Appendix 7.10 Wildlife

Contents

Appendix 7.10-1 Methods for Habitat Models by VECC

Appendix 7.10-1 Methods for Habitat Models by VECC

In the following wildlife models incorporated into the EIA and are provided by VECC. As a component of these habitat models, species-specific disturbance buffers to anthropogenic disturbances were applied to all project component footprints for the construction/operations/decommissioning scenario, and to some project component footprints for the closure scenario. Anthropogenic disturbances associated with the wildlife models are thus provided first.

Wildlife Disturbance Coefficients and Zones of Influence

Current and predicted anthropogenic disturbances to the landscape and the human activities associated with them can cause wildlife to avoid otherwise suitable habitat. All wildlife models below, assumes that habitat suitability is reduced by the presence of human disturbance. Disturbance features were categorized into classes. Zones of Influence (ZOI) were then assigned based on the best available knowledge of species avoidance to these disturbance types (Table 1). Disturbance coefficients were then assigned to each ZOI. Habitat suitability was reduced within each ZOI. Thus, any habitat that falls within the ZOI (including the actual footprint) is considered affected and the rating of the habitat is adjusted according to the projected impact (see Table1).

Table 1 Zones of Influence and associated habitat rating adjustments by Wildlife VECC

Anthropogenic Disturbance Type	Moose			Grizzly Bear			Sheep			Lynx			Marten			Caribou		
	Footprint	Buffer (m)	Rating	Footprint	Buffer (m)	Adjustment	Footprint	Buffer (m)	Rating	Footprint	Buffer (m)	Rating	Footprint	Buffer (m)	Rating	Footprint	Buffer (m)	Rating
Clearings / Camps	0	250	0.75	6	800	+3	0	350	0.5	0	250	0.75	0	100	0.75	0	100	0.5
Cutlines	0.75	100	0.75	N/A	400	+1	0	N/A	N/A	0.75	N/A	N/A	0.75	N/A	N/A	0	100	0.5
Industrial Liquid dump/depot	0	250	0.5	6	800	+3	0	500	0.5	0	250	0.75	0	100	0.75	0	500	0.5
Structure (buildings/campgrounds)	0	100	0.75	6	400	+1	0	500	0.5	0	250	0.75	0	100	0.75	0	500	0.5
Main Roads	0	250	0.5	6	800	+3	0	500	0.5	0	250	0.75	0	100	0.75	0	500	0.5
Main Road - ground level, loose surface, operational road	0	250	0.5	6	800	+3	0	500	0.5	0	250	0.75	0	100	0.75	0	500	0.5
Secondary Road - ground level, hard surface, operational road	0	100	0.75	6	800	+3	0	350	0.5	0	N/A	N/A	0	100	0.75	0	500	0.5
Limited-use, Cart, Track, Road, or Drill Road	0	100	0.75	6	400	+1	0	350	0.5	0.75	0	N/A	0.75	N/A	N/A	0	100	0.5
Airstrip	0	300	0.5	6	800	+3	0	500	0.5	0	250	0.75	0	100	0.75	0	500	0.5
Mine Site	0	250	0.25	6	400	+1	0	500	0.5	0	250	0.75	0	100	0.75	0	500	0.5

Note: Habitat suitability may be reduced within the footprint and/or a buffer zone by multiplying the HSI value by the disturbance coefficient or by adjusting the habitat suitability rating. For example, a disturbance coefficient of 0.25 will reduce the HSI value by 75% or increasing the suitability rating by 3 (+3) will reduce the 6 point scale habitat rating by 50%.

Caribou

Habitat models for winter and fall caribou habitat in the RSA included data from aerial telemetry studies on the Finlayson Caribou Herd between 1982 and 2004 (data provided by Farnell, 2005), satellite imagery interpretations, and key wildlife habitat areas identified by environment Yukon for the Finlayson Caribou herd (data provided by Farnell 2005).

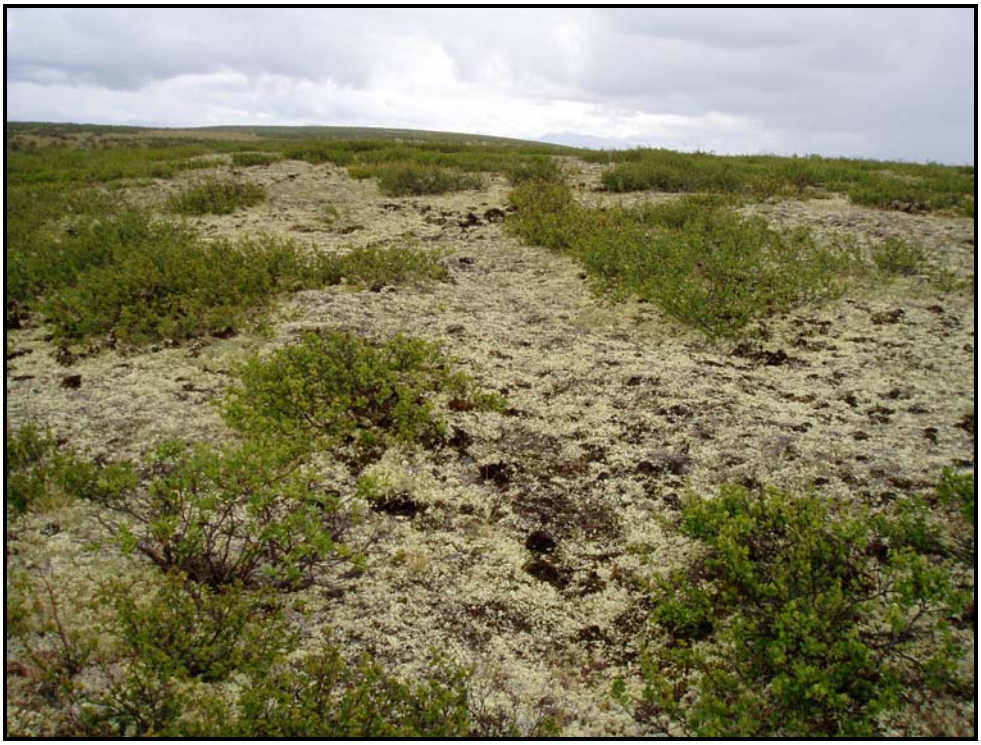
Fall and winter caribou habitat models were completed in 3 steps including a supervised sattelitte imagery classification; validation between habitat polygons and aerial telemetry data, and a ranking scheme using of suitable habitats from the satellite imagery classification in context with confirmed key wildlife habitat areas in the RSA. Each of these steps is discussed below, in order of application.

I - As an initial step in he modeling process, supervised satellite imagery interpretations were conducted based on vegetation and caribou habitat assessments conducted within the Wolverine Project LSA. Specifically, four caribou habitat types were classified through this process at an accuracy of 76% confirmation. These four habitat types are defined by the following; provided for each is an associated picture depicting the typical habitat type below each description:

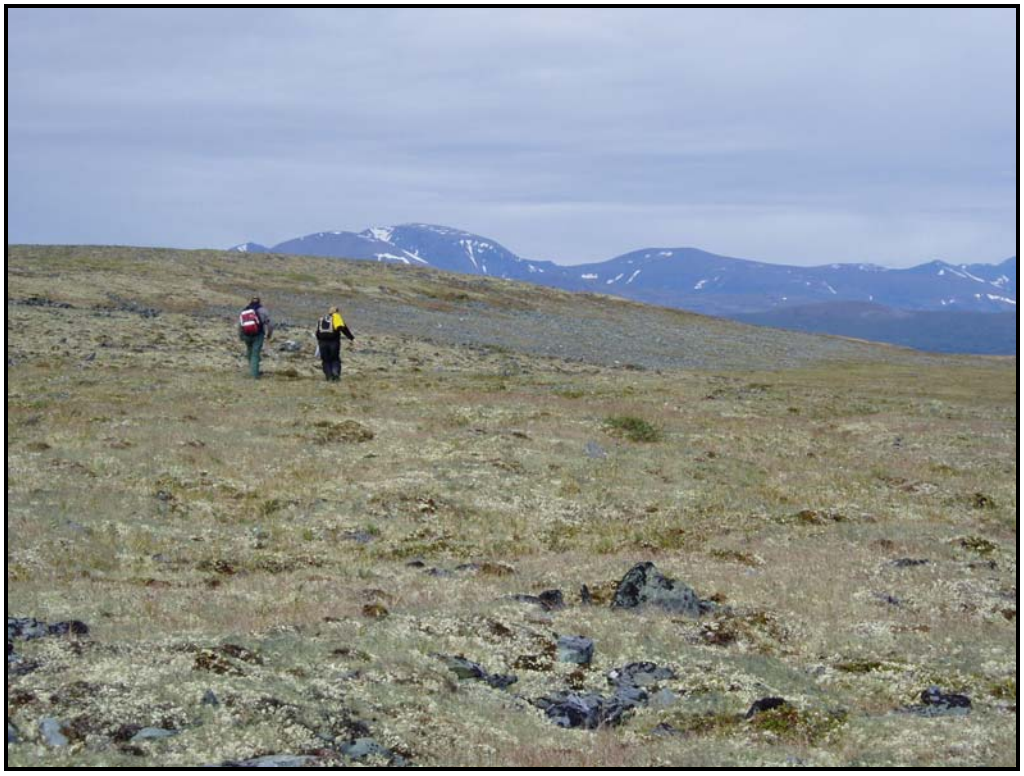
1. Forested stands (defined by a minimum 5% canopy closure) having significant terrestrial lichen cover.

2. Forested stands defined by a minimum 5% canopy closure) not having significant terrestrial lichen cover.

3. Shrub cover stands as defined in the Vegetation Section (including Shrub Ecosystems, Scrub birch medium/tall shrub, Willow-scrub birch medium/tall shrub, Willow medium/tall shrub, and Dwarf Shrub, Herb, Grass, and Lichen Ecosystems) having significant terrestrial lichen cover.



4. Alpine or open grassland areas having significant terrestrial lichen cover.



II- Next, the locations of winter and aerial telemetry relocations (survey locations and aerial telemetry locations) were compared to each of the four habitat types identified above (I) to assess predictive capability. Through this process the two habitat types were found to be most predictable in identifying winter habitat suitability and two habitat types were found to be most predictable in identifying winter habitat suitability (Table 2)

Table 2: Habitat types used to Define Winter and Fall Caribou Habitats

Habitat Type	Habitat Type as defined from supervised satellite imagery interpretations (defined in I)
Winter Caribou Habitat	1. Forested stands defined by a minimum 5% canopy closure) not having significant terrestrial lichen cover; and 2. Forested stands (defined by a minimum 5% canopy closure) having significant terrestrial lichen cover.
Fall Caribou Habitat	1. Shrub cover stands as defined in the Vegetation Section (including Shrub Ecosystems, Scrub birch medium/tall shrub, Willow-scrub birch medium/tall shrub, Willow medium/tall shrub, and Dwarf Shrub, Herb, Grass, and Lichen Ecosystems) having significant terrestrial lichen cover. 2. Alpine or open grassland areas having significant terrestrial lichen cover.

The accuracy of the predicted winter habitat and fall habitat classification to predict the presence of caribou locations in the RSA was assessed at approximately 90% during the winter and 80% during the fall, assuming a very conservative 100m location error on all aerial locations used in this assessment (Figure 1-1 and 1-2).

Figure 1-1 Proportion of Winter Caribou Locations in the RSA within Proximity to Satellite Imagery Habitat Interpretations n=186

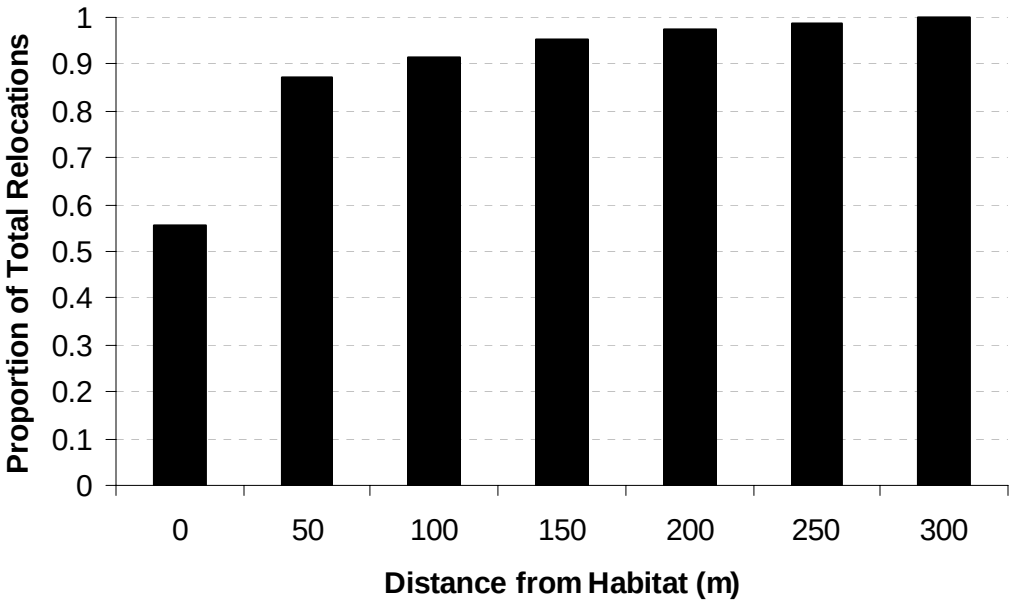
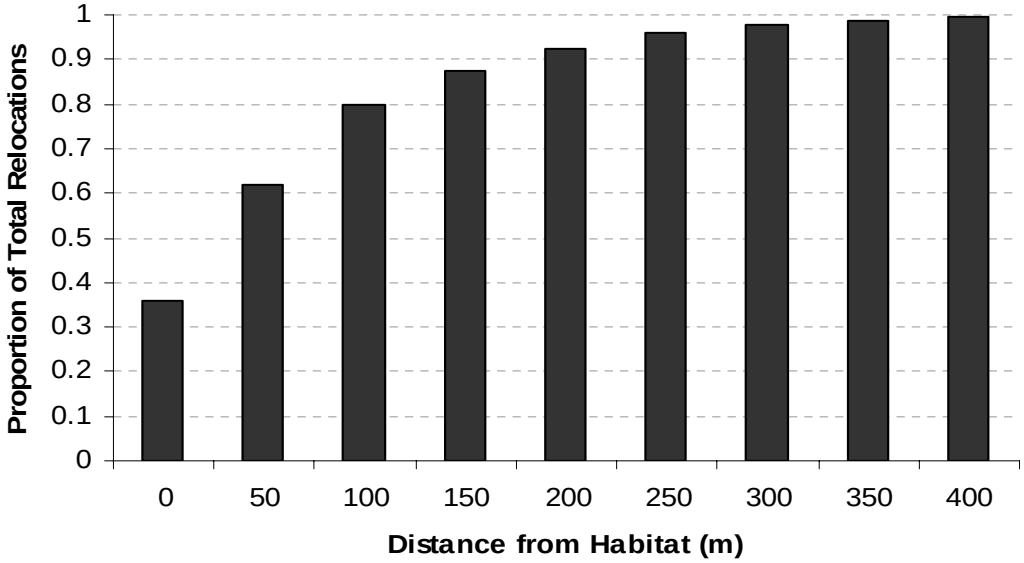


Figure 1-2 Proportion of Fall Caribou Locations in the RSA within Proximity to Satellite Imagery Habitat Interpretations n=1221



III- As a final step a ranking scheme was used to define fall and winter caribou habitats within the LSA using a confirmation approach from key wildlife habitat areas identified in the RSA by Environment Yukon. A Priority rating for each habitat type is as well assessed, whereby the higher the priority rating (1 is high and 4 is low priority) the higher the quality of the habitat. For Fall Caribou Habitat this ranking scheme is as follows:

Priority 1: "Confirmed Habitat Areas" = All fall caribou habitat (as identified above) that are located within the Key Wildlife Habitat Polygons for caribou in the fall season within the RSA.

Priority 2: "Un-Confirmed Habitat Areas" = All fall caribou habitat (as identified above) that are not located within the Key Wildlife Habitat Polygons for caribou in the fall season.

Priority 3: "Confirmed Habitat Areas" in Zone of Influence = All fall caribou habitat (as identified above) that are located within the Key Wildlife Habitat Polygons for caribou in the fall season within the RSA and that area as well within a ZOI from anthropogenic disturbances.

Priority 4: "Un-Confirmed Habitat Areas" in Zone of Influence = All fall caribou habitat (as identified above) that are not located within the Key Wildlife Habitat Polygons for caribou in the fall season within the RSA and that area as well within a ZOI from anthropogenic disturbances.

For Winter Caribou Habitat this ranking scheme is as follows:

Priority 1: "Confirmed Habitat Areas" = All winter habitat (as identified above) that is located within the Key Wildlife Habitat Polygons for caribou in the winter season within the RSA.

Priority 2: "Confirmed Habitat Areas" in Zone of Influence = All winter caribou habitat (as identified above) that are located within the Key Wildlife Habitat Polygons for caribou in the winter season within the RSA and that area as well within a ZOI from anthropogenic disturbances.

Moose

The method used for predicting habitat availability for moose incorporate a habitat suitability index (HSI) modeling approach for ecosystems mapped in the LSA. Model parameters for each species HSI model was derived and validated given (1) a field assessment of ecosystem units in the LSA by a wildlife biologist and (2) a literature review of habitats used by moose. The relationship between habitat parameters and suitability rating for moose is depicted in Figure 1-3. A mathematical function for predicting habitat based upon each habitat parameter is provided in Equation 1-2. A list of selected references supporting habitat parameters assumed for moose is provided in Table 1-5.

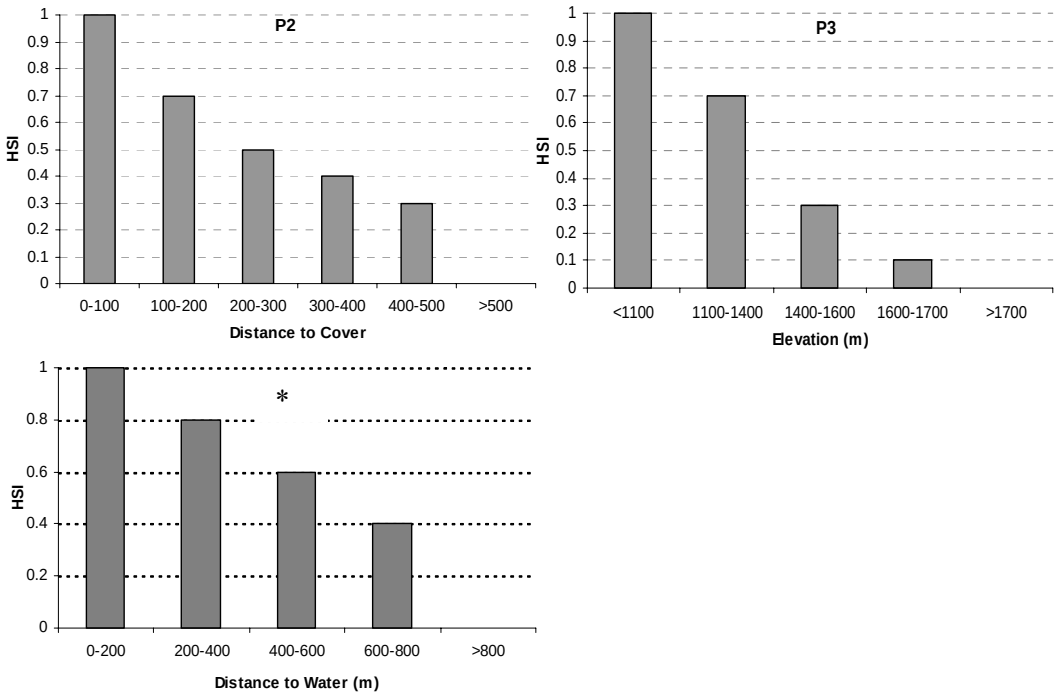
Table 1-3 Relationship between Habitat Parameters and Winter Habitat Suitability Index for Moose

P1

HSI Moose Browse Rating Scheme by Vegetation Type		
Vegetation Type	**Map Code**	**HSI: Forage Rating**
Forested Ecosystems		
Open subalpine forest	SF	0.2
Open white spruce forest	PC	1.0
Open black spruce forest	BS	0.3
Open lodgepole pine-spruce forest	LS	0.2
Open lodgepole pine forest	LP	0.2
Open lodgepole pine-aspen forest	LT	0.5

Open trembling aspen-spruce (pine) forest	TS	0.8
Shrub Ecosystems		
Scrub birch medium/tall shrub	DB	0.8
Willow-scrub birch medium/tall shrub	WD	1.0
Willow medium/tall shrub	WT	1.0
Dwarf Shrub, Herb, Grass, and Lichen Ecosystems		
Wet sedge herb	SH	0.7
Mesic mixed herb	MH	0.3
Heather-avens dwarf shrub	AS	0.0
Alectoria-cladina-cetraria fruticose lichen	AC	0.0

Figure 1-3



Notes: * Distance to cover is based on distance to nearest forestland with >5%canopy closure.
** Distance to water is calculated from NTDB satellite imagery.

Table 1-4 P5 HSI for Anthropogenic Disturbances

Disturbance Class	Disturbance Feature	Assumptions	Moose		
			Footprint: Disturbance Coefficient	Buffer width (m)	Disturbance Coefficient
Mine	Mine Foot Print	During Construction and Operations	0.0	250m	0.25
Linear Structures	Primary roads	Assume high use in absence of better information	0.0	250m	0.5
	Secondary Roads / Trails	Assume low use in absence of better information	0.0	100m	0.75

Seismic and Cutlines	Cut Line	Assume low use in absence of better information (i.e., age), assume 'soft edge' and narrow	0.75	100m	0.75
Structures	Building & Structures	Assume low use in absence of better information	0.0	100m	0.75
Transportation	Airfield	Assume high use in absence of better information	0.0	300m	0.5

Notes: Roads and trails created by resource exploration activities may be avoided by moose as a direct result of sensory disturbance or due to increased hunting pressure. Disturbance to the landscape and the human activities associated with them can cause wildlife to avoid otherwise suitable habitat. This model assumes that habitat suitability is reduced by the presence of human disturbance. Disturbance coefficients were assigned to each disturbance feature. Habitat suitability was reduced within the footprint and or a buffer distance from each disturbance feature by multiplying the HSI values by the disturbance coefficient. For example, a disturbance coefficient of 0.25 will reduce the HSI value by 75%.

Equation 1-2: Mathematical function used to determine the winter habitat suitability index for moose.

$$HSI_{Food} = P^{1}_{\text{Browse Cover}}$$

$$HSI_{Cover} = P^{2}_{\text{Distance to Cover}} \times P^{3}_{\text{Elevation}}$$

$$HSI_{Overall} = [(0.6 \times HSI_{Food} + 0.4 \times HSI_{Cover}) \times P^{4}_{\text{Distance to Water}}] \times P5_{\text{Disturbance Coefficient}}$$

Table 1-5 Supporting Literature for each Habitat Parameter used in the Winter Moose HSI Model

Species	Parameter	References
Moose	P1 - % Cover Browse	Banfield 1974; Silver 1976; Wolff & Cowling 1981; Sambaa k'e Development Corporation 2004; Johnson & Rutton 1993; Nowlin 1978; Walton-Rankin 1977; Synergy West Ltd. 1973; Westworth et al. 1989.
	P2 – Distance to Forest Cover	Doerr 1983; Nietfeld *et al* 1984; Pierce & Peek 1984; Telfer 1978; 1984; Eccles et al. 1986; Eccles & Duncan 1988; Mytton & Keith 1981.
	P3 - Elevation	Ruttan 1974; Eccles et al. 1986; Serrouya R. and D'Eon, R. 2002; Matchett 1985; Simpson et al. 1988.
	P4 – Distance to Water	(Prescott et al. 1973; Ruttan 1974; Sambaak k'e Development Corporation 2004; Rolley & Keith 1980; Mytton & Keith 1981; Brackett et al. 1985; Salter et al. 1986; Jingfors et al. 1987; Eccles & Duncan 1988; Telfer 1984.

Thinhorn Sheep

For sheep, biophysical attributes that typically define primary winter range include escape terrain, distance from escape terrain, aspect and elevation. A habitat Suitability Index (HSI) for sheep winter habitat was developed based on the following algorithm that assigns and combines relative attribute values for each polygon on the study area map.

$$HSI = (P1 \times 0.35) + (P2 \times 0.25) + (P3 \times 0.25) + (P4 \times 0.15)$$

The HSI algorithm predicts winter sheep habitat on a scale between 0 and 5. Habitats predicted to have HSI values greater than or equal to 3 were defined as suitable winter mountain sheep habitat and were outlined on the study area map (Figure xx).

The four primary habitat variables (P1 to P4) were identified using data from a digital elevation model as a raster in a Geographic Information System (GIS) with 25m-pixel resolution. A minimum area of five hectares was used as a final step in mapping habitat polygons. In ranked order of importance, the four model attributes are described below.

Distance from Escape Terrain was considered the most important defining element in delineating the boundaries of winter habitat. Based on review of available literature, an inverse linear relationship between distance and escape terrain outwards to 250 m was used predict this element of ideal winter habitat (P1 in Figure xx below). Distance from esacpe terrain varies with other conditions not included in is model, including quality and availability of forage and herd size where larger group sizes (>10) are thought to venture further from escape terrain, presumably because of group dynamics where individuals find security in numbers (Risenhoover and Bailey 1985; Rachlow and Bower 1988).

Slope Steepness is important for sheep due to the security it provides from predators (Geist 1971; Hoefs and Cowan 1979; Festa-Bianchet 1988; Frid 1999). This is particularly important during lambing season. Willard and Tilton (1982) found that wintering bighorn sheep primarily used slopes that were between 36% and 80% steep with selection for slopes that were greater than 80% steep. A study of sheep wintering thinhorn sheep habitat in northeastern British Columbia found similar winter observations, and observed use of less steep slopes during the rut and summer seasons (K. Parker, pers. comm., 2005). In the Savannah Field winter model algorithm, ideal slope steepness was defined as slopes ranging between 45° and 60° (P2 in Figure xx below).

Aspect is important for sheep as it directly influences solar radiation and prevailing winds. Solar radiation affects metabolic rates in mountain ungulates and the length of growing season for forage plants. Both solar radiation and prevailing winds affect snow depths and availability of forage during winter months. Consequently, on northern latitudes, ungulates tend to utilize south and southwest facing slopes, something that's been well documented in past studies (Geist 1971; Hoefs and Cowan 1979; Risenhoover and Bailey 1985) (P3 in Figure xx below).

Elevation is important in that sheep utilize subalpine and alpine areas with preference for mid-elevations during winter. In the Wolverine Project Area the winter model algorithm, ideal elevations were influenced by heights of land (ca. 2000 m) with preference ranging between 1000 m and 1800 m (P4 in Table 1-4 below).

Table 1-4 Relationships between Habitat Parameters and Habitat Suitability for Thinhorn Sheep Winter Habitat

Parameter 1 – Distance from 45-60 degree steep slopes (P1)

Distance from Escape Terrain (45-60)	Habitat Rating (1-5)
0 to 50m	5
51m to 100m	4
101m to 150m	3
151m to 200m	2
201m to 250m	1

251-300m	0
301-350m	0

Parameter 2 - Slope steepness (P2)

Slope Steepness	Habitat Rating (1-5)
20° to 25°	1
26° to 30°	2
31° to 35°	3
36° to 40°	4
41° to 45°	4
46° to 50°	4
51° to 55°	4
56° to 60°	4
61° to 65°	2
66° to 70°	1

Parameter 3 - Slope aspect (P3)

Aspect	Habitat Rating (1-5)
100° to 120°	1
121° to 140°	2
141° to 160°	2
161° to 180°	4
181° to 200°	5
201° to 220°	5
221° to 240°	5
241° to 260°	5
260° to 280°	3
281° to 300°	2
300 to 320	1

Parameter 4 – Elevation (P4)

Elevation	Habitat Rating (1-5)
400 – 500m	1
500 – 600	1
600 -700	1
700 – 800	2
800 – 900	2
900 -1000	3
1000 – 1100	4
1100 – 1200	5
1200 – 1300	5
1300 – 1400	5
1400 – 1500	5
1500- 1600	5
1600 – 1700	5
1700 - 1800	5
1800 – 1900	4
1900+	3

Grizzly Bear

The suitability of a particular habitat type for grizzly bears is determined by the quality of the vegetation as well other attributes of the habitat. The effects of these attributes on northern interior grizzly bear habitat suitability are incorporated in the models using various assumptions (Table 1-6 and 1-7, respectively). Assumptions are based on season and the needs of an individual bear. The habitat ratings for grizzly bears in the area utilized a 6-category rating scheme for grizzlies. Thus the ratings scheme for grizzly bear habitat includes very high (1), high (2), moderate (3), low (4), very low (5) and no value (6) categories. A rule for making a habitat rating call based on two vegetation parameters (% herbaceous cover and % berry bearing cover) is provided in Table 1-8.

Table 1-6 Habitat Ratings for Grizzly Bear Spring Forage Habitat

Season	Variable	Parameter	Priority	Class	Rating	Comments
Grizzly Bear Habitat, Spring Forage (May1 to June 30)	Vegetation	% Herbaceous Cover (grasses and herbs)	1	>50	1	
				10 – 50	2	
				<10	4	
		% berry bearing shrub cover	2	>30%	1	
				10 – 30	2	
				1 - 10	4	
				<1	6	
	Adjustment	Slope Aspect	See modifier adjustment table			
		Human Activity	See modifier adjustment table			
		Fire	See modifier adjustment table			

Table 1-7 Habitat Ratings for Grizzly Bear Summer/Fall Forage Habitat

Season	Variable	Parameter	Priority	Class	Rating	Comments
Grizzly Bear Habitat, Summer/Fall Forage (July 15 to Nov. 10)	Vegetation	% berry bearing shrub cover	1	>30%	1	
				10 – 30	2	
				1 - 10	4	
				<1	6	
		% Herbaceous Cover (grasses and herbs)	2	>50	1	
				10 – 50	2	
				<10	3	
	Modifiers	Fire	See modifier adjustment table			
		Human Activity	See modifier adjustment table			

Table 1-8 Decision Rules for Ranking Vegetation Parameters Based on Two Vegetation Types

Rank of 1st Priority Attribute	Rank of 2nd Priority Attribute	Resulting Rank A		Rank of 1st Priority Attribute	Rank of 2nd Priority Attribute	Resulting Rank A
1	1	1		4	1	3
1	2	1		4	2	3
1	3	2		4	3	4
1	4	2		4	4	4
1	5	3		4	5	4
1	6	4		4	6	5
2	1	2		5	1	3

2	2	2		5	2	4
2	3	2		5	3	4
2	4	3		5	4	5
2	5	3		5	5	5
2	6	4		5	6	5
3	1	2		6	1	3
3	2	3		6	2	4
3	3	3		6	3	5
3	4	3		6	4	5
3	5	4		6	5	6
3	6	5		6	6	6

Modifiers to Habitat Ratings:

Aspect

Slopes having at least 10 degrees of slope steepness were distinguished from remainder of relatively flat terrain by the aspects (azimuth) that these slopes face. Habitats on south, southwest, west and southeast facing slopes receive greater solar isolation, which results in earlier snowmelt and earlier access to spring forage. The rating adjustments used for spring grizzly bear habitats based on slope aspect is provided in Table 1-9, below.

Table 1-9 Spring Grizzly Bear Habitat Rating Adjustments for Aspect

Season	Variable	Class (slope Azimuth)	Habitat Rating Adjustment
Grizzly Bear Habitat, Spring Forage	Slope Aspect	South, Southwest (160° – 240°)	↑ 2
		West (245° to 300°), Southeast (110° to 160°)	↑ 1
		East (60° to 110°)	↓2
		North, Flat (300° to 60°)	↓3

Development and Human disturbances

Habitat availability for grizzly bears may be impacted in a number of ways resulting from anthropogenic disturbances: direct habitat loss (or gain) resulting from removal or alteration of habitat (human-caused or natural in origin), reduced habitat effectiveness of otherwise effective habitat as a result of noise, human presence, or other factors, or increased mortality due to increased trapping pressure as access is created in previously undisturbed areas (see Table 1-10 below).

Table 1-10 Grizzly Bear Habitat Rating Adjustments for Anthropogenic Disturbances

Grizzly Bear Habitat Type	Disturbance Type	Disturbance Footprint	Zone of Influence Buffer Distance (m)	Habitat Rating Adjustment
Spring and Summer/Fall	Clearings / Camps	6	0 – 800m	↓3
	Cutlines	N/A	0-400m	↓1

Habitat Ratings	Industrial Liquid dump/depot	6	0 – 800m	↓ 3
	Structure: - buildings - campgrounds	6	0-400	↓1
	Main Road	6	0-800	↓3
	Main, ground level, loose surface, operational road	6	0-800m	↓3
	Secondary, ground level, hard surface, operational road	6	0-800	↓3
	Limited-use, Cart, Track, Road, or drill road	6	0-400	↓1
	Airstrip Mine site	6	From ends: 0 – 800	↓3
			From sides: 0-400	↓1

Fire

Grizzly bear habitat ratings were adjusted using fire coefficients for a burned area within the project LSA (Table 8-3), and a zone of influence around human activity (Table 1-11) to account for the natural and human-caused factors that may change habitat effectiveness for grizzlies.

Table 1-11 Fire Adjustments for Grizzly Bear Models

Fire Modifier Table	Original Habitat Rating	Adjustment with presence of fire
Spring Feeding or Summer/Fall Feeding Grizzly Bear Habitat	1 – 2	1
	3	2
	4	3
	5	4
	6	6

Fire modifier rationale:

1. The fire occurred less than 5 years ago.
2. Based on field investigations little shrub or herbaceous growth has occurred since the fire.
3. Herbaceous cover and shrub growth peak in young stands will improve the overall habitat rating in these areas.

Beaver Habitat Availability Methods

Beaver habitat availability was defined by incorporating mapping from aerial photograph interpretations with an aerial survey conducted from helicopters to confirm beaver presence. Identifying adequate beaver habitat from the air required consideration of several factors. It is acknowledged that landscapes used by beavers do not provide a static ecological picture, but instead are dynamic. These habitats can change drastically in a short period of time (Foote, 2005). As such beaver habitat was categorized at the following three levels for the baseline assessment.

Potential Areas or Suitable Wetland Habitats: Any low lying, relatively flat areas that have evidence of permanent water and creeks or rivers with semi-permanent flow

Past Areas: Any suitable wetland habitat that has evidence of previous beaver inhabitation such as dams, lodges or caches. These areas included old beaver meadows, as these areas may be re-inhabited by new beavers (Foote, 2005).

Present Areas: Any suitable wetlands with evidence of active beaver colonization. Active beaver colonies were delineated only as possible during the aerial survey, defined by beaver observations or observations of beaver food caches and or fresh beaver sign.

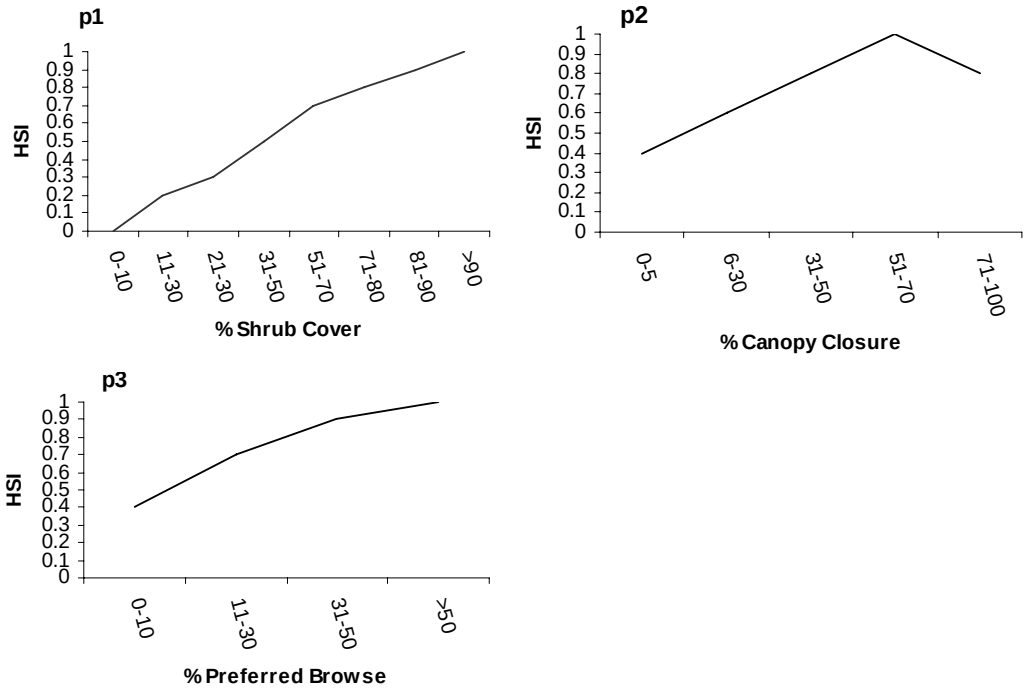
As the initial step to identifying beaver habitat, suitable wetland habitat areas (as defined above) were delineated based on aerial photograph interpretations within the Wolverine Project LSA. Secondly, an aerial presence / absence survey was conducted from helicopter on September 10, 2005, within a survey extent defined by all areas of suitable wetland habitat delineated in the LSA. Aerial survey navigation was conducted using topographic maps assisted by a global positioning system (GPS) to collect GPS waypoints for beaver presence and to collect flight path data from the helicopter during the survey. A digital camera was used to record images of wetland habitats, beavers, and their associated lodges, dams and food caches. Lastly, habitats containing presence of active beaver colonies were identified. To ensure correct classification of active beaver colonies, the aircraft circled beaver lodges until the observer was confident that the lodge was either active or inactive. The primary criterion for an active lodge is the presence of a fresh feed pile within 150 m of the lodge (Novak 1987). Other criteria used to locate and classify active beaver colonies included: sightings of beaver(s), maintained dams, high water levels in ponds, fresh cuttings, or fresh mud on a lodge (Popko and Veitch 1998).

As above, beaver habitat availability was mapped in the LSA, with a provision for three levels of habitat quality. In this context habitat quality is defined in terms of (a) mapping confidence and (b) risk to the beaver population if habitat is impacted. Present areas or suitable wetland habitats with confirmed presence of active beaver colonies have the highest level of habitat quality, while suitable wetlands not identified to have any presence of beaver activities have the lowest level of habitat quality (Figure 1-5)

Lynx and Snowshoe Hare Habitat Availability Methods

Methods for predicting habitat availability for lynx and snowshoe hare habitat, incorporate a habitat suitability index (HSI) modeling approach for ecosystems mapped in the LSA (See vegetation Section 7.9). Model parameters for each species HSI model were derived and validated given (1) a field assessment of ecosystem units in the LSA by a wildlife biologist and (2) a literature review of habitats used by lynx and snowshoe hare. The relationship between habitat parameters and suitability rating for each species is depicted in Figure 1-6 (snowshoe hare) and Figure 1-7 (lynx). Mathematical functions for predicting habitat based upon each habitat parameter, are provided in Equations 1-3 and 1-4. A list of selected references supporting habitat parameters assumed for both snowshoe hare and lynx are provided in Table 1-12.

Figure 1-6 Relationship between Habitat Parameters and Habitat Suitability Index for Snowshoe Hare



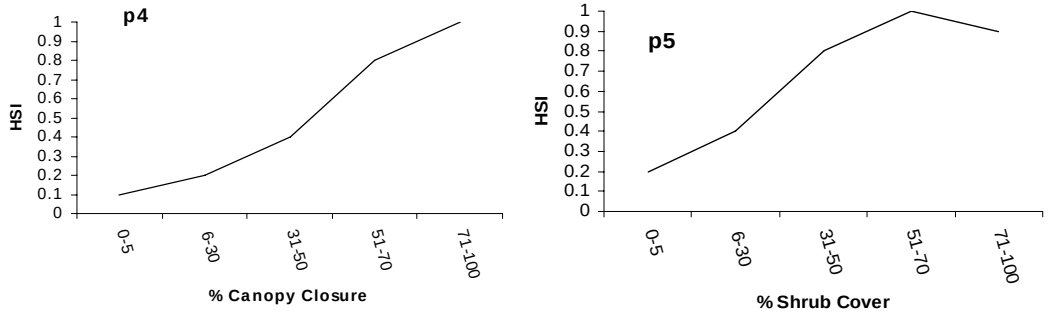
Equation 1-3: Mathematical function used to define habitat suitability index for snowshoe hare habitat.

$$HSI_{Cover} = (0.8 \times P1_{Shrub\ Cover}) + (0.2 \times P2_{Canopy\ Cover})$$

$$HSI_{Food} = (P1_{Shrub\ Cover} \times P3_{\%Preferred\ Browse})$$

$$HSI_{Overall} = (0.5 \times HSI_{Food}) + (0.5 \times HSI_{Cover})$$

Figure 1-7 Relationship between Habitat Parameters and Habitat Suitability Index for Lynx



Equation 1-4: Mathematical function used to define habitat suitability index for lynx habitat.

HSI_{Food} = Snowshoe hare overall HSI

$HSI_{Cover} = [0.5 \times P^{4}_{\text{Canopy Cover}}] + [0.5 \times P^{5}_{\text{Shrub Cover}})]$

$HSI_{Overall} = [(0.8 \times HSI_{Food}) + (0.2 \times HSI_{Cover})]$

Table 1-12 Supporting literature for lynx and snowshoe hare habitat parameter definitions used in the HSI model.

Species	Parameter	Reference
Snowshoe Hare	P1 – Shrub Cover	(Duncan *et al.* 1986; Eccles *et al.* 1986)
	P2 – Canopy Closure	(Grange 1932; Adams 1959; Telfer 1972; Dolbeer and Clark 1975; Walski and Mautz 1977; Orr and Dodds 1982)
	P3 – Preferred Browse Cover	(Dodds 1960; Keith and Surrendi 1971; Bookhout 1965; Pease *et al.* 1979; Keith *et al.* 1984; Trapp 1962; O'Farrell 1965; Wolff 1978)
Lynx	P1 – Canopy Closure	(Soper 1964, Banfield 1974, Smith 1993)
	P2 – Shrub Cover	(Soper 1964, Banfield 1974, Smith 1993)

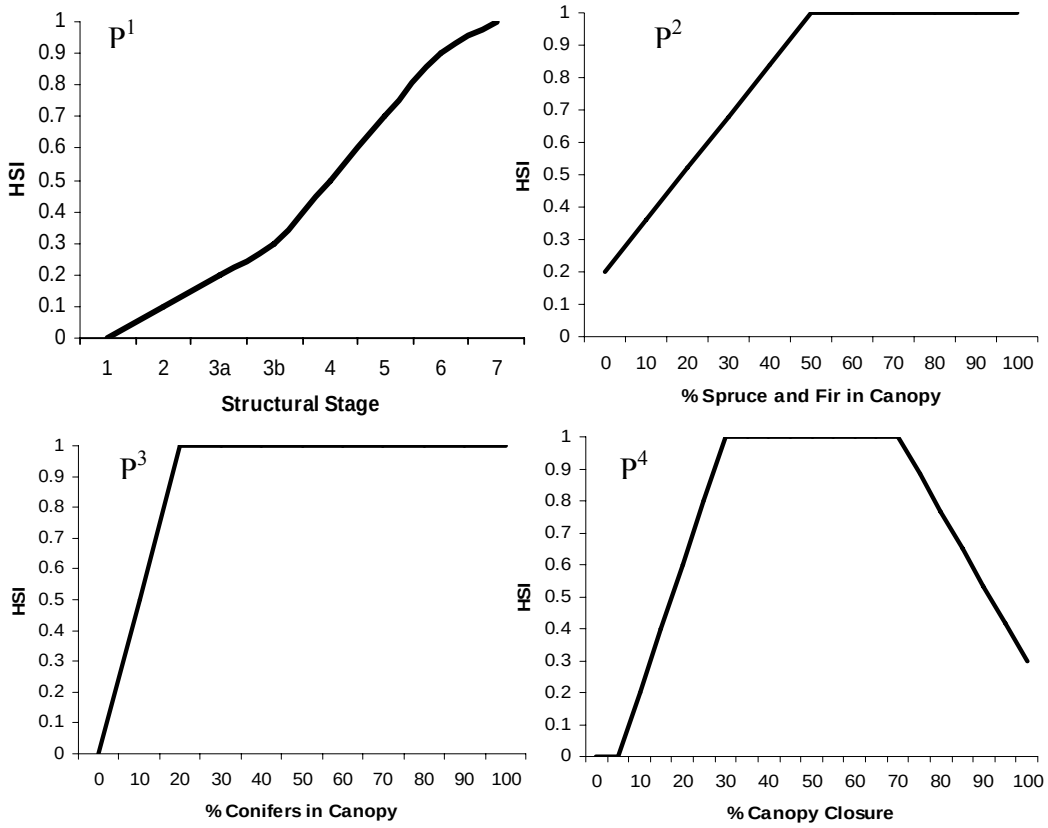
American Marten Winter Habitat Availability Methods

Although it is known that marten utilize a wider variety of habitat types and consume a broader array of food items during the summer than in the winter, the available literature

is not specific about this animal's summer habitat requirements. However, it is highly unlikely that summer habitat needs are limiting for marten. Therefore, the evaluation model concentrates on identifying the key features associated with the winter habitat requirements of the marten.

Methods for predicting habitat availability for American Marten winter habitat, incorporate a habitat suitability index (HSI) modeling approach for ecosystems mapped in the LSA (See vegetation section 7.9). Model parameters for the American marten HSI model were derived and validated given (1) a field assessment of ecosystem units in the LSA by a wildlife biologist and (2) a literature review of habitats used by the American marten. The relationship between habitat parameters and suitability rating for the American marten is depicted in Figure 1-8. A mathematical function for predicting winter habitat based upon each winter habitat parameter, is provided in Equation 1-5. Two supporting HSI models for predicting American marten winter habitat (Takats et al, 1999; and Allen, 1983) have been incorporated in this approach. A list of selected references supporting habitat parameters assumed for American marten are provided in Table 1-13.

Figure 1-8 Relationship between Habitat Parameters and Winter Habitat Suitability Index for Marten



Equation 1-5: Mathematical function used to define habitat suitability index for American marten winter habitat.

$$HSI = P^1 \times (P^2 \times P^3 \times P^4)^{1/2}$$

Table 1-13 Supporting Literature for each Model Parameter used in the Winter HSI Model for American Marten

Habitat Variable	Supporting Literature
Species composition (P2, P3)	Thompson and Curran, 1995; Sheburne and Bissonette, 1944; Corn and Raphael, 1992; Allen, 1982; Buskirk, 1984; Strickland and Douglas, 1987.
Tree Canopy Height (P3)	Allen, 1982; Buskirk, 1984; Strickland and Douglas, 1987.
Structural Stage (P1)	Allen, 1982; Buskirk, 1984; Strickland and Douglas, 1987; Steventon and Major, 1982; Hargis et al., 1999; Bateman, 1968; Spencer et al., 1983.

Song Bird Community Methods

Impacts on the songbird community from the proposed development were assessed using both a habitat and population approach.

The habitat assessment involved quantifying the amount of songbird habitat (i.e., broad habitat classes) available within the LSA during baseline, construction and operations scenarios. Broad habitat classes were selected to reflect general bird habitat requirements, as reported in previous bird community analyses (e.g., Machtans and Latour 2003, Kirk et al. 1996). Changes in the availability of broad habitat classes resulting from project development were considered to reflect changes in the bird community in the LSA (e.g., decrease in forest dependent species and increase in habitat generalists).

The population assessment involved quantifying the abundance (i.e., number) of birds that occur within the LSA during baseline, construction and operations scenarios. Abundance estimates were calculated for (1) individual songbird species within each broad habitat class, (2) combined species within each broad habitat class, and (3) combined species across all broad habitat classes. Bird abundance was calculated by multiplying bird density (i.e., number / ha) within a given broad habitat class by the area (ha) of the given broad habitat class. Because bird surveys have not been conducted within or adjacent to the LSA (Scott Herron, pers. comm.; Wendy Nixon, pers. comm.), data from other studies conducted in similar habitats (e.g., Cooper et al. 2004) were used to provide density estimates within broad habitat classes in the LSA. A list of birds and their associated density by habitat class, including a reference to the source data, is provided in Table 1-14, below.

Table 1-14(a) Density of Individual Bird Species by Habitat Class, and Associated Background Information Sources

Common	Scientific	Yukon Zinc Habitat	Density (mean # of birds/ha)	Reference
American Pipit	Anthus rubescens	V106/V107/V108/V112/V115/V202/V212/V300/V303	1.26	Westworth Associates, 1998b
American Pipit	Anthus rubescens	V16/V109 - Alpine fir medium/tall shrub	0.05	Westworth Associates, 1998b
Bohemian Waxwing	Bombycilla garrulus	V17-Open White Spruce	0.03	Cooper et al, 2004
Bohemian Waxwing	Bombycilla garrulus	V19 - Open Black Spruce	0.03	Cooper et al, 2004
Ruffed Grouse	Bonasa umbellus	V30 - Open trembling aspen - spruce (pine) forest	0.08	Cooper et al, 2004
Common Redpoll	Carduelis flammea	V113 - Black spruce - shrub birch medium/tall shrub	0.02	Cooper et al, 2004
Pine Siskin	Carduelis pinus	V16 - Open alpine forest	1.77	Westworth Associates, 1998b
Pine Siskin	Carduelis pinus	V16/V109 - Alpine fir medium/tall shrub	0.15	Westworth Associates, 1998b
Pine Siskin	Carduelis pinus	V18 - Open Black Spruce	0.15	Westworth Associates, 1998a
Pine Siskin	Carduelis pinus	V30 - Open trembling aspen - spruce (pine) forest	0.07	Westworth Associates, 1998b
Hermit Thrush	Catharus guttatus	V16 - Open alpine forest	0.19	Westworth Associates, 1998b
Hermit Thrush	Catharus guttatus	V18 - Open Black Spruce	0.04	Westworth Associates, 1998b
Hermit Thrush	Catharus guttatus	V21 - Open lodgepole pine - spruce forest	0.03	Westworth Associates, 1998b
Hermit Thrush	Catharus guttatus	V113 - Black spruce - shrub birch medium/tall shrub	0.02	Cooper et al, 2004
Hermit Thrush	Catharus guttatus	V16/V109 - Alpine fir medium/tall shrub	0.15	Westworth Associates, 1998b
Hermit Thrush	Catharus guttatus	V17-Open White Spruce	0.08	Cooper et al, 2004
Hermit Thrush	Catharus guttatus	V19 - Open Black Spruce	0.08	Cooper et al, 2004
Hermit Thrush	Catharus guttatus	V22 - Open lodgepole pine forest	0.08	Cooper et al, 2004
Hermit Thrush	Catharus guttatus	V30 - Open trembling aspen - spruce (pine) forest	0.31	Westworth Associates, 1998a
Hermit Thrush	Catharus guttatus	V16 - Open alpine forest	0.22	Westworth Associates, 1998a
Hermit Thrush	Catharus guttatus	V18 - Open Black Spruce	0.06	Cooper et al, 2004
Hermit Thrush	Catharus guttatus	V21 - Open lodgepole pine - spruce forest	0.04	Westworth Associates, 1998a
Swainson's Thrush	Catharus ustulatus	V17-Open White Spruce	0.30	Cooper et al, 2004
Swainson's Thrush	Catharus ustulatus	V18 - Open Black Spruce	0.14	Westworth Associates, 1998a
Swainson's Thrush	Catharus ustulatus	V19 - Open Black Spruce	0.29	Westworth Associates, 1998a
Swainson's Thrush	Catharus ustulatus	V21 - Open lodgepole pine - spruce forest	0.20	Westworth Associates, 1998b
Swainson's Thrush	Catharus ustulatus	V22 - Open lodgepole pine forest	0.05	Westworth Associates, 1998b
Swainson's Thrush	Catharus ustulatus	V30 - Open trembling aspen - spruce (pine) forest	0.28	Westworth Associates, 1998a

Table 1-14(b) Density of Individual Bird Species by Habitat Class, and Associated Background Information Sources (cont'd)

Common	Scientific	Yukon Zinc Habitat	Density (mean # of birds/ha)	Reference
Swainson's Thrush	Catharus ustulatus	V30 - Open trembling aspen - spruce (pine) forest	0.06	Westworth Associates, 1998b
Swainson's Thrush	Catharus ustulatus	V30 - Open trembling aspen - spruce (pine) forest	0.16	Cooper et al, 2004
Swainson's Thrush	Catharus ustulatus	V17-Open White Spruce	0.16	Cooper et al, 2004
Swainson's Thrush	Catharus ustulatus	V18 - Open Black Spruce	0.10	Cooper et al, 2004
Swainson's Thrush	Catharus ustulatus	V19 - Open Black Spruce	0.14	Cooper et al, 2004
Swainson's Thrush	Catharus ustulatus	V21 - Open lodgepole pine - spruce forest	0.43	Westworth Associates, 1998a
Swainson's Thrush	Catharus ustulatus	V22 - Open lodgepole pine forest	0.16	Cooper et al, 2004
Swainson's Thrush	Catharus ustulatus	V30 - Open trembling aspen - spruce (pine) forest	0.49	Cooper et al, 2004
Olive-sided Flycatcher	Contopus cooperi	V16 - Open alpine forest	0.06	Westworth Associates, 1998b
Common Raven	Corvus corax	V16 - Open alpine forest	0.05	Westworth Associates, 1998a
Yellow-rumped Warbler	Dendroica coronata	V16 - Open alpine forest	0.06	Westworth Associates, 1998a
Yellow-rumped Warbler	Dendroica coronata	V22 - Open lodgepole pine forest	0.77	Westworth Associates, 1998b
Yellow-rumped Warbler	Dendroica coronata	V17-Open White Spruce	0.25	Westworth Associates, 1998a
Yellow-rumped Warbler	Dendroica coronata	V17-Open White Spruce	0.22	Cooper et al, 2004
Yellow-rumped Warbler	Dendroica coronata	V18 - Open Black Spruce	0.35	Westworth Associates, 1998a
Yellow-rumped Warbler	Dendroica coronata	V18 - Open Black Spruce	0.28	Westworth Associates, 1998b
Yellow-rumped Warbler	Dendroica coronata	V30 - Open trembling aspen - spruce (pine) forest	0.64	Westworth Associates, 1998a
Yellow-rumped Warbler	Dendroica coronata	V30 - Open trembling aspen - spruce (pine) forest	0.49	Westworth Associates, 1998b
Yellow-rumped Warbler	Dendroica coronata	V30 - Open trembling aspen - spruce (pine) forest	0.16	Cooper et al, 2004
Yellow-rumped Warbler	Dendroica coronata	V16/V109 - Alpine fir medium/tall shrub	0.04	Westworth Associates, 1998b
Yellow-rumped Warbler	Dendroica coronata	V19 - Open Black Spruce	0.14	Cooper et al, 2004
Yellow-rumped Warbler	Dendroica coronata	V21 - Open lodgepole pine - spruce forest	0.56	Westworth Associates, 1998b
Yellow-rumped Warbler	Dendroica coronata	V16 - Open alpine forest	0.59	Westworth Associates, 1998b
Yellow-rumped Warbler	Dendroica coronata	V22 - Open lodgepole pine forest	0.16	Cooper et al, 2004
Yellow-rumped Warbler	Dendroica coronata	V17-Open White Spruce	0.24	Cooper et al, 2004
Yellow-rumped Warbler	Dendroica coronata	V18 - Open Black Spruce	0.18	Cooper et al, 2004
Yellow-rumped Warbler	Dendroica coronata	V30 - Open trembling aspen - spruce (pine) forest	0.41	Cooper et al, 2004
Blackpoll Warbler	Dendroica striata	V17-Open White Spruce	0.14	Cooper et al, 2004

Table 1-14(c) Density of Individual Bird Species by Habitat Class, and Associated Background Information Sources (cont'd)

Common	Scientific	Yukon Zinc Habitat	Density (mean # of birds/ha)	Reference
Blackpoll Warbler	Dendroica striata	V19 - Open Black Spruce	0.08	Cooper et al, 2004
Blackpoll Warbler	Dendroica striata	V113 - Black spruce - shrub birch medium/tall shrub	0.03	Cooper et al, 2004
Townsend's Warbler	Dendroica townsendi	V18 - Open Black Spruce	0.33	Westworth Associates, 1998a
Townsend's Warbler	Dendroica townsendi	V21 - Open lodgepole pine - spruce forest	0.04	Westworth Associates, 1998a
Townsend's Warbler	Dendroica townsendi	V16 - Open alpine forest	1.14	Westworth Associates, 1998b
Townsend's Warbler	Dendroica townsendi	V17-Open White Spruce	0.68	Westworth Associates, 1998a
Townsend's Warbler	Dendroica townsendi	V19 - Open Black Spruce	1.71	Westworth Associates, 1998a
Townsend's Warbler	Dendroica townsendi	V30 - Open trembling aspen - spruce (pine) forest	0.11	Westworth Associates, 1998a
Townsend's Warbler	Dendroica townsendi	V18 - Open Black Spruce	1.80	Westworth Associates, 1998b
Townsend's Warbler	Dendroica townsendi	V21 - Open lodgepole pine - spruce forest	2.04	Westworth Associates, 1998b
Pileated Woodpecker	Dryocopus pileatus	V30 - Open trembling aspen - spruce (pine) forest	0.10	Westworth Associates, 1998a
Alder Flycatcher	Empidonax alnorum	V104 - Willow medium/tall shrub	0.08	Cooper et al, 2004
Alder Flycatcher	Empidonax alnorum	V113 - Black spruce - shrub birch medium/tall shrub	0.07	Cooper et al, 2004
Alder Flycatcher	Empidonax alnorum	V19 - Open Black Spruce	2.35	Westworth Associates, 1998b
Yellow-bellied Flycatcher	Empidonax flaviventris	V18 - Open Black Spruce	0.04	Cooper et al, 2004
Hammond's Flycatcher	Empidonax hammondii	V30 - Open trembling aspen - spruce (pine) forest	0.29	Westworth Associates, 1998b
Hammond's Flycatcher	Empidonax hammondii	V18 - Open Black Spruce	0.71	Westworth Associates, 1998a
Hammond's Flycatcher	Empidonax hammondii	V21 - Open lodgepole pine - spruce forest	0.48	Westworth Associates, 1998a
Hammond's Flycatcher	Empidonax hammondii	V22 - Open lodgepole pine forest	0.10	Westworth Associates, 1998b
Hammond's Flycatcher	Empidonax hammondii	V30 - Open trembling aspen - spruce (pine) forest	2.13	Westworth Associates, 1998a
Least Flycatcher	Empidonax minimus	V30 - Open trembling aspen - spruce (pine) forest	0.88	Westworth Associates, 1998b
Least Flycatcher	Empidonax minimus	V30 - Open trembling aspen - spruce (pine) forest	1.55	Cooper et al, 2004
Horned Lark	Eremophila alpestris	V106/V107/V108/V112/V115/V202/V212/V300/V302	0.94	Westworth Associates, 1998b
Spruce Grouse	Falcipennis canadensis	V18 - Open Black Spruce	0.02	Cooper et al, 2004
Wilson's Snipe	Gallinago delicata	V113 - Black spruce - shrub birch medium/tall shrub	0.02	Cooper et al, 2004
Common Yellowthroat	Geothlypis trichas	V104/V105/V101/V105	0.49	Cooper et al, 2004
Common Yellowthroat	Geothlypis trichas	V19 - Open Black Spruce	0.59	Westworth Associates, 1998b
Varied Thrush	Ixoreus naevius	V18 - Open Black Spruce	0.04	Westworth Associates, 1998b

Table 1-14(d) Density of Individual Bird Species by Habitat Class, and Associated Background Information Sources (cont'd)

Common	Scientific	Yukon Zinc Habitat	Density (mean # of birds/ha)	Reference
Varied Thrush	Ixoreus naevius	V21 - Open lodgepole pine - spruce forest	0.03	Westworth Associates, 1998b
Varied Thrush	Ixoreus naevius	V16 - Open alpine forest	0.15	Westworth Associates, 1998b
Varied Thrush	Ixoreus naevius	V16/V109 - Alpine fir medium/tall shrub	0.04	Westworth Associates, 1998b
Varied Thrush	Ixoreus naevius	V30 - Open trembling aspen - spruce (pine) forest	0.11	Westworth Associates, 1998a
Varied Thrush	Ixoreus naevius	V18 - Open Black Spruce	0.58	Westworth Associates, 1998a
Varied Thrush	Ixoreus naevius	V21 - Open lodgepole pine - spruce forest	0.05	Westworth Associates, 1998a
Dark-eyed Junco	Junco hyemalis	V16 - Open alpine forest	0.24	Westworth Associates, 1998a
Dark-eyed Junco	Junco hyemalis	V18 - Open Black Spruce	0.46	Westworth Associates, 1998b
Dark-eyed Junco	Junco hyemalis	V17-Open White Spruce	0.25	Westworth Associates, 1998a
Dark-eyed Junco	Junco hyemalis	V17-Open White Spruce	0.22	Cooper et al, 2004
Dark-eyed Junco	Junco hyemalis	V30 - Open trembling aspen - spruce (pine) forest	0.11	Westworth Associates, 1998a
Dark-eyed Junco	Junco hyemalis	V30 - Open trembling aspen - spruce (pine) forest	0.72	Westworth Associates, 1998b
Dark-eyed Junco	Junco hyemalis	V113 - Black spruce - shrub birch medium/tall shrub	0.02	Cooper et al, 2004
Dark-eyed Junco	Junco hyemalis	V16/V109 - Alpine fir medium/tall shrub	0.87	Westworth Associates, 1998b
Dark-eyed Junco	Junco hyemalis	V19 - Open Black Spruce	0.14	Cooper et al, 2004
Dark-eyed Junco	Junco hyemalis	V21 - Open lodgepole pine - spruce forest	0.13	Westworth Associates, 1998a
Dark-eyed Junco	Junco hyemalis	V22 - Open lodgepole pine forest	0.37	Westworth Associates, 1998b
Dark-eyed Junco	Junco hyemalis	V16 - Open alpine forest	0.29	Westworth Associates, 1998b
Dark-eyed Junco	Junco hyemalis	V18 - Open Black Spruce	0.14	Cooper et al, 2004
Dark-eyed Junco	Junco hyemalis	V17-Open White Spruce	0.08	Cooper et al, 2004
Dark-eyed Junco	Junco hyemalis	V30 - Open trembling aspen - spruce (pine) forest	0.08	Cooper et al, 2004
Swamp Sparrow	Melospiza georgiana	V104/V105/V101/V108	0.65	Cooper et al, 2004
Swamp Sparrow	Melospiza georgiana	V113 - Black spruce - shrub birch medium/tall shrub	0.03	Cooper et al, 2004
Lincoln's Sparrow	Melospiza lincolnii	V104/V105/V101/V107	0.33	Cooper et al, 2004
Lincoln's Sparrow	Melospiza lincolnii	V113 - Black spruce - shrub birch medium/tall shrub	0.42	Cooper et al, 2004
Lincoln's Sparrow	Melospiza lincolnii	V17-Open White Spruce	0.03	Cooper et al, 2004
Lincoln's Sparrow	Melospiza lincolnii	V18 - Open Black Spruce	0.10	Cooper et al, 2004
Lincoln's Sparrow	Melospiza lincolnii	V19 - Open Black Spruce	0.11	Cooper et al, 2004
Townsend's Solitaire	Myadestes townsendi	V16 - Open alpine forest	0.10	Westworth Associates, 1998a

Table 1-14(e) Density of Individual Bird Species by Habitat Class, and Associated Background Information Sources (cont'd)

Common	Scientific	Yukon Zinc Habitat	Density (mean # of birds/ha)	Reference
Savannah Sparrow	Passerculus sandwichensis	V113 - Black spruce - shrub birch medium/tall shrub	0.03	Cooper et al, 2004
Fox Sparrow	Passerella iliaca	V113 - Black spruce - shrub birch medium/tall shrub	0.03	Cooper et al, 2004
Fox Sparrow	Passerella iliaca	V16 - Open alpine forest	0.63	Westworth Associates, 1998a
Fox Sparrow	Passerella iliaca	V16/V109 - Alpine fir medium/tall shrub	0.38	Westworth Associates, 1998b
Fox Sparrow	Passerella iliaca	V17-Open White Spruce	0.03	Cooper et al, 2004
Fox Sparrow	Passerella iliaca	V30 - Open trembling aspen - spruce (pine) forest	0.08	Cooper et al, 2004
Gray Jay	Perisoreus canadensis	V17-Open White Spruce	0.05	Cooper et al, 2004
Gray Jay	Perisoreus canadensis	V18 - Open Black Spruce	0.08	Cooper et al, 2004
Gray Jay	Perisoreus canadensis	V19 - Open Black Spruce	0.08	Cooper et al, 2004
Downy Woodpecker	Picoides pubescens	V30 - Open trembling aspen - spruce (pine) forest	0.08	Cooper et al, 2004
Hairy Woodpecker	Picoides villosus	V113 - Black spruce - shrub birch medium/tall shrub	0.02	Cooper et al, 2004
Pine Grosbeak	Pinicola enucleator	V17-Open White Spruce	0.03	Cooper et al, 2004
Pine Grosbeak	Pinicola enucleator	V18 - Open Black Spruce	0.02	Cooper et al, 2004
Pine Grosbeak	Pinicola enucleator	V19 - Open Black Spruce	0.03	Cooper et al, 2004
Black-capped Chickadee	Poecile atricapillus	V30 - Open trembling aspen - spruce (pine) forest	0.22	Westworth Associates, 1998b
Boreal Chickadee	Poecile hudsonica	V17-Open White Spruce	0.03	Cooper et al, 2004
Boreal Chickadee	Poecile hudsonica	V18 - Open Black Spruce	0.02	Cooper et al, 2004
Ruby-crowned Kinglet	Regulus calendula	V17-Open White Spruce	0.08	Cooper et al, 2004
Ruby-crowned Kinglet	Regulus calendula	V19 - Open Black Spruce	1.08	Westworth Associates, 1998b
Ruby-crowned Kinglet	Regulus calendula	V16 - Open alpine forest	0.26	Westworth Associates, 1998a
Ruby-crowned Kinglet	Regulus calendula	V16/V109 - Alpine fir medium/tall shrub	0.17	Westworth Associates, 1998b
Ruby-crowned Kinglet	Regulus calendula	V18 - Open Black Spruce	0.16	Cooper et al, 2004
Ruby-crowned Kinglet	Regulus calendula	V30 - Open trembling aspen - spruce (pine) forest	0.07	Westworth Associates, 1998b
Ruby-crowned Kinglet	Regulus calendula	V17-Open White Spruce	0.08	Cooper et al, 2004
Ruby-crowned Kinglet	Regulus calendula	V19 - Open Black Spruce	0.03	Cooper et al, 2004
Golden-crowned Kinglet	Regulus satrapa	V16 - Open alpine forest	0.10	Westworth Associates, 1998a
Golden-crowned Kinglet	Regulus satrapa	V16/V109 - Alpine fir medium/tall shrub	0.08	Westworth Associates, 1998b
Golden-crowned Kinglet	Regulus satrapa	V18 - Open Black Spruce	2.96	Westworth Associates, 1998b
Golden-crowned Kinglet	Regulus satrapa	V21 - Open lodgepole pine - spruce forest	2.70	Westworth Associates, 1998b

Table 1-14(f) Density of Individual Bird Species by Habitat Class, and Associated Background Information Sources (cont'd)

Common	Scientific	Yukon Zinc Habitat	Density (mean # of birds/ha)	Reference
Northern Waterthrush	Seiurus noveboracensis	V113 - Black spruce - shrub birch medium/tall shrub	0.03	Cooper et al, 2004
Northern Waterthrush	Seiurus noveboracensis	V30 - Open trembling aspen - spruce (pine) forest	0.08	Cooper et al, 2004
American Redstart	Setophaga ruticilla	V30 - Open trembling aspen - spruce (pine) forest	0.31	Westworth Associates, 1998b
American Redstart	Setophaga ruticilla	V30 - Open trembling aspen - spruce (pine) forest	0.08	Cooper et al, 2004
Red-breasted Nuthatch	Sitta canadensis	V18 - Open Black Spruce	0.05	Westworth Associates, 1998b
Red-breasted Nuthatch	Sitta canadensis	V21 - Open lodgepole pine - spruce forest	0.08	Westworth Associates, 1998b
Red-breasted Nuthatch	Sitta canadensis	V16/V109 - Alpine fir medium/tall shrub	0.05	Westworth Associates, 1998b
Red-breasted Nuthatch	Sitta canadensis	V30 - Open trembling aspen - spruce (pine) forest	0.07	Westworth Associates, 1998b
Red-breasted Nuthatch	Sitta canadensis	V18 - Open Black Spruce	0.18	Westworth Associates, 1998a
Red-breasted Nuthatch	Sitta canadensis	V21 - Open lodgepole pine - spruce forest	0.20	Westworth Associates, 1998a
Yellow-bellied Sapsucker	Sphyrapicus varius	V17-Open White Spruce	0.03	Cooper et al, 2004
Yellow-bellied Sapsucker	Sphyrapicus varius	V30 - Open trembling aspen - spruce (pine) forest	0.90	Cooper et al, 2004
Yellow-bellied Sapsucker	Sphyrapicus varius	V17-Open White Spruce	0.41	Cooper et al, 2004
Chipping Sparrow	Spizella passerina	V17-Open White Spruce	0.19	Cooper et al, 2004
Chipping Sparrow	Spizella passerina	V18 - Open Black Spruce	1.26	Westworth Associates, 1998a
Chipping Sparrow	Spizella passerina	V19 - Open Black Spruce	1.40	Westworth Associates, 1998b
Chipping Sparrow	Spizella passerina	V21 - Open lodgepole pine - spruce forest	0.10	Westworth Associates, 1998a
Chipping Sparrow	Spizella passerina	V22 - Open lodgepole pine forest	0.89	Westworth Associates, 1998b
Chipping Sparrow	Spizella passerina	V104/V105/V101/V104	0.08	Cooper et al, 2004
Chipping Sparrow	Spizella passerina	V113 - Black spruce - shrub birch medium/tall shrub	0.20	Cooper et al, 2004
Chipping Sparrow	Spizella passerina	V30 - Open trembling aspen - spruce (pine) forest	0.08	Cooper et al, 2004
Chipping Sparrow	Spizella passerina	V17-Open White Spruce	0.41	Cooper et al, 2004
Chipping Sparrow	Spizella passerina	V18 - Open Black Spruce	0.16	Cooper et al, 2004
Chipping Sparrow	Spizella passerina	V19 - Open Black Spruce	0.30	Cooper et al, 2004
Chipping Sparrow	Spizella passerina	V21 - Open lodgepole pine - spruce forest	0.17	Westworth Associates, 1998b
Chipping Sparrow	Spizella passerina	V22 - Open lodgepole pine forest	0.16	Cooper et al, 2004
Lesser Yellowlegs	Tringa flavipes	V113 - Black spruce - shrub birch medium/tall shrub	0.03	Cooper et al, 2004
Lesser Yellowlegs	Tringa flavipes	V18 - Open Black Spruce	0.02	Cooper et al, 2004
Winter Wren	Troglodytes troglodytes	V18 - Open Black Spruce	0.66	Westworth Associates, 1998b

Table 1-14(g) Density of Individual Bird Species by Habitat Class, and Associated Background Information Sources (cont'd)

Common	Scientific	Yukon Zinc Habitat	Density (mean # of birds/ha)	Reference
Winter Wren	Troglodytes troglodytes	V21 - Open lodgepole pine - spruce forest	0.14	Westworth Associates, 1998a
Winter Wren	Troglodytes troglodytes	V16 - Open alpine forest	0.24	Westworth Associates, 1998b
Winter Wren	Troglodytes troglodytes	V17-Open White Spruce	0.46	Westworth Associates, 1998a
Winter Wren	Troglodytes troglodytes	V18 - Open Black Spruce	0.76	Westworth Associates, 1998a
Winter Wren	Troglodytes troglodytes	V21 - Open lodgepole pine - spruce forest	0.24	Westworth Associates, 1998b
American Robin	Turdus migratorius	V30 - Open trembling aspen - spruce (pine) forest	0.06	Westworth Associates, 1998b
American Robin	Turdus migratorius	V104/V105/V101/V102	0.08	Cooper et al, 2004
American Robin	Turdus migratorius	V16/V109 - Alpine fir medium/tall shrub	0.04	Westworth Associates, 1998b
American Robin	Turdus migratorius	V17-Open White Spruce	0.08	Cooper et al, 2004
American Robin	Turdus migratorius	V19 - Open Black Spruce	0.03	Cooper et al, 2004
American Robin	Turdus migratorius	V21 - Open lodgepole pine - spruce forest	0.13	Westworth Associates, 1998b
American Robin	Turdus migratorius	V22 - Open lodgepole pine forest	0.09	Westworth Associates, 1998b
American Robin	Turdus migratorius	V30 - Open trembling aspen - spruce (pine) forest	0.08	Cooper et al, 2004
Sharp-tailed Grouse	Tympanuchus phasianellus	V113 - Black spruce - shrub birch medium/tall shrub	0.02	Cooper et al, 2004
Orange-crowned Warbler	Vermivora celata	V30 - Open trembling aspen - spruce (pine) forest	0.85	Westworth Associates, 1998b
Orange-crowned Warbler	Vermivora celata	V113 - Black spruce - shrub birch medium/tall shrub	0.05	Cooper et al, 2004
Orange-crowned Warbler	Vermivora celata	V17-Open White Spruce	0.16	Cooper et al, 2004
Orange-crowned Warbler	Vermivora celata	V19 - Open Black Spruce	0.11	Cooper et al, 2004
Orange-crowned Warbler	Vermivora celata	V30 - Open trembling aspen - spruce (pine) forest	0.49	Cooper et al, 2004
Tennessee Warbler	Vermivora peregrina	V17-Open White Spruce	0.22	Cooper et al, 2004
Tennessee Warbler	Vermivora peregrina	V30 - Open trembling aspen - spruce (pine) forest	0.08	Cooper et al, 2004
Tennessee Warbler	Vermivora peregrina	V104/V105/V101/V109	0.08	Cooper et al, 2004
Tennessee Warbler	Vermivora peregrina	V18 - Open Black Spruce	0.20	Cooper et al, 2004
Tennessee Warbler	Vermivora peregrina	V22 - Open lodgepole pine forest	0.33	Cooper et al, 2004
Tennessee Warbler	Vermivora peregrina	V17-Open White Spruce	0.73	Cooper et al, 2004
Tennessee Warbler	Vermivora peregrina	V30 - Open trembling aspen - spruce (pine) forest	0.90	Cooper et al, 2004
Warbling Vireo	Vireo gilvus	V21 - Open lodgepole pine - spruce forest	0.04	Westworth Associates, 1998a
Warbling Vireo	Vireo gilvus	V30 - Open trembling aspen - spruce (pine) forest	0.30	Westworth Associates, 1998a
Warbling Vireo	Vireo gilvus	V30 - Open trembling aspen - spruce (pine) forest	1.77	Westworth Associates, 1998b

Table 1-14(h) Density of Individual Bird Species by Habitat Class, and Associated Background Information Sources (cont'd)

Common	Scientific	Yukon Zinc Habitat	Density (mean # of birds/ha)	Reference
Warbling Vireo	Vireo gilvus	V30 - Open trembling aspen - spruce (pine) forest	0.16	Cooper et al, 2004
Warbling Vireo	Vireo gilvus	V17-Open White Spruce	0.03	Cooper et al, 2004
Warbling Vireo	Vireo gilvus	V18 - Open Black Spruce	0.59	Westworth Associates, 1998b
Warbling Vireo	Vireo gilvus	V21 - Open lodgepole pine - spruce forest	0.83	Westworth Associates, 1998b
Warbling Vireo	Vireo gilvus	V30 - Open trembling aspen - spruce (pine) forest	0.24	Cooper et al, 2004
Wilson's Warbler	Wilsonia pusilla	V16 - Open alpine forest	0.57	Westworth Associates, 1998b
Wilson's Warbler	Wilsonia pusilla	V16/V109 - Alpine fir medium/tall shrub	0.10	Westworth Associates, 1998b
Wilson's Warbler	Wilsonia pusilla	V18 - Open Black Spruce	1.76	Westworth Associates, 1998b
White-throated Sparrow	Zonotrichia albicollis	V104/V105/V101/V110	0.08	Cooper et al, 2004
White-throated Sparrow	Zonotrichia albicollis	V18 - Open Black Spruce	0.04	Cooper et al, 2004
White-crowned Sparrow	Zonotrichia leucophrys	V113 - Black spruce - shrub birch medium/tall shrub	0.41	Cooper et al, 2004
White-crowned Sparrow	Zonotrichia leucophrys	V16 - Open alpine forest	0.06	Westworth Associates, 1998a
White-crowned Sparrow	Zonotrichia leucophrys	V17-Open White Spruce	0.03	Cooper et al, 2004
White-crowned Sparrow	Zonotrichia leucophrys	V19 - Open Black Spruce	0.03	Cooper et al, 2004

Trumpeter Swan Breeding Habitat Availability Methods

Trumpeter swan breeding and nesting habitats were assessed within the LSA in order to identify potential project specific impacts on trumpeter swans. Trumpeter swan habitat availability was defined by incorporating mapping from aerial photograph interpretations with an aerial survey conducted from helicopters to confirm trumpeter swan presence. As the initial step to identifying trumpeter swan habitat, suitable wetland habitat areas (as defined above) were delineated based on aerial photograph interpretations within the Wolverine Project LSA. Secondly, an aerial presence / absence survey was conducted from helicopter on September 10, 2005, within a survey extent defined by all areas of suitable wetland habitat delineated in the LSA. Since suitable habitats for trumpeter swan are consistent with that for beavers, the aerial wetland survey for beavers and trumpeter swans were conducted together. Aerial survey navigation was conducted using topographic maps assisted by a global positioning system (GPS) to collect GPS waypoints for trumpeter swan presence and to collect flight path data from the helicopter during the survey. A digital camera was used to record images of wetland habitats, and trumpeter swans including adults and cygnets. Lastly, habitats containing presence of nesting and breeding trumpeter swans were identified. Trumpeter swan breeding habitat was categorized at the following two levels for the baseline assessment:

Potential Areas or Suitable Wetland Habitats: includes any lakes and marshes with permanent water and or slow moving creeks or rivers with semi-permanent flow, having emergent and submergent vegetation.

Present Areas: Any suitable wetlands with confirmed presence of breeding trumpeter swans observed during the aerial wetland survey or from any previous assessments, defined by presence of adult trumpeter swans with cygnets and or trumpeter swan nests.

In this context habitat quality is defined in terms of (a) mapping confidence and (b) risk to the trumpeter swan population if habitat is impacted. Present areas or suitable wetland habitats with confirmed presence of breeding trumpeter swans have the highest level of habitat quality, while suitable wetlands not identified to have any presence of trumpeter swans have the lowest level of habitat quality.

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Appendix 7.10-2 Wildlife Species List

Appendix 7.10-2 Wildlife Species List

#	Common Name	Scientific Name	Group
1	Arctic Ground Squirrel	*Spermophilus parryii*	Mammal
2	Beaver	*Castor canadensis*	Mammal
3	Black Bear	*Ursus americanus*	Mammal
4	Boreal Gray Wolf	*Canis lupis occidentalis*	Mammal
5	Brown Lemming	*Lemmus sibiricus*	Mammal
6	Bushy-tailed Wood Rat	*Neotoma cinerea*	Mammal
7	Chestnut-cheeked (Taiga) Vole	*Microtus xanthognathus*	Mammal
8	Common Porcupine	*Erethizon dorsatum*	Mammal
9	Coyote	*Canis latrans*	Mammal
10	Dall's Sheep	*Ovis dalli dallii*	Mammal
11	Deer Mouse	*Peromyscus maniculatus*	Mammal
12	Dusky Shrew	*Sorex monticolus*	Mammal
13	Eastern Heather Vole	*Phenacomys intermedius (ungava)*	Mammal
14	Ermine (Stoat)	*Mustela erminea*	Mammal
15	Grizzly Bear	*Ursus arctos*	Mammal
16	Hoary Marmot	*Marmota caligata*	Mammal
17	Least Chipmunk	*Eutamias (Tamias) minimus*	Mammal
18	Least Weasel	*Mustela nivalis*	Mammal
19	Little Brown Bat	*Myotis lucifugus*	Mammal
20	Long-tailed vole	*Microtus longicaudus*	Mammal
21	Lynx	*Lynx canadensis*	Mammal
22	Marten	*Martes americana*	Mammal
23	Masked Shrew	*Sorex cinereus*	Mammal
24	Meadow Jumping Mouse	*Zapus hudsonius*	Mammal
25	Meadow Vole	*Microtus pennsylvanicus*	Mammal
26	Mink	*Mustela vison*	Mammal
27	Moose	*Alces alces*	Mammal
28	Mountain Goat	*Oreamnos americanus*	Mammal
29	Muskrat	*Ondatra zibethicus*	Mammal
30	Northern Bog Lemming	*Synaptomys borealis*	Mammal
31	Northern Flying Squirrel	*Glaucomys sabrinus*	Mammal
32	Northern Myotis	*Myotis septentrionalis*	Mammal
33	Northern Red-backed Vole	*Clethrionomys rutilus*	Mammal
34	Pigmy Shrew	*Sorex hoyi*	Mammal
35	Red Fox	*Vulpes vulpes*	Mammal
36	Red Squirrel	*Tamiasciurus hudsonicus*	Mammal
37	River Otter	*Lutra canadensis*	Mammal
38	Singing Vole	*Microtus miurus*	Mammal
39	Snowshoe Hare	*Lepus americanus*	Mammal
40	Striped Skunk	*Mephitis mephitis*	Mammal
41	Wolverine	*Gulo gulo*	Mammal
42	Woodchuck	*Marmota monax*	Mammal
43	Woodland Caribou (northern mountain)	*Rangifer tarandus caribou*	Mammal

44	Alder Flycatcher	*Empidonax alnorum*	Bird
45	American Coot	*Fulica americana*	Bird
46	American Crow	*Corvus brachyrhynchos*	Bird
47	American Kestrel	*Falco sparverius*	Bird
48	American Pipit	*Anthus rubescens*	Bird
49	American Redstart	*Setophaga ruticilla*	Bird
50	American Robin	*Turdus migratorius*	Bird
51	American Tree Sparrow	*Spizella arborea*	Bird
52	American Wigeon	*Anas americana*	Bird
53	Arctic Tern	*Sterna paradisaea*	Bird
54	Bald Eagle	*Haliaeetus leucocephalus*	Bird
55	Bank Swallow	*Riparia riparia*	Bird
56	Barn Swallow	*Hirundo rustica*	Bird
57	Barred Owl	*Strix varia*	Bird
58	Barrow's Goldeneye	*Bucephala islandica*	Bird
59	Bay-breasted Warbler	*Dendroica castanea*	Bird
60	Belted Kingfisher	*Ceryle alcyon*	Bird
61	Black-and-white Warbler	*Mniotilta varia*	Bird
62	Black-backed Woodpecker	*Picoides arcticus*	Bird
63	Black-capped Chickadee	*Poecile atricapillus*	Bird
64	Blackpoll Warbler	*Dendroica striata*	Bird
65	Blue Grouse	*Dendragapus obscurus*	Bird
66	Blue-headed Vireo	*Vireo solitarius*	Bird
67	Blue-winged Teal	*Anas discors*	Bird
68	Bohemian Waxwing	*Bombycilla garrulus*	Bird
69	Bonaparte's Gull	*Larus philadelphia*	Bird
70	Boreal Chickadee	*Poecile hudsonicus*	Bird
71	Boreal Owl	*Aegolius funereus*	Bird
72	Brewer's Blackbird	*Euphagus cyanocephalus*	Bird
73	Brown-headed Cowbird	*Molothrus ater*	Bird
74	Bufflehead	*Bucephala albeola*	Bird
75	Canada Goose	*Branta canadensis*	Bird
76	Canada Warbler	*Wilsonia canadensis*	Bird
77	Canvasback	*Aythya valisineria*	Bird
78	Cape May Warbler	*Dendroica tigrina*	Bird
79	Cedar Waxwing	*Bombycilla cedrorum*	Bird
80	Chipping Sparrow	*Spizella passerina*	Bird
81	Clay-colored Sparrow	*Spizella pallida*	Bird
82	Cliff Swallow	*Petrochelidon pyrrhonota*	Bird
83	Common Goldeneye	*Bucephala clangula*	Bird
84	Common Grackle	*Quiscalus quiscula*	Bird
85	Common Loon	*Gavia immer*	Bird
86	Common Merganser	*Mergus merganser*	Bird
87	Common Nighthawk	*Chordeiles minor*	Bird
88	Common Raven	*Corvus corax*	Bird
89	Common Redpoll	*Carduelis flammea*	Bird
90	Common Snipe	*Gallinago gallinago*	Bird
91	Common Yellowthroat	*Geothlypis trichas*	Bird
92	Dark-eyed Junco	*Junco hyemalis*	Bird

93	Downy Woodpecker	*Picoides pubescens*	Bird
94	Eastern Kingbird	*Tyrannus tyrannus*	Bird
95	Eastern Phoebe	*Sayornis phoebe*	Bird
96	European Starling	*Sturnus vulgaris*	Bird
97	Evening Grosbeak	*Coccothraustes vespertinus*	Bird
98	Fox Sparrow	*Passerella iliaca*	Bird
99	Golden Eagle	*Aquila chrysaetos*	Bird
100	Golden-crowned Kinglet	*Regulus satrapa*	Bird
101	Golden-crowned Sparrow	*Zonotrichia atricapilla*	Bird
102	Gray Jay	*Perisoreus canadensis*	Bird
103	Gray-cheeked Thrush	*Catharus minimus*	Bird
104	Great Gray Owl	*Strix nebulosa*	Bird
105	Great Horned Owl	*Bubo virginianus*	Bird
106	Greater Scaup	*Aythya marila*	Bird
107	Greater White-fronted Goose	*Anser albifrons*	Bird
108	Green-winged Teal	*Anas crecca*	Bird
109	Gyrfalcon	*Falco rusticolus*	Bird
110	Hairy Woodpecker	*Picoides villosus*	Bird
111	Hammond's Flycatcher	*Empidonax hammondii*	Bird
112	Hermit Thrush	*Catharus guttatus*	Bird
113	Herring Gull	*Larus argentatus*	Bird
114	Hoary Redpoll	*Carduelis hornemanni*	Bird
115	Horned Grebe	*Podiceps auritus*	Bird
116	Killdeer	*Charadrius vociferus*	Bird
117	Le Conte's Sparrow	*Ammodramus leconteii*	Bird
118	Least Flycatcher	*Empidonax minimus*	Bird
119	Least Sandpiper	*Calidris minutilla*	Bird
120	Lesser Scaup	*Aythya affinis*	Bird
121	Lesser Yellowlegs	*Tringa flavipes*	Bird
122	Lincoln's Sparrow	*Melospiza lincolnii*	Bird
123	Magnolia Warbler	*Dendroica magnolia*	Bird
124	Mallard	*Anas platyrhynchos*	Bird
125	Merlin	*Falco columbarius*	Bird
126	Mew Gull	*Larus canus*	Bird
127	Mountain Bluebird	*Sialia currucoides*	Bird
128	Mourning Warbler	*Oporornis philadelphia*	Bird
129	Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	Bird
130	Northern Flicker	*Colaptes auratus*	Bird
131	Northern Goshawk	*Accipiter gentilis*	Bird
132	Northern Harrier	*Circus cyaneus*	Bird
133	Northern Hawk Owl	*Surnia ulula*	Bird
134	Northern Pintail	*Anas acuta*	Bird
135	Northern Shoveler	*Anas clypeata*	Bird
136	Northern Shrike	*Lanius excubitor*	Bird
137	Northern Waterthrush	*Seiurus noveboracensis*	Bird
138	Olive-sided Flycatcher	*Contopus cooperi*	Bird
139	Orange-crowned Warbler	*Vermivora celata*	Bird
140	Osprey	*Pandion haliaetus*	Bird
141	Ovenbird	*Seiurus aurocapillus*	Bird

142	Pacific Loon	*Gavia pacifica*	Bird
143	Palm Warbler	*Dendroica palmarum*	Bird
144	Philadelphia Vireo	*Vireo philadelphicus*	Bird
145	Pied-billed Grebe	*Podilymbus podiceps*	Bird
146	Pileated Woodpecker	*Dryocopus pileatus*	Bird
147	Pine Grosbeak	*Pinicola enucleator*	Bird
148	Pine Siskin	*Carduelis pinus*	Bird
149	Purple Finch	*Carpodacus purpureus*	Bird
150	Red Crossbill	*Loxia curvirostra*	Bird
151	Red-breasted Merganser	*Mergus serrator*	Bird
152	Red-breasted Nuthatch	*Sitta canadensis*	Bird
153	Red-eyed Vireo	*Vireo olivaceus*	Bird
154	Red-necked Grebe	*Podiceps grisegena*	Bird
155	Red-necked Phalarope	*Phalaropus lobatus*	Bird
156	Red-tailed Hawk	*Buteo jamaicensis*	Bird
157	Red-throated Loon	*Gavia stellata*	Bird
158	Red-winged Blackbird	*Agelaius phoeniceus*	Bird
159	Ring-necked Duck	*Aythya collaris*	Bird
160	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Bird
161	Ruby-crowned Kinglet	*Regulus calendula*	Bird
162	Ruffed Grouse	*Bonasa umbellus*	Bird
163	Rusty Blackbird	*Euphagus carolinus*	Bird
164	Sanderling	*Calidris alba*	Bird
165	Sandhill Crane	*Grus canadensis*	Bird
166	Savannah Sparrow	*Passerculus sandwichensis*	Bird
167	Semipalmated Plover	*Charadrius semipalmatus*	Bird
168	Sharp-shinned Hawk	*Accipiter striatus*	Bird
169	Sharp-tailed Grouse	*Tympanuchus phasianellus*	Bird
170	Short-eared Owl	*Asio flammeus*	Bird
171	Solitary Sandpiper	*Tringa solitaria*	Bird
172	Sora	*Porzana carolina*	Bird
173	Spotted Sandpiper	*Actitis macularia*	Bird
174	Spruce Grouse	*Falcipennis canadensis*	Bird
175	Surf Scoter	*Melanitta perspicillata*	Bird
176	Swainson's Thrush	*Catharus ustulatus*	Bird
177	Swamp Sparrow	*Melospiza georgiana*	Bird
178	Tennessee Warbler	*Vermivora peregrina*	Bird
179	Three-toed Woodpecker	*Picoides tridactylus*	Bird
180	Townsend's Solitaire	*Myadestes townsendi*	Bird
181	Tree Swallow	*Tachycineta bicolor*	Bird
182	Trumpeter Swan	*Cygnus buccinator*	Bird
183	Varied Thrush	*Ixoreus naevius*	Bird
184	Vesper Sparrow	*Pooecetes gramineus*	Bird
185	Violet-green Swallow	*Tachycineta thalassina*	Bird
186	Warbling Vireo	*Vireo gilvus*	Bird
187	Western Tanager	*Piranga ludoviciana*	Bird
188	Western Wood-Pewee	*Contopus sordidulus*	Bird
189	White-crowned Sparrow	*Zonotrichia leucophrys*	Bird
190	White-throated Sparrow	*Zonotrichia albicollis*	Bird

191	White-winged Crossbill	*Loxia leucoptera*	Bird
192	White-winged Scoter	*Melanitta fusca*	Bird
193	Willow Ptarmigan	*Lagopus lagopus*	Bird
194	Wilson's Warbler	*Wilsonia pusilla*	Bird
195	Winter Wren	*Troglodytes troglodytes*	Bird
196	Yellow Warbler	*Dendroica petechia*	Bird
197	Yellow-bellied Flycatcher	*Empidonax flaviventris*	Bird
198	Yellow-bellied Sapsucker	*Sphyrapicus varius*	Bird
199	Yellow-rumped Warbler	*Dendroica coronata*	Bird