APPENDIX 14-III

Wildlife Habitat Models

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NEXTBRIDGE INFRASTRUCTURE

1. INTRODUCTION

Habitat suitability modelling is an approach and tool that can be used to predict the availability and distribution of habitat for a particular wildlife species or suite of species, and that can help to identify areas of higher quality habitat in a given landscape. This approach has been used extensively to document areas of important wildlife habitat and to predict the potential effects of habitat alteration on wildlife populations (Brooks 1997; Marzluff et al. 2002). Model results and mapping outputs are tools in the evaluation of land management because they help to quantify and display the distribution of habitat "quality" across a landscape. Using habitat suitability modeling is an accepted method of identifying habitat value and specific geographic locations as the basis of impact assessment and wildlife management.

Habitat suitability modelling was used to quantify habitat changes between the net effects assessment and baseline characterization, and between the cumulative effects assessment and baseline characterization for the nine wildlife criteria selected for the East-West Tie Transmission Project (the Project) (Table 14-III-1). Selected wildlife criteria are provincially and/or federally listed and/or of social/cultural importance, as well as being representative of the habitat requirements of other species (i.e., they serve as "umbrella species" that capture the habitat needs of a suite of species or represent reliance on a particular landscape feature of ecological significance, such as a wetland ecosystem). Wildlife criteria selected for habitat suitability modelling are, therefore, representative species that allow for a focused examination of the ways a project may result in changes to the environment in terms of issues of importance to the species and the habitats they use.

Table 14-III-1: Wildlife Criteria Habitat Suitability Models

Species	Season	Habitat Type
Woodland caribou	All seasons	■ Winter habitat ■ Refuge habitat ■ Other areas in the range (Category 3 [(a)])
Moose	All seasons	Nursery, winter use and travel corridors
American marten	All seasons	Denning, foraging habitat
Little brown myotis/northern myotis	All seasons	Summer maternity roosting habitat, winter hibernacula
Bald eagle	Breeding	Nesting habitat
Bobolink	Breeding	Nesting habitat
Canada warbler	Breeding	Nesting habitat
Eastern whip-poor-will	Breeding	Nesting habitat
Olive-sided flycatcher	Breeding	Nesting habitat

a) Features or areas with the highest tolerance to alteration before their function or usefulness is compromised.

Disturbance metrics were central to describing available wildlife habitat and were calculated differently, depending on the spatial extent of the criterion-specific Regional Study Area (RSA). In the caribou RSA, total disturbance (absolute area and relative area [proportion]) was calculated using methods outlined by Environment Canada (2012) and the Ontario Ministry of Natural Resources and Forestry (MNRF) (2014a), and a disturbance layer was created using available data from the MNRF, Ministry of Northern Development and Mines (MNDM), Forest Resources Inventory (FRI), and Provincial Land Cover 2000 (Government of Ontario 2000). Disturbances were classified as either a linear feature (e.g., roads, transmission lines and rail lines), polygon (e.g., cutblocks, urban development), or point feature (e.g., mineral exploration). Anthropogenic disturbances were conservatively buffered by approximately 500 meters (m) so that footprint results were unlikely to underestimate anthropogenic

disturbances. No buffer was applied to the natural disturbances (i.e., burns). The total length of linear disturbances (kilometers) and the density of linear disturbances (kilometer per square kilometer [km/km^2]) in the caribou RSA were also calculated as quantitative indicators of fragmentation.

In the moose RSA, and in the RSA for marten, bat, and birds criteria, total disturbance (area and percentage) was calculated using a disturbance layer that was created using available data from the MNRF, MNDM, FRI, and Provincial Land Cover 2000. Disturbances were classified as either linear (e.g., roads, transmission lines, rail lines), polygonal (e.g., cutblocks, urban development), or points (e.g., drill holes). To calculate the area and percentage of human disturbance, point and linear anthropogenic disturbances were buffered to create footprints for each disturbance type (Table 14-III-2).

Table 14-III-2: Footprints for Developments in the Moose Regional Study Area and the Regional Study Area for Marten, Bat, and Birds Criteria

Type of Development	Feature Type	Footprint Radius or Corridor[a] (m)
Rural freeway, 4-lane divided highway	Linear	100
Rural arterial undivided highway	Linear	60
Rural collector undivided road, ramp	Linear	46
Rural local undivided road, street	Linear	20
Rural resource road	Linear	20
Recreation road	Linear	20
Service road	Linear	20
Forestry road	Linear	20
Winter road	Linear	20
Existing access road	Linear	20
Rail[b]	Polygon	Actual
Mineral exploration – drill holes	Point	12.5
Aggregate site (active and inactive)	Polygon	Actual
Mine	Polygon	Actual
Airport	Polygon	Actual
Cottage, residential site, recreation site	Point	5
Cottage, residential site, recreation site	Polygon	Actual
Tourism establishment area	Polygon	Actual
Communication/fire structure	Point	21
Utility site	Point	77
Utility line	Linear	40
Power generation station	Point	37
Tank	Polygon	Actual
Waste management site	Polygon	Actual
Forest processing facility	Point	310
Recent harvested (logged) area	Polygon	Actual
Dam/barrier	Point	50

a) A radius was applied to point features and a corridor was applied to line features.
b) Captured by FRI data in buffered line (BFL) polytype.
c) FRI = Forest Resources Inventory.
m = meter.

1.1 Woodland Caribou

Availability and distribution of woodland caribou (*Rangifer tarandus caribou*) habitat was estimated and mapped using FRI and Land Cover 2000 data in a geographic information systems (GIS) platform.

The description of habitat availability and habitat distribution followed the Ontario *Range Management Policy in Support of Woodland Caribou Conservation and Recovery* (MNRF 2014a) by addressing the policy's three guiding principles: (1) cumulative disturbance, (2) habitat amount and arrangement, and (3) sub-range habitat features.

- **Sub-range habitat features.** These features are habitats that support specific ecological function (MNRF 2014a). Functional caribou habitats include three categories (high-use areas, seasonal ranges, and remaining areas in the range), as described in the *General Habitat Description for the Forest Dwelling Woodland Caribou (Rangifer tarandus caribou)* (MNR 2013a). The Ministry of Natural Resources and Forestry (MNR 2013a) classifies habitat into three categories:
  - **Category 1:** features or areas that have the lowest tolerance to alteration before their function or usefulness is compromised;
  - **Category 2:** features or areas that have moderate tolerance to alteration before their function or usefulness is compromised; and
  - **Category 3:** features or areas with the highest tolerance to alteration before their function or usefulness is compromised.
- **Habitat amount**. As described by MNRF (2014a), habitat amount is the quantified area within a caribou range that possesses specific biophysical attributes associated with potential caribou habitat (i.e., habitat identification is based solely on land cover instead of documented caribou use, which is the case for sub-range habitat features). Potential caribou habitat is identified using habitat suitability models developed by Elkie et al. (2014) and includes winter habitat and refuge habitat. The rationale for identifying and quantifying existing winter and refuge habitat is to support landscape-level management of natural habitat that is consistent with the estimated amount of habitat that would occur in a natural landscape (MNRF 2014a). The MNRF estimates natural levels of habitat using simulation models that generate estimates known as simulated ranges of natural variation (SRNV). The SRNV is not available for the Lake Superior Coast Range.
- **Cumulative disturbance**. As defined by Environment Canada (2011, 2012), cumulative disturbance within a caribou range includes all anthropogenic disturbances (plus a 500 m buffer) and natural disturbances (without a buffer). Quantifying the proportion of disturbance at the range scale is important because this metric is linked to the probability of caribou persistence (Environment Canada 2011, 2012). The MNRF manages caribou ranges to remain at or move towards disturbance levels that support self-sustaining caribou populations (MNRF 2014a). Environment Canada (2011, 2012) identified a threshold of 65% undisturbed habitat, which provides a 60% chance of maintaining self-sustaining caribou populations.

Category 1

Nursery Areas

Nursery areas are defined as generalized features that an individual or a group of adult female caribou select during late parturition, to give birth and raise their calves during spring, summer, and early fall (MNR 2013a). According to MNR (2013a) nursery habitat features typically comprise "lakes and wetland complexes dominated by bog and fens, particularly those interspersed with upland islands and peninsulas (Carr et al. 2011)." Nursery areas delineated by the MNRF include female caribou observations between May 1 and September 15.

This date range presumably excludes animal observations associated with large individual movements of adult females made prior to calving and those that occur in fall or early winter (MNR 2013a).

Delineation of nursery areas was completed by the MNRF and spatial files were provided to Nextbridge by the MNRF.

Winter Use Areas

As described in MNR (2013a), winter use areas typically provide an abundance of ground lichen for winter forage and have lower than average snow depth, which can facilitate easier movement than in surrounding areas. Lichen rich habitats tend to contain lower amounts of deciduous browse and therefore tend to support lower densities of alternate prey species and predators (MNR 2013a). Winter use areas may provide refuge from predators. Areas of lower snow depth (e.g., wind swept areas or dense forest) may be selected more frequently in late winter, depending on the annual snow depth conditions. Individual fidelity to specific winter use areas is typically lower than for nursery areas (Cumming et al. 1996; Ferguson and Elkie 2004; Hazell and Taylor 2011).

Delineation of winter use areas was completed by the MNRF and spatial files were provided to Nextbridge by the MNRF.

Travel Corridors

Travel corridors are the habitat features used by caribou to move between nursery areas and winter use areas in spring and fall (MNR 2013a). The habitat features of travel corridors are variable and less distinct than other Category 1 habitats. They are typically delineated using caribou movement data (i.e., telemetry data from collared individuals) observed during migration (in April and November). Travel corridors in the Lake Superior Coast Range were delineated by the MNRF and spatial files were provided to Nextbridge. Additional areas important for caribou movement were identified through a literature review and are discussed qualitatively.

Category 2

Seasonal Ranges

The MNR (2013a) defines seasonal ranges as “large sub-range habitat features that encompass the majority of current caribou distribution during all seasons within the range.” These areas tend to be large tracks of mature conifer dominated forests interspersed with lakes and wetlands. Seasonal ranges are relatively undisturbed and unfragmented, typically do not support high densities of moose, and therefore provide refuge from predators such as wolves and black bears (MNR 2013a).

Seasonal ranges are typically delineated using resource selection probability functions; however, these models have not been developed for the Lake Superior Coast Range or the discontinuous caribou range. Mapping of winter and refuge habitat (described below) may be similar to the distribution of Category 2 habitat because they represent the more mature stands of coniferous forest cover on the landscape; however, caribou occupancy or probability of selection is not considered when identifying winter or refuge habitats.

Category 3

Remaining Areas in the Range

Areas in the Lake Superior Coast Range not identified as winter or refuge habitat (described below) were considered Category 3 habitat. These areas generally have the biophysical features and forest composition consistent with seasonal ranges but are currently young or disturbed (MNR 2013a). Disturbance types considered as Category 3 habitat included natural disturbances and temporary anthropogenic disturbances (e.g., cutblocks less than [<] 40 years). All other disturbances were considered permanent disturbances and were not included as caribou habitat. Habitat within the discontinuous range of caribou distribution was classified as Category 3 habitat (Copeland 2016).

Winter Habitat

Winter habitat was mapped using the conventional boreal models for winter habitat described in Elkie et al. (2014) (Table 14-III-3). The winter habitat included both preferred and usable winter habitats described by Elkie et al. (2014). This approach is consistent with data summaries provided in the Ontario Landscape Tool (2016 Build 3.5.5937) that do not differentiate between preferred and usable winter habitats, and the habitat assessment described in the *Integrated Assessment Protocol for Woodland Caribou Ranges in Ontario* (MNRF 2014b).

Table 14-III-3: Woodland Caribou Winter Habitat

Regional Forest Unit[a]	Description	Onset Age of Habitat (Years)		FMP Forest Unit[b]
		Preferred	Usable	
OcLow	Other conifer lowland	n/a	51	OCL, OCon
PjDom	Jack pine dominated	61	41	PjPur
PjMx1	Jack pine mixedwood	61	41	–
SbDom	Black spruce dominated	n/a	61	–
SbLow	Lowland spruce	101	41	SBLC, SbLo, Slow1, Slow3, SPL
SbMx1	Black spruce mixedwood	n/a	61	–
LC1	Lowland conifer	n/a	51	LC1OC, LC1SB
PJ1	Jack pine pure	61	41	–
PJ2	Jack pine dominated	61	41	PJC, PjMx, PJSP
SP1	Spruce-pine	n/a	61	SPC, SpDom
SB1	Black spruce	101	41	SB3, SpPur, SPU
SBOG	Spruce bog	101	41	BOG

a) Regional Forest Units (i.e., forest types) that represent caribou refuge habitat (including onset age of the habitat) as identified by Elkie et al. (2014).

b) Forest unit codes from individual Forest Management Plans (Algoma Forest, White River Forest, Black Spruce Forest, Big Pic Forest, Pic River Forest, and Kenogami Forest) corresponding to Regional Forest Units.

FMP = Forest Management Plan; n/a = not applicable; – = no code.

Areas with no FRI coverage (i.e., Pukaskwa National Park and Lake Superior Provincial Park) were mapped using the provincial Land Cover 2000 data set per methods outlined by MNRF (2014b). Winter habitat was defined as the following polygon types:

- Forest Sparse;
- Forest – Dense Coniferous;
- Fen – Treed; and

- Bog – Treed.

Areas of recent fires (less than or equal to [≤] 40 years) were excluded from the polygons using MNRF wildfire inventory data.

Refuge Habitat

Refuge habitat was mapped using the conventional boreal models for refuge habitat described in Elkie et al. (2014) (Table 14-III-4). This approach is consistent with the habitat assessment data processing described in the *Integrated Assessment Protocol for Woodland Caribou Ranges in Ontario* (MNRF 2014b).

Table 14-III-4: Woodland Caribou Refuge Habitat

Regional Forest Unit[a]	Description	Onset Age of Habitat (Years)	FMP Forest Unit[b]
BfDom	Balsam fir dominated	61	BF1
ConMx	Conifer mixedwood	71	BFM, CEUP, CNM, CoMx, MC1, MC2, MxC, OC1, OCAll
OcLow	Other conifer lowland	Always	OCL, OCon
PjDom	Jack pine dominated	Always	PjPur
PjMx1	Jack pine mixedwood	41	–
SbDom	Black spruce dominant	41	–
SbLow	Lowland spruce	Always	SBLC, SbLo, Slow1, Slow3, SPL
SbMx1	Black spruce mixedwood	41	–
SF1	Spruce-fir	61	SFIR
MW1	Mixedwood conifer	71	MxW, MxWd
MW2	Mixedwood hardwood	71	–
LC1	Lowland conifer	Always	LC1OC, LC1SB
PJ1	Jack pine pure	Always	–
PJ2	Jack pine dominated	41	PJC, PjMx, PJSP
SP1	Spruce-pine	41	SPC, SpDom
SB1	Black spruce	Always	SB3, SpPur, SPU
SBOG	Spruce bog	Always	BOG

a) Regional Forest Units (i.e., forest types) that represent caribou refuge habitat (including onset age of the habitat) as identified by Elkie et al. (2014).

b) Forest unit codes from individual Forest Management Plans (Algoma Forest, White River Forest, Black Spruce Forest, Big Pic Forest, Pic River Forest, and Kenogami Forest) corresponding to Regional Forest Units.

FMP = Forest Management Plan; – = no code.

Areas with no FRI coverage (i.e., Pukaskwa National Park and Lake Superior Provincial Park) were mapped using the Provincial Land Cover 2000 data set per methods outlined by MNRF (2014b). Refuge habitat was defined as the following polygon types:

- Forest Sparse;
- Forest – Dense Mixed;
- Forest – Dense Coniferous;
- Fen – Treed; and
- Bog – Treed.

As with winter habitat, all areas of recent fires (≤40 years) were excluded from the polygons using MNRF wildfire inventory data.

Caribou Habitat Summary

As described in the previous sections, mapped caribou habitat included six classes. These classes are not all mutually exclusive, meaning that some areas of caribou range have been identified as multiple habitat classes. For ease of discussion, caribou habitat is divided into two main categories: functional habitat and potential habitat. Functional habitat included nursery areas, winter use areas, and travel corridors because these habitat classes were identified using caribou observations and they are associated with known function. Potential habitat included winter habitat, refuge habitat and Category 3 habitat (remaining areas in the range) because these habitat classes were delineated according to the biophysical attributes of the landscape.

1.2 Moose

Availability and distribution of moose (*Alces alces*) habitat was estimated and mapped using FRI and Land Cover 2000 data in a GIS platform. Habitat categorization for moose followed a Habitat Suitability Index (HSI) model approach, and good quality habitats were defined according to a threshold representing the minimum value below which the habitat is not suitable for reproduction and survival (Ackakaya et al. 2004). The standard threshold value is typically 0.5, which was used in this assessment.

The moose HSI was similar to that used by the Ontario Landscape Tool for predicting moose densities (Rempel 2008; Elkie et al. 2013). The model considers the following three parameters (Figure 14-III-1):

- percent of area in young forest cover types <20 years old;
- percent of area in mature conifer greater than (>) 40 years old; and
- percent of area in mature mixed forest >40 years old.

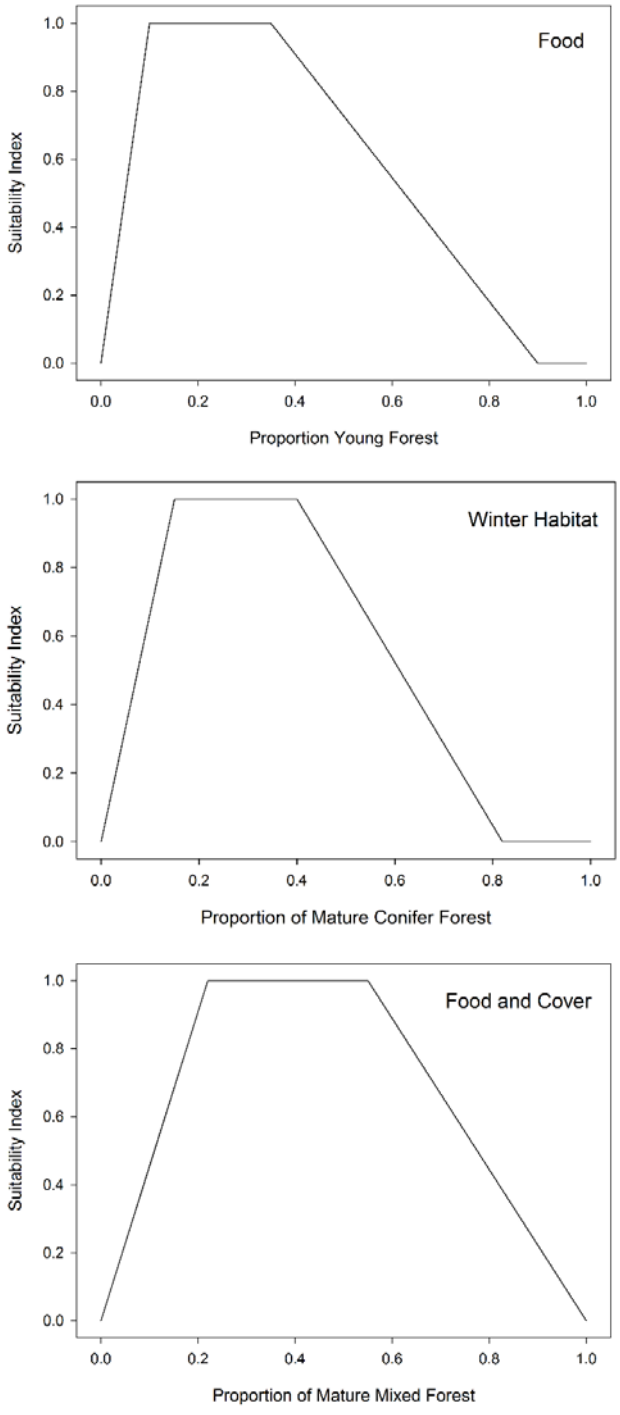

Figure 14-III-1: Suitability Relationships of Moose for Young Forest, Mature Conifer and Mixed Wood Habitat Interpolated from Rempel (2008)

The HSI was applied to FRI data. Where FRI was not available (i.e., Pukaskwa National Park, Lake Superior Provincial Park) Ontario Land Cover 2000 (LC2000) data were used instead. Provincial forest fire data were intersected with FRI and LC2000 data to identify areas associated with burns. Areas intersecting with fires less than 10 years or greater 20 years in age were removed. Table 14-III-5 describes how the FRI attributes of plan forest units (PLANFU) and stand age (AGE), LC2000 land cover types and provincial forest fire data were rescaled to apply the HSI.

Table 14-III-5: Reclassification of Forest Resources Inventory, Land Cover 2000 and Provincial Wildfire Data to Apply Moose Habitat Suitability Index

HSI Land Cover	FRI	Land Cover 2000	Provincial Wildfire Data
Young forest	**POLYTYPE** is FOR AND **AGE** is <20	Sparse forest, Regenerating depletion	Burn Age is ≥10 to ≤20 years old [since 2016], (i.e., Year of Burn is 2006 to 1996). Over-writes any forest land cover type as "Young forest" (FRI POLYTYPE is FOR OR LC2000 is Coniferous forest, Treed fen, Treed bog, Coniferous swamp)
Mature conifer	**POLYTYPE** is FOR AND **PLANFU** is [Any combination of the following] BOG, PRW, PR1, SP1, LC1, LC10C, LC1SB, PJ2, SB1, SF1, PJ1, Pj1, BF1, , PJC, PjPur, PjSMx, PJSP, Pr1, SB3, BfDom, PjDom, SbDom, OcLow, OCL, Ocon, SbLow, Slow1, Slow3, SFIR, SPC, SpDom, SPL, SpPur, SPU, SbLo, PrDom, PrDom, PwrUS AND **AGE** is >40	Coniferous forest OR Treed fen OR Treed bog OR Coniferous swamp	n/a
Mature mixed wood	**POLYTYPE** is FOR AND **PLANFU** is [Any combination of the following] , CEUP, CNM, CoMx, ConMx, BFM, BwDom, HdSel, HDSEL, HdUS, HDUS, HECE, HrdMx, HwMw, HwMx, BfMx1, PjMx1, SbMx1, PrwMx, BW1, Bw1, MW1, MW2, MxC, MxW, MxWd, MC1, MC2, MW3, OC1, OcALL, PRWM, Po1, PO1 **AND** **AGE** is >40	Mixed forest	n/a

Land Cover 2000 types of coniferous, treed fen, treed bog, coniferous swamp and mixed forest are assumed to represent mature forest stands.
FRI = Forest Resources Inventory; HSI = Habitat Suitability Index; n/a = not applicable; > = greater than; < = less than.

Preserving the original resolution of the FRI and Land Cover 2000 data, a 400 m search radius from each default map unit was used to quantify the percent young forest, mature conifer and mixed forest and create one new attribute at a 50 ha unit scale (Elkie et al. 2013). Subsequently each map unit was then classified as "moderate to high suitability" (i.e., unit value of 1) if the following conditions are met:

- 5% to 65% of 50 ha area in young forest;
- 10% to 60% of 50 ha area in mature conifer; or
- 10% to 75% of 50 ha area in mature mixed forest.

If conditions are not met, then unit value = 0 (i.e., habitat was low to nil suitability).

1.3 American Marten

Availability and distribution of American marten (*Martes americana*) habitat was estimated and mapped using FRI data in a GIS platform. Habitat mapping for American marten was based primarily on the habitat suitability models used to predict marten habitat for the Northeast region (MNR 2012). Moderate to high quality habitats were mapped according to the following parameters:

- suitable forest unit; and
- seral stage mature and overmature.

Suitable forest units are the forest units defined in ecoregion 3E and 4E as "suitable," and the forest units defined in ecoregion 5E as "preferred" (MNR 2012). For forest unit codes present in the wildlife and wildlife habitat Local Study Area (LSA) or marten RSA and not defined in MNRF's Northeast region marten models, the forest unit was reclassified to the most appropriate code based on site characteristics and tree species present (Table 14-III-6).

Seral stage age classifications for forest units were obtained from Tables 4 and 5 of the Forest Management Guide to Boreal Landscapes (MNRF 2014c) (Table 14-III-5). Where age class information was not available, mature and overmature age class information was obtained from regional Forest Management Plans (FMPs), or 80 years was assumed for mature forest because this was the upper boundary for mixed and conifer forest included in the model.

Table 14-III-6: Forest Unit Codes and Age Classification to Apply Marten Habitat Suitability Index

Suitable Regional Forest Unit Code[a]	Description	Onset Age of Habitat (Years)	Applicable FMP Forest Unit Codes[b]
CE	Cedar dominated	70	CEUP, OC1, OcAll, OCL, Ocon
LC1	Lowland conifer	80	n/a
MW1	Mixedwood conifer	70	BF1, BfDom, CNM, CoMx, ConMx, MC1, MxC
MW2	Mixedwood hardwood	70	BFM, MC2, MxW, MxWd,
PJ1	Jack pine pure	70	Pj1, PjDom, PjPur
PJ2	Jack pine mixed conifer	70	PJC, PjSMx
PRW	Red and white pine mixedwood	80	PRWM
PW1	White pine dominated	80	PwDom
PWUS4	White pine dominated	80	PwrUS
SB1	Black spruce dominated	80	SbLo, SbLow, SLow1, SLow2, SPL, SpPur, SPU
SF1	Spruce and fir mixedwood	80	n/a
SP1	Spruce and pine mixedwood	80	SPC, SpDom

a) Regional Forest Units (i.e., forest types) that represent marten habitat as defined by the MNRF marten habitat models for the Northeast region (MNR 2012).

b) Forest unit codes from individual Forest Management Plans (Algoma Forest, White River Forest, Black River Forest, Big Pic Forest, Pic River Forest, and Kenogami Forest) corresponding to Regional Forest Units.

FMP = Forest Management Plan; n/a = not applicable.

1.4 Little Brown Myotis and Northern Myotis

The habitat requirements of the little brown myotis (*Myotis lucifugus*), also known as the little brown bat, and northern myotis (*Myotis septentrionalis*) ,vary by season (COSEWIC 2013). In winter, myotis species hibernate in caves or mines where the open and accessible space extends below the frost line, and above zero temperatures and high humidity are relatively constant throughout the winter. In summer, maternity colonies are formed in trees, rock crevices, buildings, bat houses or under bridges. The trees that these species use are often large, sometimes partly dead (called snags or wildlife trees), features that are generally more abundant in late successional forest (i.e., old growth). Although there is considerable variation in the species of trees in which these bats roost, Lacki et al. (2007) identified little brown myotis most often in large trembling aspen (*Populus trembloides*), but also in white spruce (*Picea glauca*) and red spruce (*Picea rubra*). Olson and Barclay (2013) found the majority of roosts in trembling aspen or balsam poplar (*Populus balsamifera*). Broders and Forbes (2004) found that male Northern myotis preferred to roost in coniferous stands.

Myotis species are typically closed-canopy specialists (Kalcounis and Brigham 1995; Jung et al. 1999; Morris et al. 2010), however, little brown myotis is more of a generalist than other *Myotis* species including northern myotis. It is tolerant of anthropogenic disturbance, often favouring man-made structures, and prefers to forage over open areas including ponds, rivers, forest gaps, forest edges or along trails and roads (Segers and Broders 2014). Northern myotis is a forest interior species known to glean prey off foliage, however, it will also feed on flying insects along forest edges (Caceres and Barclay 2000).

Habitat mapping for this criterion considered both winter hibernacula and summer maternity roosting habitat. Habitat mapping does not fully capture foraging habitat. Foraging habitat is discussed qualitatively as appropriate. Hibernacula were identified based on the 2017 MNRF Wildlife Concentration Area (WCA) data set, a desktop habitat assessment and a helicopter field reconnaissance survey conducted in support of the permitting process in 2017. The field reconnaissance survey is described in Appendix 14-IID. Hibernacula were categorized as active or candidate. Active hibernacula are defined as those confirmed to be occupied by a colony of bats in the 2017 MNRF WCA data set. Candidate hibernacula are defined as those with high potential to support a colony of hibernating bats, but occupancy has not been previously field verified during the swarming or hibernation period. Candidate hibernacula were identified using the 2017 MNRF WCA data set, the desktop habitat assessment and associated helicopter field reconnaissance survey and the Abandoned Mines Information System (AMIS) database. The AMIS database was searched for known abandoned mine features, and each record was evaluated to determine if it could be a hibernaculum (i.e., abandoned and underground, and of suitable depth). Other natural habitats that could function as hibernacula were also identified as candidate hibernacula using air photos and topographic maps.

Critical habitat was partially identified for hibernacula in the 2015 draft recovery strategy for little brown myotis and northern myotis (Environmental Canada 2015a). An approximate 50 km² grid was used to identify general geographic areas containing critical habitat. Critical habitat is discussed qualitatively as appropriate.

Maternity roosting habitat was identified as forest greater than or equal to 80 years old (i.e., mature and late successional seral stages) within the ecosites described in Table 14-III-7. Ecosites were identified as potential maternity roosting habitat following an unpublished MNRF guidance document titled “Bat Survey Methods” obtained by Golder in May 2015 (Buck 2015).

Table 14-III-7: Land Cover Types Identified as Candidate Maternity Roosting Habitat for Little Brown Myotis and Northern Myotis in the Myotis Regional Study Area

Code[a]	Description
NE01	Black Spruce - Jack Pine/White Spruce - White Birch
NE03	White Birch - Trembling Aspen - Black Spruce - Coarse Soil
NE06	Trembling Aspen - Black Spruce - Jack Pine/Black Spruce - Trembling Aspen - Balsam Fir
NE07	Trembling Aspen - White Birch/Trembling Aspen - White Spruce - White Birch
NE09	Black Spruce - Larch - Moist Soil/White Spruce - Balsam Fir - White Cedar
NE10	Trembling Aspen - Black Spruce - Balsam Poplar - Moist Soil
NE15	Red Maple
NW15	Red Pine - White Pine: Sandy Soil
NW16	Hardwood - Fir - Spruce Mixedwood: Sandy Soil
NW18	Red Pine - White Pine: Fresh, Coarse Loamy Soil
NW19	Hardwood - Fir - Spruce Mixedwood: Fresh, Sandy - Coarse Loamy Soil
NW23	Hardwood - Fir - Spruce - Mixedwood: Moist, Sandy - Coarse Loamy Soil
NW24	Red Pine - White Pine: Fresh, Fine Loamy Soil
NW28	Hardwood - Fir - Spruce Mixedwood: Fresh, Silty Soil
NW29	Hardwood - Fir - Spruce Mixedwood: Fresh, Fine Loamy - Clayey Soil
NW30	Black Ash Hardwood: Fresh, Silty - Clayey Soil
NW33	Hardwood - Fir - Spruce Mixedwood: Moist, Silty - Clayey Soil
NW38	Rich Swamp: Black Ash (Other Hardwood): Organic - Mineral Soil
C17	Poplar - White Birch
C18	Poplar - White Birch - White Spruce - Balsam Fir
C19	Poplar - Jack Pine - White Spruce - Black Spruce
C21	White Cedar - White Pine - White Birch - White Spruce
C22	White Cedar - Other Conifer
C27	Sugar Maple - White Birch - Poplar - White Pine
C29	Sugar Maple - Yellow Birch
C33	White Cedar - Other Conifer: Very Moist to Wet Soils

a) Ecosite (Racey et al. 1996).

Field survey data collected for the Project in 2016 and 2017 were used to evaluate the performance of the bat maternity roosting habitat mapping. In 2016, Golder conducted snag density estimates to identify potential maternity roosting habitat and these surveys are described in Appendix 14-IIB. In 2017, Golder conducted an aerial reconnaissance survey, informed through desktop mapping, to further identify potential maternity roosting habitats with the Project footprint (Appendix 14-IID). A total of 101 and 93 plots were plots were surveyed in 2016 and 2017, respectively. Of the 194 plots evaluated in 2016 and 2017, 106 were considered moderate to high potential maternity roosting habitat. This ranking was extrapolated to the FRI polygon and evaluated against the predictive maternity roosting habitat suitability mapping, resulting in 36 of the 194 polygons being accurately mapped as moderate to high suitability for an overall accuracy of 34%.

The low accuracy of the bat maternity roosting habitat suitability mapping used in the amended EA is in part due to the low accuracy of vegetation maps (FRI data; GreenForest Management Inc. [2016] and MNRF [2016]). Analysis indicated that the accuracy of the FRI was 21.6% (Appendix 12-II). Another source of error is related to the landcover types identified as moderate and high suitability maternity roosting habitat in the myotis RSA (Table 14-III-7). In addition to the aerial reconnaissance survey conducted in 2017, 55 acoustic monitoring stations were set up in potential bat maternity roosting habitat in the wildlife and wildlife habitat LSA (Appendix 14-IID). The results of the acoustic monitoring data suggest that five additional ecosites should be

identified as moderate and high suitability maternity roosting habitat based on confirmed bat activity between May 30 and July 3, 2017 (Table 14-III-8).

Table 14-III-8: New Forest Ecosite Types Identified as "High" Potential Maternity Roosting Habitat for Little Brown Myotis and Northern Myotis

Code[(a)]	Description
C15	Jack Pine
NW14	Pine-Spruce Mixedwood: Sandy Soil
NW21	Fir-Spruce Mixedwood: Fresh, Coarse Loamy Soil
NW26	Spruce-Pine/Feathermoss: Fresh, Fine Loamy-Clayey Soil
NW31	Spruce-Pine/Feathermoss: Moist, Silty-Clayey Soil

a) Ecosite (Racey et al. 1996).

Addressing uncertainty associated with habitat suitability mapping in the wildlife and wildlife habitat assessment is discussed in Section 14.8 of the amended EA Report. NextBridge is in the process of refining estimates of bat maternity roosting habitat affected by the Project footprint using the results of the 2017 acoustic monitoring survey and more current FRI data, and will create maps identifying confirmed and potential bat maternity roosting habitat as part of SAR permitting process.

1.5 Bald Eagle

Bald eagles (*Haliaeetus leucocephalus*) in eastern Canada are short distance migrants that breed in eastern Canada in the summer, and may migrate farther south for the winter (Wright 2016). The Great Lakes Basin is also an overwintering site for many bald eagles (Armstrong 2014; Buehler 2000). The Project is located in breeding and overwintering habitat for the bald eagle, and these habitats are the focus of this assessment. Bald eagles are found near major lakes or rivers (Armstrong 2014), often using perches within approximately 500 m of open water when foraging at or near the surface of the water (Buehler 2000). Shallow water and near-shore emergent vegetation increase the likelihood that live fish prey will be available near the surface (Buehler 2000; Armstrong 2014). Foraging area quality may also be higher in areas without human development and disturbance (Buehler 2000). Bald eagle home range sizes vary from 7 km² in Saskatchewan to up to 21.6 km² in Oregon (Buehler 2000); assuming circular home ranges, this corresponds to home range radii of 1.5 km to 2.6 km. In winter, bald eagles congregate around food sources, for example the City of Thunder Bay landfill, hunting areas where humans might leave carrion, and areas with open water such as dams or waterfalls (Armstrong 2014).

Bald eagle breeding territories tend to be within 2 km of water near lakes greater than 1,000 ha with more than 11 km of shoreline, and average territory sizes range from 0.5 to 4 km² (Armstrong 2014). Bald eagles nest in mature or old growth forest with some edge, in the largest available trees, typically 20 to 60 m in height (Buehler 2000). In northwestern Ontario, 64% to 74% of nests are in white pine (*Pinus strobus*) and 19% to 24% of nests are in trembling aspen (*Populus tremuloides*) (Armstrong 2014). In Ontario between 1883 and 2013, 80% of bald eagle nests with recorded tree species or tree genera were in: white pine, *Populus* spp., trembling aspen, eastern cottonwood (*Populus deltoides*), *Pinus* spp., American elm (*Ulmus americana*), red oak (*Quercus rubra*), red pine (*Pinus resinosa*), or silver maple (*Acer saccharinum*) (Armstrong 2014). Conifers are preferentially

used where they are dominant in the canopy; deciduous trees are used when large conifers are absent (Buehler 2000). Bald eagles have also been observed nesting in and near the Project area on the ground on islands in Quetico Provincial Park and on the Slate Islands of Lake Superior, and on the cliffs of Lake Nipigon (Armstrong 2014). While bald eagles have clear nest tree preferences, they are also flexible in nest site selection (Grier and Guinn 2003).

Suitable bald eagle nesting habitat in the bald eagle RSA was mapped as forest with an age structure greater than 80 years and within 2.6 km of major water bodies (i.e., greater than 1,000 ha), and stream order 7 or higher watercourses using the Strahler method in the MNRF water body data set. Cliffs identified during the 2014 field surveys and from the 2016 MNRF LIO data were also mapped as suitable bald eagle nesting habitat if they were within 2.6 km of major water bodies or rivers. Suitable bald eagle winter roosting habitat is captured within the 2.6 km buffer of major water bodies and rivers. In winter, bald eagles will congregate in night roosts that afford them protection from cold weather. These roosts are traditionally used for successive years and are located in mature forest in proximity to foraging habitat (Hall 1998).

1.6 Bobolink

Bobolinks (*Dolichonyx oryzivorus*) reside in the bobolink RSA only during the breeding season. Therefore, land cover types suitable for breeding were selected for habitat mapping. Bobolinks require grassland habitat for breeding and avoid areas where shrub cover exceeds approximately 25% of the vegetative cover (McCracken et al. 2013). Historically, bobolinks bred in tall-grass prairie and, to a lesser extent, mixed-grass prairie, and they continue to breed in remnant tall-grass prairie, savannah and alvar grassland in Ontario. Bobolinks have adapted well to agricultural landscapes and will readily use hayfields and lightly grazed pastures for breeding (COSEWIC 2010; McCracken et al. 2013). They have also been observed at low densities in meadow marshes and graminoid peatlands (COSEWIC 2010). Land cover types that occur in the bobolink RSA and that are considered to be suitable breeding habitat for bobolinks are identified in Table 14-III-8. All other land cover types that occur in the bobolink RSA are considered to be non-habitat (unsuitable) for bobolinks.

Table 14-III-8: Land Cover Types Identified as Suitable Breeding Habitat for Bobolink in the Wildlife and Wildlife Habitat Regional Study Area

Land Cover Code[(a)]	Land Cover Name	Land Cover Description
NW10	Prairie/Savannah	Mineral soil vegetated primarily by herbaceous species, scattered shrubs and trees.
NW46	Meadow marsh: organic – mineral soil	Floodplains beside streams, lakes, beaver meadows, ditched and sometimes isolated basins. Graminoid dominated (sometime herb dominated). Tall shrubs may be found at <25% cover.
GRS	Grass and meadow	Agricultural areas used as pasture for domesticated animals including abandoned grass and meadows. Does not include “barren and scattered” areas and is not part of the productive forest land base. Usually fenced.
DAL	Developed agricultural land	Cultivated lands for growing crops, orchards and floral, for example. Also includes abandoned agricultural lands.

a) Ecosite (Racey et al. 1996), or polygon type (MNR 2009) where not further differentiated by ecosite.

Bobolinks appear to be sensitive to habitat edges and patch size (Renfrew et al. 2015). In particular, avoidance of habitat adjacent to forest has been documented outwards to 75 m or more from forest edges (Bollinger and Gavin 2004; Fletcher and Koford 2003). However, the degree of avoidance appears to vary among sites and may depend on the amount of open land cover in the surrounding landscape (Keyel et al. 2012; Renfrew et al. 2015).

For this assessment, a 50 m avoidance buffer was applied where suitable land cover types (Table 14-III-7) abut forest land cover types (FOR polygon type). This buffer width represents an average distance within which edge effects have been found to be strongest (Bollinger and Gavin 2004; Fletcher and Koford 2003). Land cover within this buffer area was considered to be non-habitat for bobolinks due to its proximity to forest.

Bobolinks respond favourably to periodic burns, which prevent heavy build-up of litter and the growth of woody vegetation, both of which are undesirable habitat attributes for this species (COSEWIC 2010). A positive response to burning has been observed one year after fire (Johnson et al. 1992; Vickery et al. 2005). Therefore, burns overlapping suitable land cover types were included as suitable breeding habitat for bobolinks.

1.7 Canada Warbler

Throughout their range, Canada warblers (*Cardellina canadensis*) nest in a range of usually wet, forest types, with a well-developed, dense shrub layer (COSEWIC 2008; Environment Canada 2015b). This species is commonly found in shrub marshes, red maple (*Acer rubrum*) stands, cedar (*Thuja* spp.) stands, swamps dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*), and riparian woodlands (COSEWIC 2008). In the eastern portion of their range, which includes the warbler RSA, Canada warblers are associated with wet mixedwood forests and early successional forests (6 to 30 years) created by forest harvesting or natural disturbance (Ball and Bayne 2014; Environment Canada 2015b).

The FRI data were used to determine suitable Canada warbler habitat in the wildlife and wildlife habitat LSA and the warbler RSA. The following habitats were determined to be suitable for Canada warbler:

- forest stands 6 to 30 years of age (all ecosites);
- riparian areas (all ecosites); and
- forest stands greater than 30 years of age in the ecosites presented in Table 14-III-9.

Table 14-III-9: Land Cover Types Identified as Suitable Breeding Habitat for Canada Warbler in the Wildlife and Wildlife Habitat Regional Study Area

Code[(a)]	Description
C18	Poplar - White Birch - White Spruce - Balsam Fir
C19	Poplar - Jack Pine - White Spruce - Black Spruce
C21	White Cedar - White Pine - White Birch - White Spruce
C22	White Cedar - Other Conifer
C31	Black Spruce - Tamarack: very moist mineral and wet organic soils
C32	White Cedar - Black Spruce - Tamarack: very moist mineral and wet organic soils
C33	White Cedar - Other Conifer: very moist to wet soils
C34	White Cedar - Lowland: very moist to wet soils
NE05	Black Spruce - Fine/Medium Soil
NE06	Black Spruce - Trembling Aspen/Trembling Aspen - Black Spruce - Jack Pine/Trembling Aspen - Black Spruce - Balsam Fir
NE08	Black Spruce - Feathermoss - Sphagnum - Moist Soil
NE09	Black Spruce - Larch/White Spruce - Balsam Fir - White Cedar
NE11	Black Spruce - Labrador Tea - Organic Soil
NE12	Black Spruce - Larch - Labrador Tea - Organic Soil
NE13	Black Spruce - Larch - Speckled Alder/White Cedar - Black Spruce
NE14	Black Spruce - Leatherleaf - Organic Soil
NE15	Red Maple
NW16	Hardwood - Fir - Spruce Mixedwood: Sandy Soil

Table 14-III-9: Land Cover Types Identified as Suitable Breeding Habitat for Canada Warbler in the Wildlife and Wildlife Habitat Regional Study Area

Code[a]	Description
NW17	White Cedar: Fresh - Moist, Coarse - Fine Loamy Soil
NW19	Hardwood - Fir - Spruce Mixedwood: Fresh, Sandy - Coarse Loamy Soil
NW23	Hardwood - Fir - Spruce - Mixedwood: Moist, Sandy - Coarse Loamy Soil
NW28	Hardwood - Fir - Spruce Mixedwood: Fresh, Silty Soil
NW29	Hardwood - Fir - Spruce Mixedwood: Fresh, Fine Loamy - Clayey Soil
NW30	Black Ash Hardwood: Fresh, Silty - Clayey Soil
NW33	Hardwood - Fir - Spruce Mixedwood: Moist, Silty - Clayey Soil
NW34	Treed Bog: Black Spruce / Sphagnum: Organic Soil
NW35	Poor Swamp: Black Spruce: Organic Soil
NW36	Intermediate Swamp: Black Spruce (Tamarack): Organic Soil
NW37	Rich Swamp: Cedar (Other Conifer): Organic Soil
NW40	Treed Fen: Tamarack - Black Spruce / Sphagnum: Organic Soil
NW44	Thicket Swamp: Organic - Mineral Soil

a) Ecosite (Racey et al. 1996).

1.8 Eastern Whip-poor-will

Eastern whip-poor-wills (*Caprimulgus vociferus*) breed in semi-open or patchy forests; wide-open spaces and dense forests are avoided (COSEWIC 2009). Forest structure seems to be more important than forest composition, but whip-poor-wills are found in dry deciduous or mixedwood forests throughout most of the species' range (Cink 2002). Whip-poor-wills are also commonly found in rock or sand barrens with scattered trees, old burns, other disturbed sites with early forest succession, and pine plantations (Cink 2002; COSEWIC 2009). This species prefers even-aged successional habitats and is uncommon in mature forests, although individuals may use openings in mature forest areas (Bushman and Therres 1988; Government of Ontario 2015a). Nests require tree cover, shade, and sparse ground cover, and they need to be in close proximity to open areas used for foraging (MNR 2013b). Transmission line ROWs and road corridors may provide suitable foraging habitat for this species (COSEWIC 2009).

The FRI data were used to determine suitable whip-poor-will habitat in the wildlife and wildlife habitat LSA and whip-poor-will RSA. The following habitats were determined to be suitable for whip-poor-will:

- Forest stands (polytype FOR) aged 0 to 10 years (pre-sapling stage).
- Forest stands aged 10 to 31 years of the following types:
  - hardwood-spruce-fir mixedwood (C18, NW16, NW19, NW28, NW29);
  - hardwood-pine-spruce mixedwood (C19, C20, NE06);
  - hardwood-white pine mixedwood (C27);
  - hardwood (C29);
  - hardwood-spruce mixedwood (NE01, NE03, NE07); and
  - jack pine (NE02, C15, NW13).

- Edge areas: 50 m both into and out from (i.e., 100 m in width) upland forested ecosites aged 31 years (immature forest) and older that border one or more of the following:
  - treed and open wetlands;
  - lakes, ponds, and rivers;
  - burns aged 0 to 10 years; and
  - upland ecosites and polytypes aged 0 to 10 years.
- Rock barren (NW7).

1.9 Olive-sided Flycatcher

Olive-sided flycatchers (*Contopus cooperi*) breed in forested areas in Canada and parts of the United States and overwinter in central and south America. The Project is located in breeding habitat for this species, which is, therefore, the focus of this assessment. Olive-sided flycatchers prefer tall trees and snags adjacent to open areas, which provide individuals with perches from which to hunt flying insects. Olive-sided flycatchers nest in forested stands but, because of their foraging behaviour, are associated with high contrast habitats including burned forests, logged areas, and natural forest openings such as gaps within old-growth forest stands, as well as meadows, rivers, and wetlands adjacent to forested habitat (Altman and Sallabanks 2012; COSEWIC 2007). As a result, their abundance is correlated with landscapes containing fragmented late-seral forest with high-contrast edges, mature trees and large numbers of dead trees (Altman and Sallabanks 2012; McGarigal and McComb 1995). In Ontario, olive-sided flycatchers commonly nest in conifers such as white and black spruce, jack pine and balsam fir (Government of Ontario 2015b).

Suitable olive sided flycatcher breeding habitat in the olive-sided flycatcher RSA was mapped using FRI data as follows:

- mature and late successional coniferous or mixedwood forest according to the forest units and onset ages of habitat identified in Table 14-III-10; and
- 50 m on either side of coniferous or mixedwood forest over 39 years of age (i.e., immature or older) and adjacent to wetlands and water bodies (excluding Lake Superior due to its large size) as identified in FRI data and in the MNRF water body data set, burns less than 25 years old, and cutblocks.

Table 14-III-10: Forest Units Identified as Suitable Breeding Habitat for Olive-sided Flycatcher in the Wildlife and Wildlife Habitat Regional Study Area

Regional Forest Unit	Description	Onset Age of Mature Forest (Years)[a]	FMP Forest Unit[b]
BfDom	Conifer dominated	60	BF1
ConMx	Conifer mixedwood	70	BFM, CEUP, CNM, CoMx, ConMx, MC1, MC2, MxC, OC1, OcAll
LC1	Lowland conifer	80	LC1OC, LC1SB
MW1	Mixedwood forests composed of spruce, jack pine, fir, poplar, and white birch	70	MxW, MxWd
MW2	Mixedwood forests	70	MW3
OcLow	Other conifer lowland	70	OCL, OCon
PJ1	Jack pine pure	70	N/A
PJ2	Jack pine dominated	70	PJC, PjSMx, PJSP
PjDom	Jack pine dominated	70	PjPur
PRW	Conifer	80	n/a

Table 14-III-10: Forest Units Identified as Suitable Breeding Habitat for Olive-sided Flycatcher in the Wildlife and Wildlife Habitat Regional Study Area

Regional Forest Unit	Description	Onset Age of Mature Forest (Years)[a]	FMP Forest Unit[b]
PrwMx	Nipigon forest	80	PRWM
PW1	White pine	80	n/a
PWR	White and red pine	80	Pr1, PR1, PrDom, PwDom, PWMIX, PwrUS, PWUS4
SB1	Black spruce	80	SB3, SpPur, SPU
SbLow	Lowland spruce	70	SBLC, SbLo, Slow1, Slow3, SPL
SBOG	Spruce bog	80	BOG
SF1	Mixed conifer upland	80	SFIR
SP1	Spruce-pine	80	SPC, SpDom

a) Age based on mature age classes in Table 4 and 5 from the Forest Management Guide to Boreal Landscapes (2014). Age class information was not available for BOG, PWR and PW1 so 80 years was assumed as the onset age of mature forest because this was the upper boundary for mixed and conifer forest included in the model.

b) Forest unit codes from individual Forest Management Plans (Lakehead Forest, Black Spruce Forest, Lake Nipigon Forest, Kenogami Forest, Algoma Forest, White River Forest, Big Pic Forest, and Pic River Forest) corresponding to Regional Forest Units.

FMP = Forest Management Plan; n/a = not applicable.

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