2006, 2007 and 2008.
- **Full Build-out:** Represents conditions during construction activities, operations, and decommissioning, assuming the worst-case land disturbances expected for this period (i.e., disturbance of the total area of all claim areas touched upon by project facilities).
- **Closure:** Represents conditions forecasted into the future following complete decommissioning and reclamation of the mine site. This scenario assumes implementation of all mitigation recommendations to achieve optimal wildlife habitat conditions at closure.

Decommissioning will be phased over a number of years. Reclamation will be completed five years following the end of production. All disturbed surfaces will be re-contoured, natural drainages reinstated and re-vegetated where practicable. The Tailings and Ultramafic Waste Rock Management Facility (TWRMF) will be reclaimed as a permanent pond. The access road will remain in place. Reclamation goals are a stabilized surface and a native plant community to provide wildlife habitat. Green Alder will be used for re-vegetation. It is assumed that successional processes will move post-mine vegetation communities towards the local vegetation type, ideally within a 10-year period following decommissioning and final reclamation.

7.10.7.3 Baseline Conditions

7.10.7.3.1 Methods

- **Information Sources** - Information sources used to describe baseline conditions and complete the assessment of wildlife and wildlife habitat included:
  - a literature review;
  - consultation with regulators;
  - field surveys; and
  - consultation with local traplines owners.

  Overall, the data that is currently available to describe baseline conditions and assess potential environmental effects of the project on wildlife and wildlife habitat are judged by the study team to be sufficient. The following sections describe the methods used to characterize baseline conditions, focusing on the seven selected VECCs.

- **Literature Review** - Existing wildlife information was reviewed including wildlife inventory and habitat use information for the project area and the Province of Manitoba, and from applicable studies conducted elsewhere within a similar ecological context. The review focused on the seven selected VECCs. Literature sources (including government reports and regulations, technical reports, unpublished documents, and peer-reviewed publications) are cited throughout the document.
- **Consultation -** Consultation was undertaken to gather knowledge regarding wildlife from individuals who are most familiar with the project area (traplines owners) and/or who have expertise with respect to specific VECCs. Specifically, consultation included:
  - discussions on VECC selection;
  - impact assessment approach;
  - baseline habitat assessment methods at the VECC level;
  - issues and management concerns surrounding the project and selected VECCs; and
  - available baseline knowledge and knowledge gaps for the selected VECCs in the study area.

  Through consultation, several additional baseline data and information sources were obtained for use in this assessment. These sources include, but are not limited to, the following:

  - key wildlife habitat areas delineated within the project area;
  - survey and technical reports from extensive studies;
  - a list of bird species known to occur near the Project Area, in northern Manitoba and across the Province of Manitoba;
  - a list of wildlife species of concern in Manitoba;
  - fur harvest data and current traplines within a regional context to the study area; and
  - numerous reports for wildlife surveys and for wildlife-habitat studies conducted in the project area and within similar ecological units in Manitoba.
- **Field Surveys -** Three wildlife field surveys were conducted and/or coordinated by URS and Roche Group during 2007 and 2008, respectively. These surveys included:
  - wildlife habitat assessment as part of the ecosystem mapping program;
  - aerial surveys; and
  - incidental wildlife observations within the Project Study Area.

Incidental wildlife observations were recorded during the ecosystem mapping program and the aerial wetland survey (above), referenced by a GPS location, and a digital picture was taken when possible.

7.10.7.3.2 Results

The Minago Project area is underutilized by all wildlife species but shorebirds, sharp-tailed grouse, small forest carnivores and black bear, beaver, and amphibians (and likely the red-sided garter snake) (URS, 2008e). None of the project area habitat is particularly critical to the survival of these species in the project vicinity.

With the exception of the long-tailed weasel (*Mustela frenata*), northern raccoon (*Procyon lotor*), Arctic fox (*Alopex lagopus*), American badger (*Taxidea taxus*), and bobcat (*Lynx rufus*), the range of all species of furbearers native to Manitoba generally encompass the Minago Project area (URS, 2008e).

Small forest carnivores, such as marten and ermine, were observed in moderate abundance. Other carnivores, such as lynx and fisher, utilize Minago Project area as habitat. However, prey species typically utilized by these species, such as showshoe hare and red squirrel are either limited in distribution or rare within the Minago Project area, requiring these species to utilize alternative prey species, such as voles, sharp-tailed grouse, and lemmings. Although shorebirds are probably a normal resident of the Minago Project area bog and fen habitat, their numbers are probably elevated due to the presence of the peat soil that has been converted into muck along the drilling access roads (URS, 2008e).

With rare exceptions, such as grouse, all of the birds that occur in the Minago Project vicinity are migratory and most occur at the Minago Project site only during their nesting seasons (URS, 2008e). None of the birds occurring in the Minago Project area have special status other than that conferred by the various treaties and conventions between Canada, the U.S., Japan, Mexico, and the former Soviet Union for the protection of migratory birds and by hunting seasons established by federal, provincial, and First Nations resource management agencies. These treaties and conventions prohibit take, possession, transportation, import, export, and commerce of any migratory birds, part, nest, egg, or product, manufactured or not. Exceptions are made to assure the taking of migratory birds and their eggs by the First Nations and the establishment of legal hunting seasons and regulations for migratory game birds (URS, 2008e).

As timber harvest operations in central Manitoba create suitable early seral stage habitat, white-tail deer are likely to occur occasionally in the Minago Project area as they continue to invade more northern habitats in the boreal forest of Manitoba. This may eventually lead to the spread of Meningeal worm through the moose and caribou populations, causing declines (Anderson, 1972; Elliott, 2008).

Moose populations in the Minago Project's vicinity are concentrated north, south, and west of the Minago Project area. There is currently some summer and winter utilization of riparian habitat along Oakley Creek, bog habitat between the Moose Lake winter road and Oakley Creek, and bog and post-fire shrub habitat along the western edge of the Minago Project area. Although moose do enter the Minago Project area, they do not seem to make much use of it or utilize it as a migration route. Moose have been documented to forage most heavily on riparian willow, particularly where wildfire has stimulated willow production in burned black spruce stands (Post, 1996). Moose have been documented to prefer open black spruce wetlands with willows that surround ponds with aquatic vegetation. Moose winter habitat selection appears to be more influenced by food availability than by snow cover and the probability of moose presence increases with shrub height, levelling off when shrubs reach a height of 4 m (Keystone, 2006). Moose eat forbs and aquatic vegetation during the summer months which supply the sodium needed in their diet (Post, 1996). Black spruce need to be tall enough to provide cover next to sources of forage. Suitable shrub seral communities for moose forage mostly occur from fire or alluviation (deposition of alluvial soils) (Post, 1996).

However, one wildlife species of concern has been documented to occur in the vicinity of the project area. The boreal population of woodland caribou (*Rangifer tarandus caribou*) is listed as "threatened" by the Committee on the Status of endangered Wildlife in Canada (COSEWIC) in the *Species at Risk Act* and Manitoba's boreal woodland caribou populations were listed as "threatened" in the Manitoba *Endangered Species Act* in June, 2006. It is important to note that woodland caribou was not observed by URS or Roche. Trappers in the area also have not observed the woodland caribou.

Woodland Caribou

The boreal woodland caribou, listed as threatened, was not documented in the project area or vicinity during any of the 2007 and 2008 wildlife surveys conducted for this project. This does not mean they do not ever enter the project area, it simply is not preferred habitat and most of the individuals from the two nearest herds have been documented a considerable distance north and south of the project area. Moreover, trappers in the area also have not observed Woodland caribou. The two nearest woodland caribou herds are the Wabowden and William Lake herds. There are approximately 25-40 individuals in the William Lake herd and 200-225 individuals in the Wabowden herd (Manitoba Conservation, 2005). The William Lake herd has a low conservation concern rating, while the Wabowden herd has been assigned a medium conservation concern (Manitoba conservation, 2005), based on the presence of industrial forestry in the Wabowden region north of the project vicinity (Manitoba Conservation, 2000a; Hirai, 1998). The province of Manitoba is still in the process of identifying critical habitat for the boreal woodland caribou population (Elliott, 2008). A genetic analysis of scat collected from the William Lake and North Interlake herds, located north and south of Grand Rapids, indicated that the two populations are genetically distinct with Cedar Lake and the Saskatchewan River creating a natural barrier that has significantly reduced interbreeding between the two populations (Elliott, 2008).

Studies of the Wabowden herd have concentrated on tracking the movements of radio collared cows (Elliott, 2008; Hirai, 1998). The farthest south these animals have been tracked is about 30 km north of the project area (between the Hargrave and Minago Rivers), with most individuals occurring in the vicinity of Wabowden and Ponton, north of the Hargrave River. Field data suggests that these caribou are strongly associated with lowland black spruce stands scattered across open muskeg (Hirai,1998). This type of habitat is referred to in the study as treed muskeg and is the equivalent of forested islands within a lake or open wetland. In most of the treed muskeg islands, overstory was typically dominated by black spruce (>70%) with a crown closure greater than 70% (Harai, 1998). The treed islands normally have higher elevation (about 1-3 m) and higher tree density than surrounding bogs, thus maintaining relatively well drained soil conditions. These conditions resemble those of the ridges of the project area that are slightly elevated with taller trees than the surrounding forest. However, the project area's elevated forest habitat is surrounded by slightly smaller trees, rather than open muskeg. Suitable forage is present in the project area black spruce forest habitat, but there is no protection from predators. Habitat use analysis indicates that the Wabowden herd avoids deciduous stands, early seral stages, and non-black spruce conifer stands (Hirai, 1998; Brown *et al*., 2007). Caribou have been documented to avoid marshes, treed rock, beaver ponds, aspen, and heavily forested wetlands (Schindler, 2005). In central Manitoba, caribou show fidelity to areas used for calving in summer, but not for winter locations.

Factors associated with decreases or extirpations of caribou are industrial development and agriculture, increased predation and disease caused by the removal of forest cover, which facilitates habitat for species adapted to young seral stages (moose and white-tailed deer), increased access for hunting, and reduction in food supply associated with habitat disturbances (Hirai, 1998). However, to date, the project area has not been affected by these factors.

Increases in moose and deer populations associated with early seral stage, shrub habitat maintains high wolf densities and increased opportunistic wolf predation on caribou mortalities (Hirai, 1998; Bergerud, 1988; Brown *et al*., 2000). The removal of mature forests generally causes a reduction in the production of lichen, the primary forage of caribou. Regions where lichen are the primary browse, allow caribou to occupy an ecological niche absent of competition with other herbivores. Habitat preference of female caribou with calves is governed by lower risk of predation (Hirai, 1998). Habitat on treed islands in muskeg provides adequate forage availability with protection from predators since caribou are likely to have more advantage in mobility over wolves and other predators in muskeg as compared to dry lands. In addition, the approach of predators is more easily detected when wolves have to travel noisily across open muskeg to approach caribou. Other factors associated with selection of treed islands by woodland caribou include avoidance of human disturbance and insect release. Treed islands also are of low value to moose, possibly reducing wolf density (Hirai, 1998) and snow is softer and shallower (Stardom, 1975).

The response of caribou to human activities varies depending on the situation. It has been reported that caribou habituate to various degrees of human disturbance when they are exposed to it continuously, rather than seasonally (Hirai, 1998). Caribou abundance increases with distance from mine sites in all seasons and caribou avoid areas within 4 km of mine sites in most seasons (Weir *et al*., 2007). Responses of caribou to periods of low activity in evolving oilfields, suggest that caribou do not respond to sedentary industrial developments *per se*, but to the vehicular traffic associated with them (Dyer, 1999). In the presence of ecotourists, caribou increase time vigilant and standing, mostly at the expense of time spent resting and foraging, with the impact of ecotourists decreasing as caribou become habituated to them (Duchesne *et al*., 2000). Caribou never leave their winter quarters because of human presence, however caribou will abandon their wintering areas in response to wolf presence (Duchesne *et al*., 2000). Weclaw and Hudson (2004) state that the most detrimental factor on caribou population dynamics is the functional loss of habitat due to avoidance of good quality habitat in proximity of industrial infrastructures.

Woodland caribou have been documented to select specific habitats during migrations, including conifer dominated forests and waterways (Ferguson and Elkie, 2004). Caribou do not avoid disturbed habitat, such as recent burnt or cut areas during migrations (Ferguson and Elkie, 2004). However, caribou avoid recently burned areas as winter or summer habitat to such a great degree that analysis of both data sets from GPS-collared cows and very high frequency (VHF) transmitter tracking datasets were able to reveal this relationship (Joly *et al*., 2003).

In the case of the Minago Project area, the habitat is of limited value to woodland caribou because treed islands of black spruce do not occur within open muskegs and any individual caribou migrating south from the Wabowden herd will encounter a large area of burned-over land to the north and west of the project area that is occupied by moose, a species they are not competitive with. In addition, the moose population may have increased wolf densities and the primary forage in these areas is shrub habitat, rather than the niche forage of lichens utilized by woodland caribou. Caribou migrating or repopulating habitat south of the main body of the Wabowden herd are more likely to move through the region to the east of Highway 6, where dense stands of mature black spruce provide good migration habitat and there are treed island present with large areas of open muskeg. A similar situation exists for individual caribou moving north from the main body of the William Lake herd. In addition, William Lake caribou would have to cross the headwater region of Oakley Creek, an area dominated by extensive regions of riparian shrub habitat and beaver ponds. William Lake Caribou are unlikely to select this area for movement to the north, while the area east of Highway 6 provides a better migratory corridor. The scope of this report did not include an analysis of the region west of the 18 km by 16 km area surveyed for the winter survey, so it is possible that suitable habitat exists to the west of the surveyed area for the migration and expansion of both the Wabowden and William Lake herds. However, future expansion of the herds into the project area is unlikely due to unsuitable habitat within the Minago Project area. Any woodland caribou entering the project area at this time and for the foreseeable future are likely to be stray individuals from the main bodies of the two herds and the project area is not likely to provide critical habitat for either herd.

<u>Beaver</u>

Beavers are not listed under the *Species at Risk Act*. Conservation concerns for this species are relatively few given the beaver's adaptability to human encroachment. Beavers, in fact, find roadbeds and culverts very attractive due to the reduced effort it takes to dam a road or culvert instead of a whole waterway in order to flood land. Beaver problems where roads cross a stream can be remedied by using beaver exclusions. Beavers were chosen as a VECC species due to their socio-economic value as a fur bearing species as well as their important role in wetland habitat construction. The habitat beavers create is used by other trapped species such as mink, muskrat and otter.

<u>Lynx and Snowshoe Hare</u>

Lynx and snowshoe hare populations are known to fluctuate over time with one population being dependent upon the other. Neither lynx nor snowshoe hare are listed under the *Species at Risk Act*. Lynx has been selected as one of the VECC in this assessment.

The major factors responsible for a decline in lynx numbers occurs following a crash in the hare population where juvenile lynx mortality increases from starvation and possibly from failure of yearling females to breed. Other than their close association to the distribution of snowshoe hare, typically lynx habitat is found within climax boreal forests including both coniferous and mixed-woods with a dense undercover of thickets and windfall. The snowshoe hare is a common and widely distributed resident of the boreal forest region, inhabiting forests, swamps and riverside thickets primarily having extensive shrub understories.

<u>American Marten</u>

The marten is not listed as a species at risk by COSEWIC (2004) or as a species of concern. The main rationale for the selection of this species as a VECC is due to their socio-economic value as a trapped species in the area. The marten is primarily carnivorous, generally nocturnal and active throughout the year. Prey abundance (e.g., voles) appears to be a critical factor affecting marten population dynamics. The marten's prominence in the trapping records indicates that it is likely relatively abundant in the region. Marten in the northern boreal forest are closely associated with late successional coniferous stands, especially those dominated by spruce and fir, with complex structure near the ground (i.e., coarse woody debris) but will inhabit a variety of forests and even shrublands if food is available. Commonly reported refuge sites include ground burrows, rock piles and crevices, downed logs, stumps, snags, brush or slash piles and squirrel middens.

Marten are only moderately abundant in and around the LSA. No marten or marten signs were recorded during the field sessions associated with this project. However, several records of observed marten were noted at the Minago exploration camp. Suitable habitat for marten is found within the LSA. Baseline habitat availability in the LSA was assessed and quantified for marten.

<u>Songbird Community</u>

Songbirds (i.e., passerines), as a community, were selected as a VECC and an assessment of abundance for various bird species was included. The songbird community was chosen as a VECC because of their combined sensitivity to disturbances and international conservation concerns. This songbird community included long-distance migrants, short-distance migrants and resident birds, and included birds in the families Tyranidae, Laniidae, Vireonidae, Corvidae, Alaudidae, Hirundinidae, Paridae, Sittidae, Regulidae, Turdidae, Motacillidae, Bombycillidae, Parulidae, Emberizidae, Icteridae, and Fringillidae. None of these bird species are listed as a species at risk.

7.10.7.4 Assessment Details

7.10.7.4.1 Wildlife Habitat Models

Wildlife habitat modeling is a predictive tool that provides a representation of a species' probability or density of occurrence (habitat use during a given season) in an area based on the biophysical attributes of the landbase. The following three approaches were used in this assessment:

- **Habitat Suitability Index (HSI)** - provides a probability that the habitat is suitable for the species, and hence a probability that the species will occur where that habitat occurs. If the value of the index is high in a particular location, then the chances that the species occurs there are higher than if the value of the index is low.
- **Animal Abundance Estimates** - calculates animal abundance by multiplying animal density (number/ha) within a given habitat unit by the area (ha) of the given habitat unit that is available within a study area. In order to apply this approach, estimates of animal density within habitat units are required.
- **Animal Presence and Habitat Suitability** - uses observational or other data (GPS or telemetry tracking) to confirm animal presence within suitable habitats (often defined using an HSI or similar approach). An animal presence approach is best suited for non-migratory species that have relatively small annual home ranges and or species that have a high rate of habitat (seasonal or other) fidelity (i.e., traditional habitat use behaviours). In such cases, habitats with confirmed occupancy are likely a stronger spatial predictor of areas having future presence and are thus considered to have a higher habitat value. This method requires an adequate collection of habitat use data for a species.

7.10.7.4.2 Assessment Scenarios

As noted in the previous Section, the assessment focused on three scenarios representing the full range of potential project effects and the site condition when the project is complete:

- **Baseline** – the baseline condition represents the habitat availability and use of the project area by wildlife prior to project-related habitat disturbances. This condition is the yardstick by which project effects are measured.
- **Full Build-out** – representing the maximum level of habitat and wildlife disturbance during the life of the project. It will be most intense during construction, as a result of site clearing and building activities across the site, and will persist during operation and the early stages

of decommissioning with gradual reductions, as a result of progressive reclamation. In terms of habitat effects, full build-out assumes a conservative disturbance footprint, that is, the total of all claim areas touched by project facilities and the access road (approximately 1400 ha). The use of the conservative footprint addresses all eventualities in the event that project facilities are modified or moved within that footprint. It also provides a worst-case assessment of potential effects.

- **Closure** – Reclamation of the mine site will replace some of the habitat lost, but it will be a relatively small component of the overall disturbance footprint. Accordingly, the change in habitat availability at closure while positive is relatively small.

7.10.7.4.3 Effects Attributes

Predicted project and cumulative effects on wildlife derived from quantitative and qualitative assessments were characterized using effects attributes defined in Table 7.10-7. Ecological and social contexts of effects were integrated in the attributes for effect magnitude and elaborated upon in the text where relevant.

7.10.7.4.4 Determination of Effects Significance

The significance of residual project related effects and cumulative effects will be determined based on the defined effects criteria as follows.

A residual adverse effect will be considered significant, if it is:

- a moderate magnitude adverse effect that is far future (> 10 years) in duration;
- a high magnitude adverse effect unless it is site-specific in geographic extent;
- a high magnitude adverse effect that is site-specific in geographic extent and far future in duration.

Otherwise, residual adverse effects will be rated as not significant.

7.10.7.4.5 Cumulative Effects Assessment

The general approach for the cumulative effects assessment for wildlife is as follows:

- determine conditions for the local wildlife species within the RSA (i.e., conditions at baseline and into the foreseeable future in combination with the project effects;
- identify any further mitigation measures (in addition to those identified for project effects) for reducing or eliminating cumulative effects;
- characterize and evaluate the significance of any residual cumulative effects on VECC species within the RSA; and

- characterize the project contribution to cumulative effects on VECC species within the RSA for the development phases under consideration.

Cumulative effects were assessed within the RSA. Residual cumulative effects and the project contribution to these effects were evaluated using the same effect attributes used for the project effects (Table 7.10-7). The significance of cumulative effects was determined using the same criteria used to determine significance of projects effects. Whether or not a residual cumulative effect is significant is, in theory, based on a threshold between ‘acceptable’ (not significant) and ‘unacceptable’ (significant) conditions. For wildlife, such thresholds are little understood and this determination was qualitative rather than quantitative.

If a residual cumulative effect is significant (i.e., unacceptable), one of the following conclusions applies:

1. The project contribution to cumulative effects is responsible for causing the unacceptable (significant) shift. If this is the prediction, then the project contribution to cumulative effects is considered to be significant.
2. Other projects are already responsible for the unacceptable condition. In this case, the project is contributing incrementally to already significant cumulative effects.

Contributions by the project may or may not be significant, depending on the degree of change predicted and the land use priorities for the region.

7.10.7.5 Project Effects

Potential impacts on wildlife from the project may occur from changes to habitat availability, landscape disturbance creating disruptions to animal movement patterns, and population declines related to increased mortality risk. These potential effects were assessed for the seven VECCs. Project effects were highlighted for species of conservation concern.

The greatest direct loss of habitat will occur during construction as a result of clearing for the mine site facilities and the transportation corridor (TC). One of the most important project effects will be the potential for increased rates of wildlife mortality resulting from human access provided by the proposed TC, since the project area has to date been inaccessible by vehicle. Noise and traffic flow will cause behavioural disturbance and increased mortality from collisions, as well as increased access for legal hunters and poachers. At closure, there is some concern regarding wildlife access to the TWRMF with potential for mortality (if trapped in the pond) or contaminant bioaccumulation.

In the following sections, project effects are assessed for each VECC, the three key project issues and the three assessment scenarios are undertaken. Mitigation measures are identified and residual effects are characterized and significance determinations made.

Table 7.10-7 Effect Attributes for Wildlife

Attribute	Definition
Direction	
Positive	Condition of VECC is improving.
Adverse	Condition of VECC is worsening or is not acceptable.
Neutral	Condition of VECC is not changing in comparison to baseline conditions and trends.
Magnitude	
Low	Effect occurs that might or might not be detectable, but is within the range of natural variability, does not comprise economic or social/cultural values.
Moderate	Clearly an effect but unlikely to pose a serious risk to the VECC or represent a management challenge from an ecological, economic or social/cultural standpoint.
High	Effect is likely to pose a serious risk to the VECC and represents a management challenge from an ecological, economic or social/cultural standpoint.
Geographic Extent	
Site-specific	Effect on VECC confined to a single small area within the Local Study Area (LSA).
Local	Effect on VECC within Local Study Area (LSA).
Regional	Effect on VECC within Regional Study Area (RSA).
Duration	
Short term	Effect VECC is limited to 1 year.
Medium term	Effect on VECC occurs between 1 and 4 years.
Long-term	Effect on VECC lasts longer than 4 years but does not extend more than 10 years after decommissioning and final reclamation.
Far future	Effect on baseline conditions or VECC extends > 10 years after decommissioning and abandonment.
Frequency (Short Term duration effects that occur more than once)	
Low	Frequently within range of annual variability and does not pose a serious risk to the VECC or its economic or social/cultural values.
Moderate	Frequently exceeds range of annual variability, but is unlikely to pose a serious risk to the VECC or its economic or social/cultural values.
High	Frequently exceeds range of annual variability and is likely to pose a serious risk to the VECC or its economic or social/cultural values.
Reversibility	
Reversible	Effect on VECC will cease during or after the project is complete.
Irreversible	Effect on VECC will persist during and/or after the project is complete.
Likelihood of Occurrence	
Unlikely	Effect on VECC is well understood or not well understood but, in either case, is not predicted to pose a serious risk to the VECC or its economic or social/cultural values.
Unknown	Effect on VECC is not well understood and based on potential risk to the VECC, effects will be monitored and adaptive management measures taken, as appropriate.
High	Effect on VECC is well understood and there is a high likelihood of effect on the VECC as predicted.

7.10.7.5.1 Caribou

Habitat Availability

Mine construction and transportation corridors development may result in some alteration of caribou late winter and fall habitat types, key seasonal habitat requirements to sustain caribou. However, there were no caribou recorded during the Environmental Baseline Study, and the well-known Wabowden herd is using habitat located at least 30 km north of the proposed site. Moreover, trappers have also not observed this species in the area.

The majority of this effect is related to sensory disturbance from mine-related activities in the fall season for caribou, if at any moment the caribou moves near the mine site. There will likely be some recovery of habitat suitability in this area at closure. Given these projections on habitat availability, project effects although adverse are considered low in magnitude for availability of caribou winter and fall habitats. Effects will be local, long-term and reversible in the mine site area only.

Disruption to Movement Patterns

Conservation concerns exist about potential project effects on caribou habitat fragmentation and interference with caribou moving to and from important wintering ranges and calving or post-rut habitat. This could have a serious adverse effect on caribou recruitment and over-winter adult survival.

The project is likely to have unavoidable and adverse impacts on movement patterns by caribou in the area if the herd moves in the vicinity of the Project Area. However, these effects are considered low in magnitude due to the following factors:

- No caribou were observed during the wildlife surveys and by the local trappers. If they migrate to the project area, there will be extremely limited fragmentation effects on caribou movements between wintering areas and spring calving areas or post rut habitat areas for this herd.
- The following mitigation measures will be implemented, as per the project Wildlife Protection Plan (Section 9.5):
  - Access to the mine transportation corridors will be restricted to employees and contractors only during the construction, operations, and decommissioning phases of the project.
  - Vehicle traffic volumes will be monitored by VNI.
  - Wildlife will have the right-of-way on all roads, except where it is judged to be unsafe to do so.
  - Maximum speed limit on all transportation corridors will be 60 km/h.

- ➢ Traffic signs will be posted at sensitive wildlife areas.
- ➢ Snow clearing requirements will include wildlife escape routes as identified by the Environmental Superintendent.
- ➢ Project-related traffic (including ATVs and snowmobiles) will be restricted to designated transportation corridors and trails (with certain exceptions).
- ➢ Access and use of ATVs and snowmobiles for recreational purposes on the mine haul road and the mine site will be prohibited.

Additionally, a monitoring program to specifically assess caribou movements would allow managers to monitor the effects of the project on caribou movement patterns and may also provide alternative management options. Accordingly, project effects on caribou movement patterns are expected to be adverse, low magnitude, regional, and long-term.

Mine site related disturbance will cease at closure, largely reversing the low magnitude effects on caribou movement from that source.

Mortality Risk

There are conservation concerns related to project effects on regional caribou populations as a result of increased mortality risk. These include the potential for illegal harvest of the caribou resulting from increased road access into the local area by hunters, and increased caribou mortality associated with caribou-vehicle collisions. However, this has never been a problem due to the presence of PTH6 and it is assumed that it will remain unchanged. Project effects on mortality risk are considered low in magnitude during the construction, operations, and decommissioning phases for the following reasons:

- Legal hunting within the RSA and surrounding area is by a permit hunt only. This requires candidate hunters to apply for a hunting permit issued by the Manitoba Government. It is unlawful to hunt in these areas without a valid permit. In addition, no caribou hunting is permitted.
- The project transportation corridors are minor in nature and do not go far enough into the unknown range of the caribou herd.
- No caribou signs were noted in the area during the 2007/2008 field survey.

The following mitigation measures will be implemented as per the Wildlife Protection Plan (Section 9.5):

- Access to the mine haul road will be restricted to VNI employees and associates during the construction, operations, and decommissioning phases of the project.

- Firearms will not be permitted. This includes the carrying of firearms in private vehicles to and from the project site on workdays.
- Hunting and fishing are prohibited at all times on or in the vicinity of the project site, including travel to and from the project site on workdays. This restriction is applicable to all mine employees, managers and contractors. It will be in effect throughout the life of the project from construction through to closure and reclamation. Infringement of this policy is to be reported.
- Vehicle traffic volumes will be monitored by VNI on the proposed transportation corridors.
- Maximum speed limit on all access roads is set at 60 km/hr.

Project effects on caribou mortality during the life of the project are expected to be adverse, low magnitude, regional and long-term. The adverse project effects are expected to remain low in magnitude for the following reasons:

- Legal hunting within the RSA and surrounding area is by a permit hunt only. This requires candidate hunters to apply for a hunting permit. It is unlawful to hunt caribou in these areas.
- Ongoing Provincial monitoring programs to specifically assess trends in the William Caribou Herd population and movement patterns will allow managers to monitor the effects of the project on the caribou population. A cooperative program to systematically record caribou movements in the project area may support Manitoba Government studies and provide alternative management options.
- Exploration activities have already been taken place in the Minago Project Area so that it already represents a disturbance that caribous tend to avoid.

Accordingly, there will be no changes to the effects attributes at closure. The likelihood of effects as predicted is high based on knowledge of the caribou herd distribution and regulatory requirements.

Residual Project Effects and Significance

Residual project effects on caribou habitat availability during operations, for the most part, will result from sensory disturbances related to mining activities in the fall season. Thus, there will likely be some recovery of habitat suitability at closure. Mine related disturbance causing disruptions of caribou movement patterns will be greatly reduced at closure corresponding with a dramatic decrease in traffic volumes and human presence in the area. Risks of increased caribou mortality due to increased access during operations and closure will be low due to hunting restrictions and location of the project at the perimeter of the known range of the William Herd. In summary, all residual project effects on caribou are expected to be low in magnitude and therefore, are determined to be not significant using the criteria in Table 7.10-7. Mitigation measures are summarized in Table 7.10-8. Effects are tabulized at the end of this Chapter.

Table 7.10-8 Mitigation Measures for Effects on Wildlife

Potential Project Effect	Mitigation Measures
Potential exposure of wildlife to contaminants, directly and through bio-accumulation	• Mine waste segregation and management to minimize potential ARD. • Collection of waste rock drainage for treatment, if required. • Long-term storage of PAG waste rock in non-oxidizing environments (TWRMF) to minimize the potential for acid generation. • Water management to protect water quality at closure. • Environmental Effects Monitoring (EEM) and setting aside contingencies to initiate monitoring metals accumulation in vegetation and biota, and adaptive management based on monitoring results. • Implementation of the Wildlife Protection Plan (Section 9.5).
Increased wildlife mortality risk from vehicle collisions and hunting during operations	• Implementation of the Wildlife Protection Plan (Section 9.5).
Increased wildlife mortality risk, with potential effects on moose populations, from hunting and road access at closure	• Continue to implement mitigation measures identified for the project by the responsible agency at closure. • Restrict road access onto the haul road following mine closure. • Limit hunter harvest for moose in the localized area surrounding the mine haul road. • Establish no-hunting zones for moose in the localized area surrounding the mine road. • Conduct regular enforcement monitoring in the local area, including on and surrounding the mine road.
Reduction in habitat availability for all VECCs at full build-out and closure	• Compact project footprint. • Progressive and final reclamation (Section 3.4).
Wildlife and human safety risks from problem wildlife	• Refer to Wildlife Protection Plan (Section 9.5). • Refer to Solid Waste Management Plan (Section 9.4).
Increased bird mortality due to destruction of nests, collisions	• Where possible/practical, avoid clearing in nesting season (May through July). • Properly dispose of food wastes that might attract bird into collision paths. • Implement an environmental orientation program for staff and contractors of wildlife harassment.
Potential effects of aircraft on wildlife	• Adopt and follow available guidelines for helicopters and flight paths and altitudes in the vicinity of wildlife. • Provide orientation and training to all staff, helicopter pilots, guests and contractors with respect to wildlife harassment policies.
Potential Cumulative Effect	**Mitigation Measures**
Increased mortality risk for caribou, moose, bear, marten and lynx due to cumulative effects of project	• Harvest management including hunter harvest and trapping will continue to be managed and monitored by Manitoba Conservation with the intent to maintain a sustainable or below sustainable harvest of wildlife species in the area.

	• The hunting of wildlife within and surrounding the project area will remain a permit hunt on a quota based management system.

7.10.7.5.2 Moose

Habitat Availability

The majority of the effects on moose late-winter habitat availability are related to habitat loss and alteration rather than sensory disturbance during the construction, operations, and decommissioning phases of the project. The project effect is considered low in magnitude for the following reasons:

- The assessment of habitat loss is a conservative overestimate, by assuming all claim areas are to be fully developed as a component of the mine and transportation corridors footprint while in reality the actual footprint will be significantly smaller in area.

- The LSA provides a relatively small amount of high quality late-winter moose habitat compared to other localized areas on a regional scale.

Accordingly, project effects on moose habitat availability are expected to be adverse, low magnitude, local, and long-term. At closure, effects will be largely reversible in the mine site area but will persist at lower levels along the access road. The likelihood of this effect occurring as predicted is high based on knowledge of the moose habitat availability and use in the vicinity of the project.

Disruption to Movement Patterns

The project will have unavoidable and adverse effects on movement patterns by moose in the area. However, these project effects are considered to be low in magnitude given several mitigation measures that will be implemented during the construction, operations and decommissioning phases.

These measures include the following:

- Access to the transportation corridors will be restricted to employees and VNI associates during the construction, operations, and decommissioning phases of the project.
- Vehicle traffic volumes will be monitored.
- Wildlife will have the right-of-way on all roads, except where it is judged to be unsafe to do so.
- Maximum speed limit on all access roads will be 60 km/h.
- Traffic signs for sensitive wildlife areas will be incorporated.
- Road snow clearing requirements will be conformed to at the discretion of the Environmental Superintendent.

- Project-related traffic (including ATVs and snowmobiles) will be restricted to designated access roads and trails (with certain exceptions).
- A policy prohibiting recreational use by employees and contractors of all-terrain vehicles and snowmobiles. Access and use of ATVs and snowmobiles for recreational purposes on the mine haul road and the mine site will be prohibited. All traffic will be restricted to designated transportation corridors and trails.

Accordingly, project effects on moose movement patterns are expected to be adverse, low magnitude, local, and long-term. The likelihood of this effect occurring as predicted is low based on VNI's commitment to mitigation measures. Mine site related disturbance and traffic will cease at closure, largely reversing the low magnitude effects on moose movement from that source.

Mortality Risk

Potential increases in mortality risk to local moose populations are a concern to the Communities of Interest (COI). The primary concerns are the potential for a higher and unsustainable harvest rate on the moose population resulting from increased transportation corridors into the local area for legal and illegal hunting and increased moose mortality associated with moose-vehicle collisions.

Localized effects of the project transportation corridors are not expected to increase the average harvest rate for the regional moose population during the construction, operations, and decommissioning phases assuming implementation of the following mitigation measures:

- Access to the mine transportation corridors will be restricted to VNI employees and related associates during the construction, operations, and decommissioning phases of the project.
- Firearms will not be permitted. This includes the carrying of firearms in private vehicles to and from the project site on workdays.
- Hunting and fishing will be prohibited at all times on or in the vicinity of the Project site, including during travel to and from the Project site. This restriction is applicable to all mine employees, managers and contractors. It will be in effect throughout the life of the project from construction through to closure and reclamation. Infringement of this policy is to be reported.
- Vehicle traffic volumes will be monitored on the proposed transportation corridors.
- Maximum speed limit on all transportation corridors will be set at 60 km/h.

Project effects on moose mortality risk are therefore considered to be adverse, low magnitude, local, and long-term during the construction, operations, and decommissioning phases of the project. The likelihood of effects as predicted is high, assuming implementation of identified mitigation measures.

At closure, some of the mine transportation corridors will remain in place, if requested by the COI. VNI will not be responsible for road management at that time. If public use of the access road is allowed during and after closure, there will be a risk of increased moose mortality from legal and illegal hunting that could increase mortality rates. This would constitute a significant adverse effect on the moose population. There are various mitigation options that could be employed at closure to mitigate this effect. These include:

- Continue to implement mitigation measures identified for the project, by the responsible agency at closure;
- Close and decommission the unused transportation corridors following mine closure;
- Restrict road access onto the site following mine closure;
- Depend on the Manitoba Government to limit hunter harvest for moose in the localized area surrounding the mine transportation corridors;
- Request the Manitoba Government to establish no hunting zones for moose in the localized area surrounding the mine site and related transportation corridors; and/or
- Request the Manitoba Government to conduct regular enforcement monitoring in the local area, including on and surrounding the mine site.

If adequate mitigation measures to decrease mortality risk to moose will be established at closure, this residual project effect will likely remain non significant.

Accordingly, project effects on moose mortality at closure are expected to be adverse, moderate magnitude, regional, and far future in duration. The likelihood of this effect occurring as predicted is unknown due to the current uncertainty about implementation of mitigation measures at closure.

Residual Project Effects and Significance

Residual project effects on moose winter habitat availability and on disruption to moose movement patterns at closure are considered to be low magnitude since: (1) the mine area will be reclaimed and re-vegetated following the closure phase and (2) the volume of mine traffic on the transportation corridors will decrease following mine closure. Accordingly, project effects at closure are expected to be not significant.

The likelihood that effects on habitat availability will occur as predicted is high, based on conservative assumptions regarding the actual project disturbance footprint, the abundance of available habitat in the area, and the proposed mitigation measures.

Residual effects on moose mortality during the life of the project are expected to be not significant given the proposed mitigation measures. However, residual project effects on moose mortality risk at closure and following closure are considered to be low in magnitude at this time as some of the transportation corridors will be decommissioned, thereby restricting access to the site.

Accordingly, project effects at closure are expected to be adverse, low magnitude, regional, and potentially far future. This would constitute an insignificant effect.

The likelihood that effects on mortality rates will occur as predicted during the life of the project is high, based on the proposed mitigation measures. The likelihood that effects on mortality rates will occur as predicted at closure is unknown, as the management regime and implementation of mitigation options cannot be confirmed at this time. Potential effects at closure are mitigable. Agreements and mechanisms for management of some of the transportation corridors, if they remain open at closure, will be determined by the Manitoba Government in consultation with the COI and other interested parties. Until these measures are confirmed, the significance of this effect has been determined to be "unknown". If all the transportation corridors (TC) (incl. the access road) are decommissioned, then the effect will be low. The decision whether to decommission the TC will be undertaken in consultation with the COI.

7.10.7.5.3 Black Bears

Habitat Availability

There were no bears sited during the wildlife survey. The large decrease in very high and high quality black bear habitat availability in the LSA at full build-out is considered to be a low magnitude effect because:

- relatively large amounts of very high and high quality habitat remain abundant outside the zone of project influence after development;
- on a regional scale, these losses are not expected to be substantial;
- very little bear signs were noted in the area during the 2007/2008 field surveys;
- an increase in moderate quality habitat moderates the losses to high quality sites to some degree; and
- the assessment of habitat loss is based on a conservative overestimate, by assuming all affected claim areas will become low quality or unusable habitat. The actual footprint will be considerably smaller, but use of this conservative method ensures that project related sensory effects for this disturbance-sensitive species are fully accounted for.

The food sourcing habits of black bears living in the northern boreal forest are understood only in general terms, especially in and surrounding the project area where black bears are not well studied. The omnivorous and opportunistic feeding behaviour of bears means that they will use a variety of foods according to availability within their ranges. Generally, black bears in more southerly regions prefer to feed on vegetation. More northerly ecotypes often feed on proportionally more animals, such as caribou, though they continue to rely heavily on vegetation. Due to the habitat requirements of black bears for specific vegetative units and soil types, project effects on habitat loss are deemed likely to have a long-term impact on a local scale because of the long time period required for the vegetation to regrow to a state preferred by the bears along disturbed and reclaimed areas of the Transportation Corridors (TC), mine site, the Tailings and Ultramafic Waste Rock Management Facility (TWRMF) and the waste rock dumps.

Accordingly, project effects on black bear habitat availability at full build-out are expected to be adverse, low magnitude, local, and long-term. The likelihood of this effect occurring as predicted is high based on VNI's commitment to mitigation measures.

Mine site related disturbance and traffic will cease at closure, reversing the effects on habitat availability in much of the project site. Traffic on the TCs at closure is expected to be greatly reduced at closure. Therefore, effects at closure are reduced to low magnitude but will be far future in duration. The likelihood of effects as predicted is high based on the conservative approach used in the assessment. Any changes from predicted effects would be expected to be towards a lower level of impact.

Disruption to Movement Patterns

Overall, most carnivores are intimidated by highways and TCs and tend to avoid them when possible (Jalkotzy et al., 1997). Black bears use areas near low use roads, but tend to avoid high use roads (Chruszcz et al., 2003). Bears tend to cross near areas of high quality habitat, or when traveling from low to high quality sites. As well, they are at extra risk of mortality, when crossing roads to reach required high quality habitats at different seasons or due to temporal foraging requirements (Chruszcz et al., 2003).

Copeland (Western Forest Carnivore Committee, 1994) and others (Gibeau and Heuer, 1996) have noticed that carnivore home ranges tend to be along highways, rather than crossing them, implying that movement behaviour is being disrupted, with the road forming an artificial boundary of an individual animal's home range. In addition to traffic volumes and vehicle types, road design itself can become part of the reason carnivores fail to cross. Fences, right-of-way clearance widths, cut slope grade and line of sight are design elements that can affect the ability of wildlife to attempt to cross and to cross safely (Ruediger, 1996). As traffic volume increases on roadways, the impacts of habitat fragmentation, mortality and displacement increase. However, there is a growing body of knowledge that two lane highways with low or moderate traffic volume can be negotiated by many wildlife species, particularly when long traffic pauses occur.

Based on these findings, bears are expected to avoid areas around the TCs and mine site during full build-out. Projected traffic volumes on the TCs will be monitored and will be relatively low, and bears are expected to avoid the road but remain able to cross in periods between vehicles.

In summary, the project will result in avoidance around the mine site and some movement disruptions due to the TCs, resulting in an adverse, low magnitude, local and long-term effect. Mortality on the TCs will be monitored during operations to check this prediction and implement adaptive management measures, if required. Project disturbance will cease at closure, reversing much of this effect. Effects at closure will persist into the far future.

Mortality Risk

Carnivores are particularly susceptible to mortality because of their large home ranges, low biological productivity, and the extensive areas required for sustaining stable populations and individuals. Due to the long life span of bear (over 30 years), they can persist as individuals, without persisting as populations. In this context, human caused mortalities can be important. Bears are rarely killed on highways. The rare occurrences of bear mortality are likely due to their general avoidance of highways and their low population numbers and densities. However, to a species with such a low reproductive rate as bears, even a small number of deaths can be of great importance to the population (Gibeau and Heuer, 1996). At some combination of traffic volume and road design, roads become barriers or mortality sinks for carnivores, even when adjacent land uses and habitat availability are compatible with their existence there. Increasing evidence shows that this occurs when highways are 4-laned or twinned, which is usually correlated with increased traffic volumes. At some point, large and mid-sized carnivores cannot compensate for the increased mortality, or they stop trying to cross busy highways. There is also a growing body of knowledge indicating that two lane highways with low or moderate traffic volume can be negotiated by many wildlife species, particularly when long traffic pauses occur.

Project effects on bear mortalities from collisions during full build-out are expected to be adverse, low magnitude, local and long-term, because of the fact that traffic volumes will be confined largely to the LSA and the PTH6, black bear avoidance of human use areas, and the related low probability of black bear mortality observed on other roads of this type. Wildlife mortalities in the LSA and along PTH6 will be monitored during operations. If bears are struck on the road, adaptive management measures, such as institution of traffic pauses to allow wildlife to cross will be considered. At closure, project related traffic will cease, with a corresponding reduction in the risk of wildlife collisions. Effects at closure are predicted to be low magnitude and far future. The likelihood of effects as predicted are high based on observations of road-related mortality elsewhere and mitigation measures for other wildlife such as speed limits, and environmental orientation for project personnel and contractors.

Human conflicts can also result in bear mortality. Neilsen et al. (2004) found that the highest risk of mortalities for bears in the Central Rockies Ecosystem was related to proximity to human disturbances. Areas nearer than 500 metres from human habitation or roads and closer than 200 metres from human use trails were, where bears were at greatest risk of mortality. This was due to increased problem human-bear interactions revolving around food and increased hunter and poacher access.

The mine will bring an increase in human activity to the area and increase the risk of human-bear conflicts due to food waste attractants and maybe increased access for hunter sand poachers. Proper management of food waste attractants (Section 9: Environmental Management Plan) will minimize risks of mortality to problem wildlife. As noted earlier, controlled access and prohibition of firearms or hunting by project personnel along the access road will prevent wildlife mortality from this source during operations. The risk of mortality from hunting may increase at closure, if access is not controlled. While various measures are feasible to reduce this risk, management of the site at closure is currently unknown, as some COI may want to keep some of the facilities and infrastructures open for other uses. Project effects on black bear mortality at full build-out and closure are expected to be adverse, low magnitude, local and long-term to far future in duration. The likelihood of effects as predicted is high during operations based on the effectiveness of mitigation measures. The likelihood of effects at closure is unknown as access management measures are uncertain.

At closure there is potential for wildlife, including black bears, to be exposed to contaminants accumulated in vegetation affected by contaminated discharges or drainage.

Collection and treatment of site drainage and process waters to achieve high quality effluent during operations, and measures to prevent mobilization of contaminants will minimize the risk of bioaccumulation in the vegetation on site. No effect on wildlife is anticipated.

Residual Project Effects and Significance

All residual project effects on black bear are expected to be low magnitude and local in extent. Based on criteria listed in Table 7.10-7, these effects are determined to be not significant (as tabulized at the end of this Chapter). Potential adverse effects on habitat availability, while moderate in the context of the LSA, are low in a regional context and largely reversible at closure. Disturbance to movement patterns is unlikely, due to the low level of bear activity in the area.

Black bear mortality from road collisions and hunting can be effectively mitigated during operations and at closure. The likelihood for effects occurring as predicted at full build-out is high, based on conservative assumptions for disturbance footprint, the effectiveness of mitigation measures and observations of black bear behaviour in comparable circumstances. Management measures at closure have not been confirmed, the likelihood of mortality effects occurring as predicted is unknown, as some COI may want to keep some of the facilities and infrastructures open. Should this be the case, appropriate management measures will be developed by the Manitoba Government in consultation with the COI and other interest holders. Observations of bear activity in the vicinity of the project during operations and reporting of mortalities, should they occur, will provide information for adaptive management measures, if necessary.

7.10.7.5.4 Beaver

Habitat Availability

Conservation concerns for this species are relatively few due to the beaver's adaptability to human disturbance (Foote, 2005). Beavers, in fact, find road beds and culverts attractive due to the reduced effort it takes to dam a culvert instead of a whole waterway in order to flood land (Martell, 2004).

Project disturbances within 50 m of beaver habitat were considered as impacts and are assessed in terms of effects on habitat area. The overall decrease in the available beaver habitat (confirmed use and potential wetlands) in the LSA during full build-out is low. Effects therefore are characterized as adverse, low magnitude, local and long-term. The small habitat reductions due to disturbance effects at full build-out are expected to be largely reversible at closure. The likelihood of this effect occurring as predicted is high based on knowledge of beaver activity in relation to human disturbance.

Disruption to Movement Patterns

Disruption to movement patterns is a concern for beavers in areas where project roads and mine development cross streams, fragmenting suitable habitats for beavers. This effect is expected to be low in magnitude given:

- Facility siting and road routing attempts to avoid wetland habitats as much as possible as part of the engineering design. However, this will not always be possible because the site is predominantly muskeg.
- Beavers adapt well to disturbances including roads and project developments.
- Mitigation measures to reduce potential effects on beaver movement patterns include:
  - ➢ Restricting use of machinery and vehicles in beaver wetlands and surrounding riparian areas, where possible.
  - ➢ Access to the mine site will be restricted by a locked gate during the construction, operations and decommissioning phases of the project. Only project related users will be allowed.

Project effects on beaver movement patterns are expected to be adverse, low magnitude, local and long-term to far future. Effects of disturbance on beaver movements will be largely reversed at closure. The likelihood of this effect occurring as predicted is high based on knowledge of beaver activity in relation to human disturbance.

Mortality Risk

Mortality risk to beaver may result from vehicle collisions and/or from direct removal of beavers from the project area by mine staff and associated personnel. However, conservation concerns for this species are relatively few due to the beaver's adaptability (Foote, 2005). Beavers are known to have a fast rate of population recruitment and may rapidly colonize areas. Furthermore, the areas within the local and regional study areas support relatively healthy beaver populations. Project effects on beaver mortality are expected to be low in magnitude based on the following mitigation measures:

- Access to the mine will be restricted by a locked gated during the construction, operations, and decommissioning phases of the project.

- Firearms will not be permitted on site. This includes the carrying of firearms in private vehicles to and from the project site on workdays (for project related employees and associates).
- Hunting and fishing will be prohibited at all times on or in the vicinity of the project site, including during travel to and from the site on workdays. This restriction is applicable to all mine employees, managers and contractors. It will be in effect throughout the life of the project. Infringement of this policy is to be reported.
- Vehicle traffic volumes will be monitored on mine roads.
- Maximum speed limit on all access roads is set at 60 km/h.

Project effects on beaver mortality, while potentially adverse, are expected to be low in magnitude, local, long-term and largely reversible at closure. The likelihood of effects occurring as predicted is high, based on the effectiveness of mitigation measures.

Residual Project Effects and Significance

All project effects on beaver are expected to be of low magnitude, local extent and long-term in duration. Based on criteria, defined in Table 7.10-7, these effects are determined to be not significant. The likelihood of effects occurring as predicted is high, based on the knowledge of beaver response to human behaviour and the effectiveness of identified mitigation measures.

7.10.7.5.5 Lynx Habitat Availability

Although there is a large decrease in high and moderate quality lynx/snowshoe hare habitat availability in the LSA at full build-out, this is considered to be a low magnitude effect because:

- high quality habitat is not abundant within the LSA;
- there are no structurally complex forests within the LSA;
- on a regional scale, these losses are not expected to be substantial; and
- the assessment of habitat loss is based on a conservative overestimate, by assuming the total area of all affected claim areas will become low quality or unusable habitat.

The actual footprint will be smaller, but use of this conservative method ensures that project related sensory effects for this disturbance-sensitive species are fully accounted for.

Lynx depend on more structurally complex forests (Mowat et al., 2000), though they may use young forests with sufficient structural complexity to provide hunting cover. Based on this requirement for older and more structurally diverse forests, project effects of site and access road clearing are deemed to be far future in duration, because of the long time period required to regenerate mature forest.

Accordingly, project effects on lynx habitat suitability are expected to be adverse, low magnitude, local and far future. Reductions in habitat availability due to disturbance will be reversible at closure, but loss of habitat on the transportation corridors may persist. The likelihood of effects occurring as predicted is high based on the conservative disturbance footprint and abundance of available high quality habitat.

Disruption to Movement Patterns

Lynx, because of their requirements as a large predatory animal, require relatively large areas of land in which to hunt and live. This means that individuals need to move large distances on the landscape in order to fulfill their minimum requirements for survival.

Lynx are a shy ‘stalk-and-pounce’ predator that prefers to avoid human contact, and they have been observed to avoid large openings during daily movements within their home ranges (Koehler,1990; Staples, 1995). This is partially due to a lack of hiding cover for hunting and avoiding possible exposure to larger predators. A study of lynx behaviour in relation to intensity of traffic on roads and highways found that this species is reluctant to cross high-use roads, but will more readily cross those with lower traffic volumes, and with no centerline barrier.

The transportation corridors are unpaved and will have less traffic volume than the roads in the studies cited above. Lynx are thus expected to cross any forest gap caused by the haul road without great difficulty. Any avoidance of the haul road traffic or reluctance to cross by lynx should be reversible at closure.

Changes in the landscape from project development will break formerly contiguous blocks of suitable lynx habitat into smaller patches, and will create some impediment to movement of lynx across the haul road and in the vicinity of the mine site and TWRMF. Potential habitat fragmentation caused by the location of the mine site will occur in generally low suitability habitat; therefore, effects to movement are considered to be low magnitude, and ultimately reversible.

In summary, project effects on lynx movements are expected to be adverse, low magnitude, local and far future. Disturbance barriers to movement will be reversible at closure while any physical barrier caused by the road corridor will persist. The likelihood of effects occurring as predicted is high, based on knowledge of lynx behaviour related to crossing roads like the transportation corridor.

Mortality Risk

Due to the relatively long life spans of lynx (over 12 years), they can continue existing as individuals without persisting as populations, making assessments of population effects difficult without long-term assessment or resorting to population modeling. Despite behavioural avoidance of roads, lynx are occasionally killed on the Trans-Canada Highway in Banff National Park (Gibeau and Heuer, 1996). In the north, occurrences of lynx highway mortalities have been documented in Alaska (Staples, 1995). Given the reported occurrence of lynx mortality on roads, it is possible that haul roads traffic could result in lynx mortality.

The risk and magnitude of mortality at full build-out is expected to be low given the speed restrictions (60 km/h), in comparison to situations in other studies where road related mortalities were observed (Gibeau and Heuer, 1996; Theil, 1987; Staples, 1995). In addition, lynx are expected to change their behaviour to avoid the cleared and high human-use mine site area.

At closure, there is a risk that the presence of the transportation corridor may increase trapping success. Effects on the local and regional lynx population could increase to moderate magnitude in years when the lynx population cycle is low. The project may give access to habitat that was once a refuge, and depress the population when it is in a vulnerable recovery phase. Depressing population growth at such a site may reduce overall lynx population recovery by removing individuals that could spread to re-establish populations at other sites (Ruediger, 1996). However, it is unlikely that these effects will occur as there are numerous areas of refuge habitat in the vicinity of LSA to support the regional lynx population.

Accordingly, project effects on lynx mortality are expected to be adverse, low magnitude, local and far future. Effects will be partially reversed at closure. The likelihood of effects occurring as predicted is high, based on knowledge of lynx behaviour related to crossing transportation corridors and the abundance of refuge habitat in the project area.

Residual Project Effects and Significance

All adverse residual project effects on the lynx VECC and snowshoe hare are expected to be low magnitude and local (as tabulized at the end of this Chapter). Effects in the LSA are largely offset by the abundance of lynx/snowshoe hare habitat in the area. Effects of clearing on habitat availability are expected to be far future in duration, based on the time required for recovery of more mature forest stands that are the preferred habitat of lynx.

Using the criteria listed in Table 7.10-7, project effects on lynx/snowshoe hare are determined to be not significant. The likelihood of these effects occurring as predicted is high, based on available information concerning lynx response to human disturbances and the abundance of high quality habitat in the project area.

7.10.7.5.6 American Marten

Habitat Availability

The majority of the effects on marten habitat availability are related to habitat loss and alteration rather than sensory disturbance during full build-out. Moderate winter habitat for marten within the LSA represents a relatively small proportion of habitat available within the RSA. There is no high quality winter habitat rated in the LSA relative to a broader boreal forest scale benchmark for marten. This region contains no area of high suitability habitat, under full build-out. However, since the projected footprint of the mine road is overestimated and as there are no high quality habitats for marten in the LSA, the project effects, although adverse, are judged to be low in magnitude. Since marten depend on older and more structurally complex forests (Poole et al., 2004), this effect is deemed likely to have a far future duration due to the long time period required for the re-growth to a mature forested state.

In general, habitat availability is expected to decrease at full build-out and return to slightly lower than baseline values at closure. This change is expected because construction and operational activities will remove some available habitat (through direct habitat loss and sensory disturbance), which will then be reversed by lower activity and mitigation measures such as re-vegetation at closure. During operations, the effects of cleared land on marten habitat may be mitigated to some degree by leaving slash piles for cover enhancement. Marten are known to use slash piles as a preferred part of their habitat (Slough, 1989; Buskirk and Powell, 1994; Poole et al., 2004), and leaving the brush and woody debris from the road clearings may add some habitat quality for marten following post closure.

Project effects on habitat availability for marten are expected to be adverse, low magnitude, local and far future. Effects will be partially reversible at closure, but those associated with the road corridor will persist. The likelihood of effects occurring as predicted is high given the lack of good habitat in the LSA, the conservative size of the disturbance footprint and the opportunity for some mitigation of habitat loss.

Disruption to Movement Patterns

Some behavioural effects causing disruption to the movement patterns of marten may result from vegetation clearing and vehicle traffic associated with the transportation corridors (TCs) and mine site. Project effects associated with habitat loss and alteration will fragment moderate habitat patches into several disjunct smaller blocks, and potentially cause disruptions to marten movements between these patches.

Marten have been observed to cross high-use roads less frequently than low use roads (Alexander and Waters, 2000; Clevenger et al., 2001), implying that movement disruptions may occur for marten due to the haul road. However, because the mine site transportation corridors will be confined to the LSA and will have less traffic volume than did the roads in those studies, marten are expected to cross the forest gap caused by the TCs without great difficulty. Similarly, the width of the TCs and adjacent clearings is expected to be relatively narrow (less than 35 m), which is likely to facilitate marten movements.

It has been shown that small territorial animals such as marten will avoid project footprints during actual construction, but will not significantly shift their territorial distributions in response to rights-of-way activities (Eccles and Duncan, 1987; Morgantini, 1994). As the density of disturbance is low in the project areas, impacts resulting in habitat fragmentation and isolation are unlikely.

Project effects on disruption to marten movement patterns are expected to be adverse, low magnitude, local and long-term. Effects will be partially reversible at closure. The road will remain, but traffic will be substantially reduced. The likelihood of effects occurring as predicted is high based on observations of marten movements related to similar sized TCs and the fact that the disturbance footprint will be confined to one area (LSA), with no other habitat fragmentation in the project area.

Mortality Risk

Mortality risk to marten from the project development is expected to arise from two separate sources: collisions with project vehicles or machinery and direct mortality from road collisions or machinery.

Although expected to some degree, mortalities caused by collisions and machinery are expected to be minimal because of the controlled traffic volume. Other traffic control measures (speed limits, signage) will reduce the risk of collisions during operations. If traffic volume increases, vehicle departures could be staggered, to create gaps, which would allow marten and other wildlife to cross the road. Since marten tend to change their use behaviours in relation to areas of high human use, it is expected that they will avoid the mine site unless attracted by poorly managed food wastes. Indeed, it is likely that martens have already started to avoid the Minago Project Area, since exploration activities have been taken place in the area.

Residual Project Effects and Significance

All project effects on marten are expected to be low magnitude and local. Based on criteria listed in Table 7.10-7, effects are determined to be not significant. Effects on habitat in the mine site area and those related to human disturbance and road traffic will be largely reversible at closure, but effects associated with the road right-of-way will persist. The likelihood of effects occurring as predicted is high.

7.10.7.5.7 Song Bird Community

Habitat Availability

Edges in the landscape are important because they interface between two different types of environment or habitat. They share characteristics of both adjacent areas but have a unique character of their own. Some species require large sections of contiguous habitat and may not be able to live in areas where edges occur, a process referred to as 'edge effects' (Ries et al., 2004). For example, individuals of a forest-dependent species living in an area adjacent to a disturbance may become more susceptible to predators that use the clearings to move around the landscape. At the regional scale, human developments often contribute to creation of edge environments, and there is potential for edge effects as a result of project development. The very conservative approach taken in this habitat analysis implicitly accounts for the possibility of 'edge effects', by assuming that a large area around the construction sites will become unsuitable habitat.

Disturbance by roads and construction is known to negatively affect the habitat use by passerine birds, reducing densities of many species in broad zones of woodland and open habitat adjacent to noisy developments and busy roads (Reijnen et al., 1997). To avoid this potential problem, construction activities for the project may be timed to avoid the time of year when migrant passerine birds are living in the area (the incubating and fledging period for most species is May to July). Winter-resident species are highly mobile and, in the event of disturbance from project construction, will be able to select alternate habitat situated away from the source of disturbance along the project footprint. Year-round resident bird species may be exposed to sensory disturbance and reduced habitat availability. These individuals will likely relocate away from the sources of disturbance.

Estimated effects are very conservative to ensure that they encompass any potential effects. During full build-out, actual losses are predicted to be minor within the LSA/RSA. Where possible, efforts will be made to minimize the effects of forest loss, but may impact species that prefer open spaces. However, there were no signs of migrant birds recorded during the survey. Residual project effects are expected to be adverse, low magnitude, local, long-term and partially reversible at closure when the mine site is revegetated and traffic is greatly reduced. The likelihood of effect is unknown, but the conservative assumptions used in the assessment suggest that effects are not likely to be greater than predicted.

Disruption to Movement Patterns

Movement of individuals at local, regional and even global scales is a key process in maintaining animal populations. Usually disturbance results in a primary effect from the simple loss of habitat area. Fragmentation of habitat caused by breaking up larger contiguous blocks of habitat by natural and anthropogenic disturbances has been shown to strongly affect most species, including birds, by affecting their movement behaviour (Bélisle and St-Clair, 2001). For example most birds were found to follow strips of forest (travel corridors) to avoid crossing forest gaps of greater than 25 m (St-Clair et al.,1998). However, when relocated across the road they were reluctant to re-cross rivers and noisy roads such as the high-use Trans-Canada Highway (~50 m width), but were not averse to crossing smaller forest gaps or quieter roads (St-Clair, 2003). If the density of disturbances reaches a critical threshold, there may also be a state where the remaining patches of habitat have become isolated from each other (Andren,1996). This results in even lower habitat quality. The combined effect of habitat loss and isolation of remaining habitat patches act synergistically to have a negative impact on the disturbance affected species.

In the LSA, some unavoidable disturbance to movements is expected to occur around the pit, the TWRMF, and the waste rock dumps due to habitat clearing and heavy machinery. Both factors are expected to result in some reluctance by the birds to cross road right-of-ways. The haul road right-of-way is expected to be under 35 m and birds have been noted to cross natural gaps of up to 200 m (St-Clair et al., 1998). For the project area, the density of disturbance is low because there is only one haul road proposed. This means that cumulative development impacts resulting in habitat fragmentation and isolation are unlikely. Currently, birds have been observed to cross PTH6.

Accordingly, effects of full build-out on songbird movement patterns are expected to be adverse, low magnitude, local, long-term and partially reversible at closure. The likelihood of effects occurring as predicted is high, based on the project design and observations of bird behaviour at road crossings.

Mortality risk

Direct mortality of individuals may also affect bird populations. Potential sources of bird mortality at the project include:

- bird strike by vehicles or machinery while attempting to cross project clearings; and
- direct or indirect destruction of nests by clearing or disturbance causing nest abandonment.

Mitigation measures include:

- waste management to minimize bird attraction into oncoming vehicles or flight paths; and
- avoidance of clearing during the nesting season (May to July).

Monitoring to check water and sediment quality and vegetation analysis will examine potential pathways of bird exposures to contaminants and flag any concerns that might require adaptive management. Based on these measures, residual project effects on songbird mortality are expected to be adverse, low magnitude, local, and long-term. Effects due to clearing and traffic during full build-out will be reversed at closure. The likelihood of effects occurring as predicted is high based on the effectiveness of mitigation measures.

Residual Project Effects and Significance

All residual project effects on songbirds are expected to be of low magnitude and local extent. Based on criteria listed in Table 7.10-7, these effects are determined to be not significant. Effects will be partially reversed at closure due to mine site reclamation and reduced traffic and human disturbance. Persistent effects due to ongoing road use will be functionally irreversible. The likelihood of effects on habitat availability is unknown, but predictions are considered to be conservative and effects are unlikely to be of higher magnitude than predicted. The likelihood of project effects due to movement barriers and mortality occurring as predicted is considered high, based on the effectiveness of mitigation measures.

7.10.7.6 Residual Project Effects and Significance

Residual project effects on wildlife VECCs and significance determinations were made at the end of each preceding section.

7.10.7.7 Cumulative Effects

Based on the project effects described in this section, the main concern with respect to potential cumulative effects is increased mortality risk for VECC species, with extensive home ranges or movement patterns that might encounter other sources of mortality risk in daily or seasonal movements. This concern is low for caribou, black bear, marten, and lynx.

Residual project effects were identified for the VECCs; all were low magnitude except for moose, which were expected to be low to moderate at closure.

Other facilities or activities within the range of these species that could contribute to cumulative effects include:

- PTH6 - increased traffic on the southern and northern legs of the PTH6 associated with operation of the mining operations in Snow Lake and Thompson. The likelihood of effects from this is unknown due to various factors (e.g., potential highway improvements, traffic volumes, and associated effects on nonindustrial traffic).
- Harvest management including hunter harvest and trapping will continue to be managed and monitored by Manitoba Conservation with intent to maintain a sustainable or below sustainable harvest of wildlife species in the area.
- The hunting activities within and surrounding the Project area will remain a permit hunt on a quota based management system as per Manitoba Government Regulations.

7.10.7.8 Residual Cumulative Effects and Significance

Given the general uncertainty with expected management directions of the project road networks (as some COI may want them to stay open) at closure, it is difficult to accurately assess the residual cumulative effects on mortality risk for moose. If all TCs associated with the project are decommissioned, there will be no mortality due to the project. During construction, operations, and decommissioning, the Project will be able to largely control access and subsequent effects of mortality along the TCs. Following closure and in the event that COI want some of the infrastructures to be left in place for other uses, the management of TCs will no longer be in the proponent’s control. If not managed well, the increased access into high quality moose habitat may have significant effects on local moose populations. However, it is likely that residual cumulative effects at a regional level will not be significant for the following reasons:

- Moose mortality risk associated with the TCs is minimal;
- Traffic volumes on the site road network are likely to decrease following closure;

- Traffic volumes and traffic speed on the PTH6 have a limited potential mortality risk for moose in the RSA;
- Agreements and mechanisms for management of the site TCs at closure will likely be determined by the Manitoba Government and the COI, in consultation with interested parties.

Residual cumulative effects for mortality risk associated with caribou are considered to be adverse and not significant. These effects are considered low in magnitude for several reasons. First, mortality resulting from caribou–vehicle collisions is considered to be low in the LSA since traffic volume associated with the site wide road network will decrease following Project closure and traffic volumes are not predicted to change along the PTH6 within areas overlapping the range of the William Caribou Herd in the future. Second, the harvest of caribou within and surrounding the LSA and RSA is not permitted. Residual cumulative effects on caribou are thus considered to be not significant with a high prediction confidence given mitigation measures already in place and ongoing monitoring of the regional caribou population by Manitoba Government.

Residual cumulative effects on mortality risk to black bears are considered to be adverse and not significant, low in magnitude and far future in duration. The magnitude of these effects was considered low since: 1) black bear-vehicle collisions within the LSA and RSA affecting mortality are likely to be minimal as traffic volumes are likely to decrease following project closure; 2) black bear and human interactions are likely to decrease in the area following project closure since there is likely to be less human presence in the area after project closure; and 3) black bear density in the area is relatively low when compared to the remainder of the Manitoba and surrounding areas that likely support the area's bear population. Prediction confidence for this residual cumulative effects assessment on black bear mortality risk is considered to be moderate given a limited understanding of black bears in the region.

Residual cumulative effects on American marten and lynx VECCs and snowshoe hare are considered not to be significant, low in magnitude, and far future in duration. The potential residual cumulative effects of greatest concern are from wildlife-vehicle collisions, increased trapping harvest and chronic poisoning by ingestion and maybe by bioaccumulation of residual contaminants from the mine tailings and milling waste that may potentially increase the mortality risk to the respective species population. These mortality risks are, however, expected to be minimal since: (1) mining operations in the LSA and RSA mitigate wildlife interactions with residual contaminants during the life of mine operations and as well as plan for remediation after project closure; and (2) Manitoba Conservation monitors trapping harvest in the area.

The prediction confidence is considered moderate to high in this assessment given the minimal level of cumulative disturbances currently assessed within the RSA and the mitigation processes already in place, as discussed. Several monitoring and mitigation practices are recommended with respect to improving predictive capabilities of this residual cumulative effects assessment and/or for implementing a process of adaptive management practices to learn from potential mitigation measures.

7.10.7.9 Mitigation Measures

Many mitigation measures for wildlife have been compiled into the Wildlife Protection Plan in Section 9.5. Other measures are integrated into the site waste management plans including water management and tailings management to achieve high quality discharges and minimize the risk of metals accumulation in vegetation used by wildlife. At closure, the pit and TWRMF will be reclaimed as a permanent pond facility and contents will be physically and chemically stable. The risk of wildlife exposure to contaminants will be minimal. TCs, if requested to remain open by COI, will need to be addressed accordingly. Mitigation options will be developed by the Manitoba Government, the COI and other interest holders as appropriate to support preferred use and minimize potential adverse effects on wildlife (Table 7.10-8).

7.10.7.10 Monitoring and Follow-up

Follow-up Studies

In order to improve predictive capabilities for project effects at closure, it is recommended that follow-up work includes development of an Access Management Plan for the TCs (if some COI want the roads to remain open) at closure, with emphasis on measures to minimize risk of moose mortality and associated effects on regional population sustainability. As the agents responsible for management of the road at closure, it is recommended that the COI and Manitoba Government lead this work, in consultation with other interested parties.

Monitoring Programs

Onsite wildlife monitoring programs will be conducted by VNI during the life of the project that will include:

- where practical, systematic documentation wildlife sightings in or near the project area, road kills, and problem wildlife incidents; and
- systematic documentation of wildlife use of reclaimed habitats.

These programs are specifically intended to check mortality predictions and mitigation effectiveness (Section 9.5: Wildlife Protection Plan) and guide adaptive management as required.

The onsite environmental monitor will maintain systematic records of wildlife observations, and incidents (e.g., wildlife-vehicle collision, aggressive bear observation) in or near the project area, which will be kept in a ‘wildlife log’. Reports will include the date, time, description of location, species, number of individuals, and the activity (e.g. feeding, nesting).

The following monitoring programs and, where applicable, adaptive management strategies, are proposed:

- **Wildlife-vehicle mortalities** – Large mammal mortalities or accidents along TCs will be recorded and reviewed, where possible. If road kills occur within the LSA, corrective actions or additional mitigation measures (e.g., lower speed limits, warning signs, improvement of visibility, worker advisories) may be implemented.
- **Problem wildlife** – Problem wildlife incidents will be monitored and recurrent incidents will precipitate a re-evaluation of the effectiveness and enforcement of existing prevention measures.
- **Black bears** – Observations of black bears or their signs (e.g., tracks, scat) in and around the project area will be recorded. These observations will informally track black bear use patterns within the project area through all development phases.

The proposed monitoring program and follow-up programs for wildlife are summarized in Table 7.10-9.

7.10.7.11 Summary of Effects

Residual project and cumulative effects are summarized in Table 7.10-10 during construction and in Table 7.10-11 during Closure.

Table 7.10-9 Monitoring and Follow-up Programs for Wildlife

Potential Project Effect	Program Objectives	General Methods	Reporting	Implemen-tation
Follow-Up Programs				
Management of the TC at closure	• Confirm the accuracy of the effects predictions. • Initiate contingency plans to address unexpected effects, as required.	• Consult with Manitoba First Nations, Norway House Resource Management Board and other interested parties relevant to the development of a Wildlife Protection Plan for the TC at closure.	• N/A	MB Gov.'t
Wildlife vehicle mortalities	• Confirm the accuracy of the effects predictions. • Initiate contingency plans to address unexpected effects, as required.	• Record and report incidents.	• MB Gov.'t as required	Proponent
Problem Wildlife	• Confirm the accuracy of the effects predictions. • Initiate contingency plans to address unexpected effects, as required.	• Record and report incidents.	• MB Gov.'t as required	Proponent
Bear/project interactions	• Confirm the accuracy of the effects predictions. • Initiate contingency plans to address unexpected effects, as required.	• Record observations of bear signs and activities in the project area.	• MB Gov.'t as required	Proponent
Exposure to contaminants and potential bioaccumulation of metals	• Confirm the accuracy of the effects predictions. • Initiate contingency plans to address unexpected effects, as required.	• Conduct Environmental Effects Monitoring (EEM). • Conduct vegetation metals analysis.	• EEM reports as required	Proponent
Monitoring Programs				
Moose and caribou mortality	• Confirm the accuracy of the effects predictions. • Initiate contingency plans to address unexpected effects, as required.	• Conduct ongoing Manitoba regional population monitoring.	• N/A	MB Gov.'t

Table 7.10-10 Program Effects on Wildlife during Construction

VECC	Potential Effect	Level of Effect[1]						Effect Rating[2]	
		Direction	Magnitude	Extent	Duration/ Frequency	Reversibility	Likelihood	Project Effect	Cumulative Effective
Construction									
Moose	Reduction in seasonal habitat availability due to clearing and sensory disturbance	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Disruption to movement patterns due to habitat fragmentation and sensory disturbance	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Increased mortality risk from collisions	Adverse	Low	Local	Long-term	Irreversible	High	Not significant	Not significant
Woodland Caribou	Reduction in seasonal habitat availability due to clearing and sensory disturbance	Adverse	Low	Local	Long-term	Partially reversible	High	Not significant	Not significant
	Disruption to movement patterns due to sensory disturbance	Adverse	Low	Regional	Long-term	Reversible	High	Not significant	Not significant
	Increased mortality risk from collisions	Adverse	Low	Regional	Long-term	Irreversible	High	Not significant	Not significant
Bears	Reduction in seasonal habitat availability due to clearing and sensory disturbance	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Increased mortality risk from collisions and site conflicts	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Disruption to movement patterns from sensory disturbance	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant

Table 7.10-10 (Cont.'d) Program Effects on Wildlife during Construction

VECC	Potential Effect	Level of Effect[1]						Effect Rating[2]	
		Direction	Magnitude	Extent	Duration/ Frequency	Reversibility	Likelihood	Project Effect	Cumulative Effective
Beaver	Reduction to seasonal habitat availability from wetland removal	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Disruption to movement patterns from sensory disturbance	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Increased mortality risk from collisions	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
Lynx	Reduction in seasonal habitat availability due to clearing and sensory disturbance	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Increased mortality risk from collisions	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Disruption to movement patterns from disturbance or habitat fragmentation	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
American Marten	Reduction in seasonal habitat availability due to clearing and sensory disturbance	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Increased mortality risk from collisions	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
	Disruption to movement patterns from sensory disturbance or habitat fragmentation	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	Not significant
Songbird community	Reduction in seasonal habitat availability due to clearing and sensory disturbance	Adverse	Low	Local	Long-term	Partially Reversible	Unknown	Not significant	N/A
	Disruption to movement patterns due to habitat fragmentation and sensory disturbance	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	NA

	Increased mortality risk due to nest destruction, collisions or contaminant exposure	Adverse	Low	Local	Long-term	Partially Reversible	High	Not significant	NA

Table 7.10-10 (Cont.'d) Program Effects on Wildlife during Construction

Notes:

1 Based on effects attributes in Table 7.10-7

2 Based on significance criteria

The significance of Project effects and cumulative project effects are unknown at this time since the management regime and implementation of mitigation options for the site road networks following project closure cannot be confirmed at this time. Agreements and mechanisms for management of the site wide road networks at closure will be determined by Manitoba Government and the First Nations in consultation with interested parties. It is likely that once mitigation measures have been established that project effects and cumulative effects will not be significant.

Partially reversible effects refers to the reduction of effects due to mine site reclamation and reduction in human activity and traffic.

N/A = not applicable

Table 7.10-11 Program Effects on Wildlife during Closure

VECC	Potential Effect	Level of Effect[1]						Effect Rating[2]	
		Direction	Magnitude	Extent	Duration/ Frequency	Reversibility	Likelihood	Project Effect	Cumulative Effective
Moose	Reduction in seasonal habitat availability due to access road	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	N/A
	Disruption to movement patterns due to access road	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	N/A
	Increased mortality risk from collisions, hunting and poaching	Adverse	Moderate	Regional	Far Future	Reversible	Unknown	Unknown[3]	Unknown[3]
Woodland Caribou	Reduction in seasonal habitat availability due to TC	Adverse	Low	Local	Far Future	Partially Reversible	High	Not significant	N/A
	Disruption to movement patterns due to TC	Adverse	Low	Regional	Far Future	Irreversible	High	Not significant	N/A
	Increased mortality risk from collisions, hunting and poaching	Adverse	Low	Regional	Far Future	Irreversible	High	Not significant	Not significant
Black bear	Increased mortality risk from collisions and hunting	Adverse	Moderate	Local	Far Future	Reversible	Unknown	Not significant	Not significant
	Disruption to movement patterns from sensory disturbance	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	N/A
	Reduction to seasonal habitat availability from TC	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	N/A
Beaver	Reduction in seasonal habitat availability from TC	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	N/A
	Disruption to movement patterns from sensory disturbance	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	N/A
	Increased mortality risk from hunting and collisions	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	N/A

Table 7.10-11 (Cont.'d) Program Effects on Wildlife during Closure

VECC	Potential Effect	Level of Effect[1]						Effect Rating[2]	
		Direction	Magnitude	Extent	Duration/ Frequency	Reversibility	Likelihood	Project Effect	Cumulative Effective
Lynx	Reduction in seasonal habitat availability due to TC	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	N/A
	Increased mortality risk from hunting and collisions	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	Not significant
	Disruption to movement patterns from sensory disturbance or habitat fragmentation	Adverse	Low	Local	Far Future	Irreversible	High	Not significant	N/A
American Marten	Increased mortality risk from collisions and harvest	Adverse	Low	Local	Far Future	Partially Reversible	High	Not significant	Not significant
	Disruption to movement patterns from access road	Adverse	Low	Local	Far Future	Partially Reversible	High	Not significant	N/A
	Reduction in seasonal habitat availability from access road	Adverse	Low	Local	Far Future	Partially Reversible	High	Not significant	N/A
Songbird Community	Disruption to movement patterns from sensory disturbance or habitat fragmentation	Adverse	Low	Local	Far Future	Irreversible	Unknown	Not significant	N/A
	Increased mortality risk from collisions and exposure to contaminants	Adverse	Low	Site Specific	Far Future	Irreversible	Unknown	Not significant	N/A
	Reduction in seasonal habitat availability from access road	Adverse	Low	Local	Far Future	Irreversible	Unknown	Not significant	N/A

Table 7.10-11 (Cont.'d) Program Effects on Wildlife during Closure

Notes:

1 Based on effects attributes in Table 7.10-7

2 Based on significance criteria

The significance of Project effects and cumulative project effects are unknown at this time since the management regime and implementation of mitigation options for the site road networks following project closure cannot be confirmed at this time. Agreements and mechanisms for management of the site wide road networks at closure will be determined by Manitoba Government and the First Nations in consultation with interested parties. It is likely that once mitigation measures have been established that project effects and cumulative effects will not be significant.

Partially reversible effects refers to the reduction of effects at closure due to mine site reclamation and reduction in human activity and traffic. At closure, habitat alienation and sensory disturbance associated with ongoing use of the haul road is expected to persist and will be functionally irreversible.

N/A = not applicable