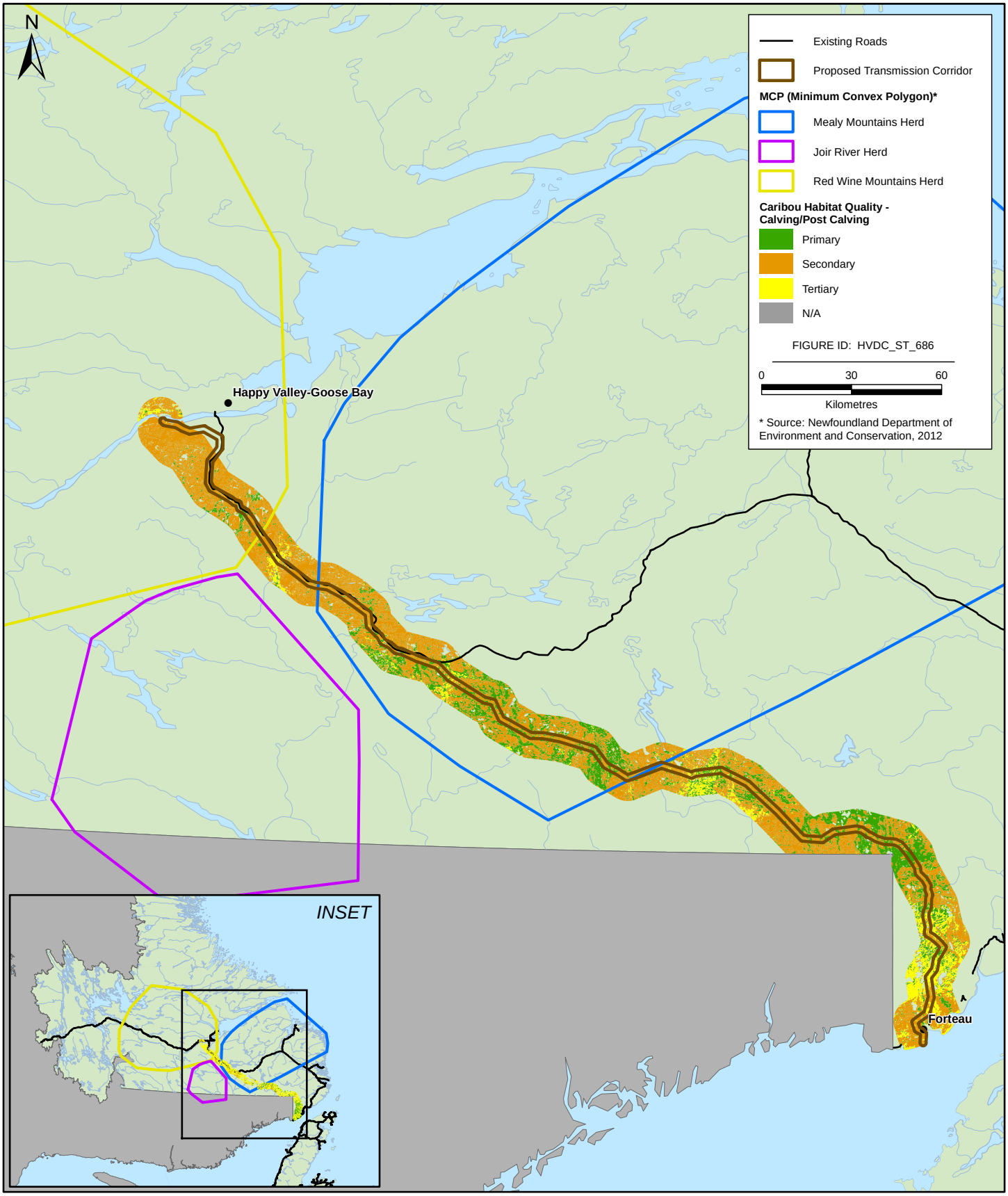

FIGURE WD1-1

Caribou habitat quality in relation to herd ranges in Southeastern Labrador during calving/post-calving

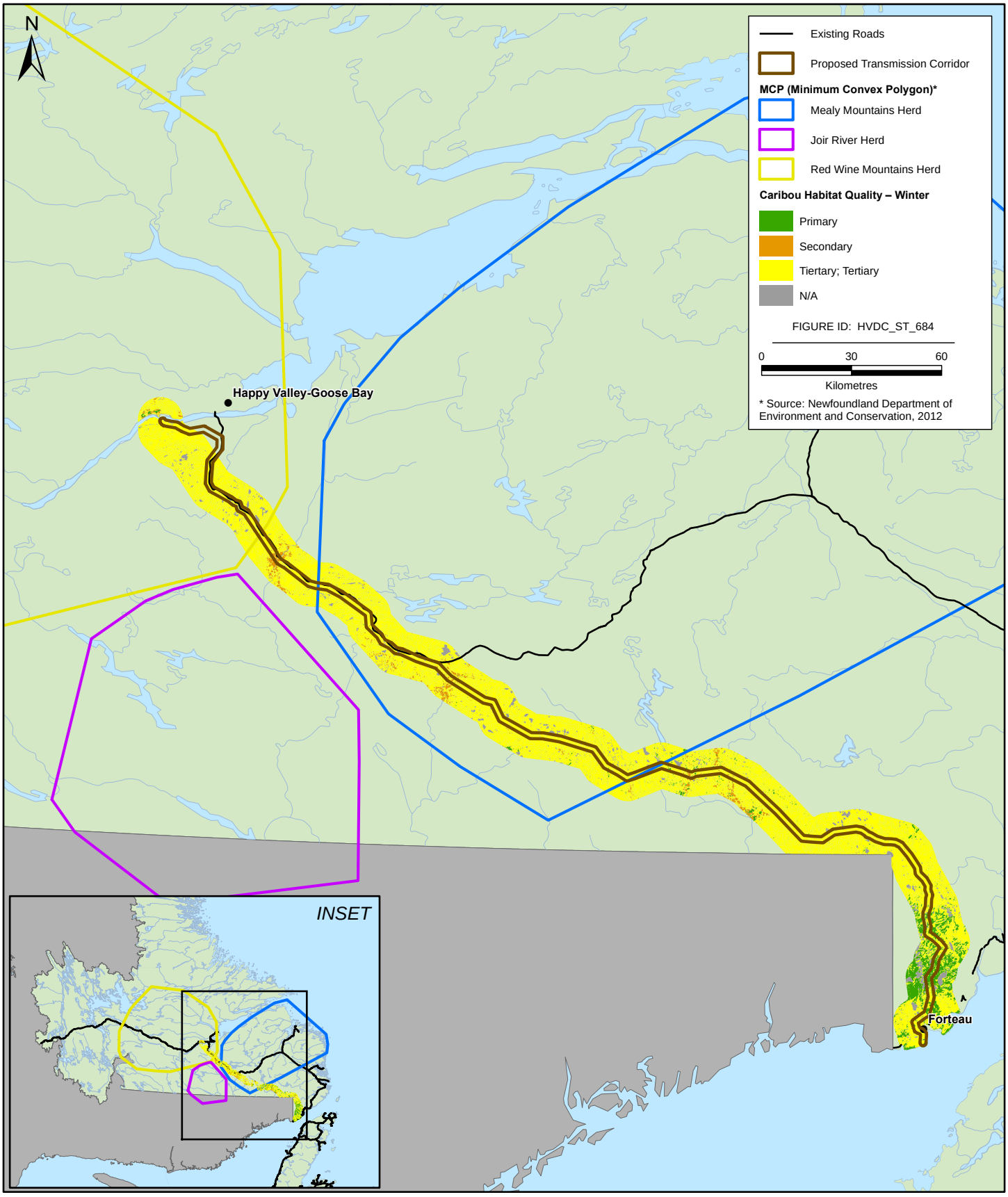

FIGURE WD1-2

Caribou habitat quality in relation to herd ranges in Southeastern Labrador during winter

Estimates of habitat that may be indirectly affected by the Project increase with increasing buffer widths used in the analysis (i.e., 1,000 m and 2,000 m buffers; Table 3). Studies have indicated a wide range of avoidance distances of man-made, linear features by caribou, with the avoidance distances typically being greater for features with higher levels of vehicle and/or human activity. Nalcor provided references to several studies that reflect these avoidance distance ranges under different scenarios (see Table 12.3.5-1 and Table 12.3.6-1 for Existing Knowledge on Project-related effects on caribou). An additional study, Polfus et al. (2011) found avoidance by mountain caribou of high-use roads by 2 km and low-use roads by 1 km. However, mountain caribou may respond differently to disturbance than woodland caribou, either due to actual behavioural differences or due to the effects of terrain amplifying sensory disturbance (for example the effects of acoustics and increased visibility on slopes adjacent to valley bottom roads). In Quebec, Leblond et al. (2012) detected apparent avoidance of roads by woodland caribou within 5 km through the use of a Resource Selection Function (RSF). However, logistic regression parameters from a RSF are difficult to interpret directly and are highly sensitive to error (Johnson and Gillingham 2008). In addition, maximum detectable avoidance distances must be interpreted with caution, because although the high samples sizes inherent in modern GPS telemetry collar studies allows the detection of avoidance at great distances, degrees of avoidance at those distances may not be biologically meaningful. For example, Rudolph et al. (2012) used a RSF to detect caribou avoidance of roads beyond 2,000 m in northern Quebec, but showed that the relative probability of occurrence declined exponentially. This analysis suggested that areas 500 m and 1,000 m from roads had relative probabilities of caribou occurrence about 60% and 80% of maximum, respectively (estimated from Figure 13 in Rudolph et al. 2012). Therefore, although avoidance may be detected at greater distances from roads, most habitat out to those maximum distances is not lost to caribou.

Potential disturbance (i.e., indirect effects on habitat) was evaluated in the EIS by quantifying all habitat within a 500 m buffer around the 2 km wide corridor rather than the right-of-way, plus the EIS included a 20% contingency for disturbance area calculations when assessing direct effects. This 3 km wide corridor is expected to conservatively reflect potential effects resulting from the Project that appropriately reflect the range of avoidance distances by caribou reported in the literature. The assessment considered habitat alteration/losses relative to the different herd's ranges, in consideration of the mitigation proposed by Nalcor (e.g., following the existing TLH3 access through the Mealy Mountains Herd range to the extent practical to limit the potential for adverse effects).

Taking all available information into account, including new information presented by the Wildlife Division, Nalcor believes that the approach used in the EIS is conservative and precautionary, and results in a reasonable estimation of the effects of the Project on woodland caribou.

The effects of the Project relative to baseline (i.e., the contribution of the Project to the existing conditions) are not likely to affect the viability or recovery of woodland caribou populations in Central and Southeastern Labrador and Newfoundland. Therefore, the Project is not likely to result in significant adverse environmental effects on caribou (Section 12.3.7.2, page 12-134). The information presented in this response does not affect the mitigation, findings or confidence of Nalcor in the conclusions of the EIS.

References:

Dyer, S.J., J.P. O'Neill, S.M. Wasel and S. Boutin. 2001. Avoidance of Industrial Development by Woodland Caribou, Journal of Wildlife Management 65: 531-542.

Environment Canada. 2012. Recovery Strategy for Woodland Caribou (*Rangifer tarandas caribou*), Boreal population, in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. xi + 138 pp.

Johnson, C.J. and M.P. Gillingham. 2008. Sensitivity of species-distribution models to error, bias, and model design: An application to resource selection functions for woodland caribou. Ecological Modelling 213: 143-155.

Leblond, M., C. Dussault and J.-P. Oullet. 2012. Avoidance of roads by large herbivores and its relation to disturbance intensity. Journal of Zoology, published online August 22, 2012. 9pp.

Polfus, J.L., M. Hebblewhite and K. Heinmeyer. 2011. Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou. Biological Conservation 144: 2637-2646.

Rudolph, T.D., P. Drapeau, M.-H. St. Laurent and L. Imbeau. 2012. Status of woodland caribou (Rangifer tarandus caribou) in the James Bay Region of northern Quebec. Woodland Caribou Recovery Task Force Scientific Advisory Group Nord-Du-Quebec.

Schmelzer, I. 2012. Range use, life history and trends in abundance of forest-dwelling *threatened* caribou populations in Labrador: An overview. Wildlife Division, Department of Environment and Conservation, Corner Brook, NL.

Requesting Organization: Department of Environment and Conservation

Information Request No.: DEC, Wildlife Division – 2

Reference: Caribou and Their Predators Component Study; Volume 2B, Section 12.3 Caribou

Information Requested: **Incorporate temporal aspects of Labrador caribou distribution into the environmental assessment.**

Using 90% kernel shape files of caribou telemetry data from 2007-2012 for Labrador caribou herds provided by Wildlife Division. These files are organized for wintering and calving/post-calving periods. Using the current (15 October 2012) ROW routing, Nalcor proposes to:

- Calculate the amount of 90% kernel distribution by each season for the relevant herds for the area within the 60 m wide ROW and the 1.06 km wide assessment area (i.e., 60 m wide ROW plus 500 m buffer on either side, 2.06 km wide assessment area, and 4.06 km wide assessment area;
- Present values in tabular format for the area of the 90% kernel affected by the 60 m ROW and within the 1.06 km-wide assessment area, 2.06 km wide assessment area, and 4.06 km wide assessment area also indicating the percentage of each kernel affected for each of the herds examined for these seasons;
- Present results with respect to seasonal range loss and at the scale of the population range;
- Create a separate figure showing the 90% kernel for each season for each herd and the overlap with the current routing (i.e., at least four figures); and
- Describe implications of this additional information on the environmental assessment predictions in the EA.

Response:

Table 1. Seasonal caribou occurrence in Southeastern Labrador – Various Assessment Areas (90% kernels from 2007-2012 telemetry data - reference Figure WD2-1 and Figure WD2-2).

Caribou Herd	Winter			Calving/Post-Calving		
	90% Kernel Total Area (km^2)	90% Kernel in Assessment Area		90% Kernel Total Area (km^2)	90% Kernel in Assessment Area	
		(km^2)	(%)		(km^2)	(%)
60 m ROW = 23.8 km^2						
Red Wine Mountains	6,957	0	0	9,267	0	0
Joir River	1,776	0	0	1,323	0	0
Mealy Mountains	9,321	0	0	8,338	1.6	0.02
60 m ROW + 500 m buffer = 421.0 km^2						
Red Wine Mountains	6,957	0	0	9,267	0	0
Joir River	1,776	0	0	1,323	0	0
Mealy Mountains	9,321	0	0	8,338	27.6	0.33
60 m ROW + 1,000 m buffer = 819.3 km^2						
Red Wine Mountains	6,957	0	0	9,267	0	0
Joir River	1,776	0	0	1,323	0	0
Mealy Mountains	9,321	0	0	8,338	51.5	0.62
60 m ROW + 2,000 m buffer = 1,619.2 km^2						
Red Wine Mountains	6,957	0	0	9,267	0	0
Joir River	1,776	0	0	1,323	0	0
Mealy Mountains	9,321	0.6	0.01	8,338	99.3	1.19

Note: ROW = right-of-way

As noted in the EIS, the Project crosses the reported ranges of the Red Wine Mountains Herd and the Mealy Mountains Herd provided by the Wildlife Division (see Figure 10.3.4-4). To evaluate the potential effects of the Project on important habitat within those ranges, Nalcor evaluated the recently determined Project right-of-way alignment in relation to the 90% probability of occupancy kernel for the caribou calving/post-calving season (i.e., summer) and the winter season.

There is no overlap of the 60 m wide right-of-way or any of the three assessment areas examined (i.e., 500 m, 1,000 m or 2,000 m buffer widths) with the 90% probability of occupancy kernel for the calving season (Figure WD2-1) or the winter season (Figure WD2-2) for the Red Wine Mountains Herd or the Joir River (Table 1).

There is no overlap of the 60 m wide right-of-way with either 500 m or 1,000 m buffers and the 90% probability of occupancy kernel for the Mealy Mountains Herd in winter. However, there is overlap with the 2,000 m buffer and the 90% kernel in winter (0.01%), which occurs on the south-west edge of the 90% probability of occupancy kernel (Table 1; Figure WD2-2). There is also overlap with the Mealy Mountains Herd 90% kernel, the right-of-way (0.02%) and the right-of-way with 500 m (0.33%), 1,000 m (0.62%) and 2,000 m (1.19%) buffers in summer (Figure WD2-1).

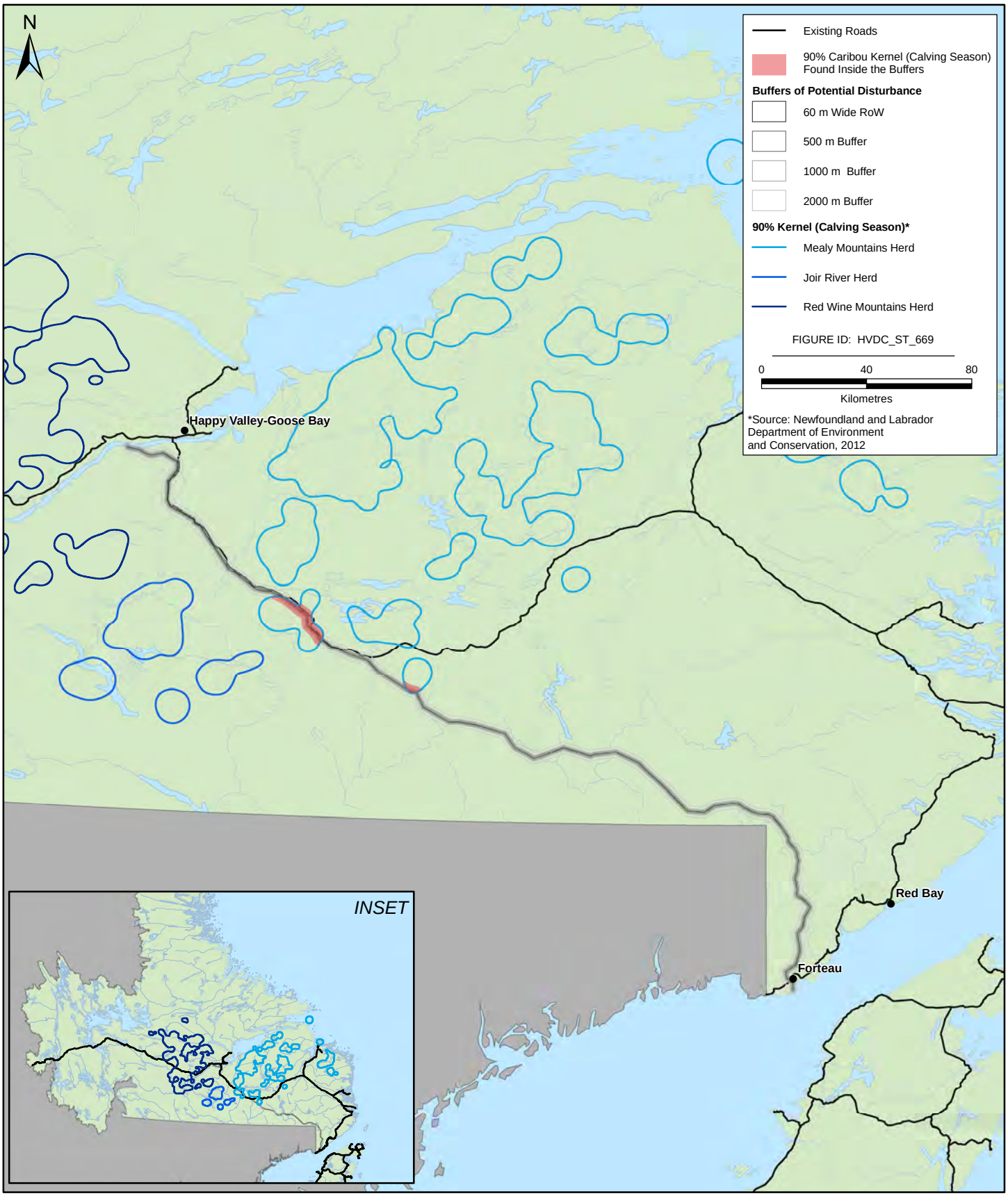

FIGURE WD 2-1

Summer Caribou occurence in the Southeastern Labrador Region and assessment area buffers

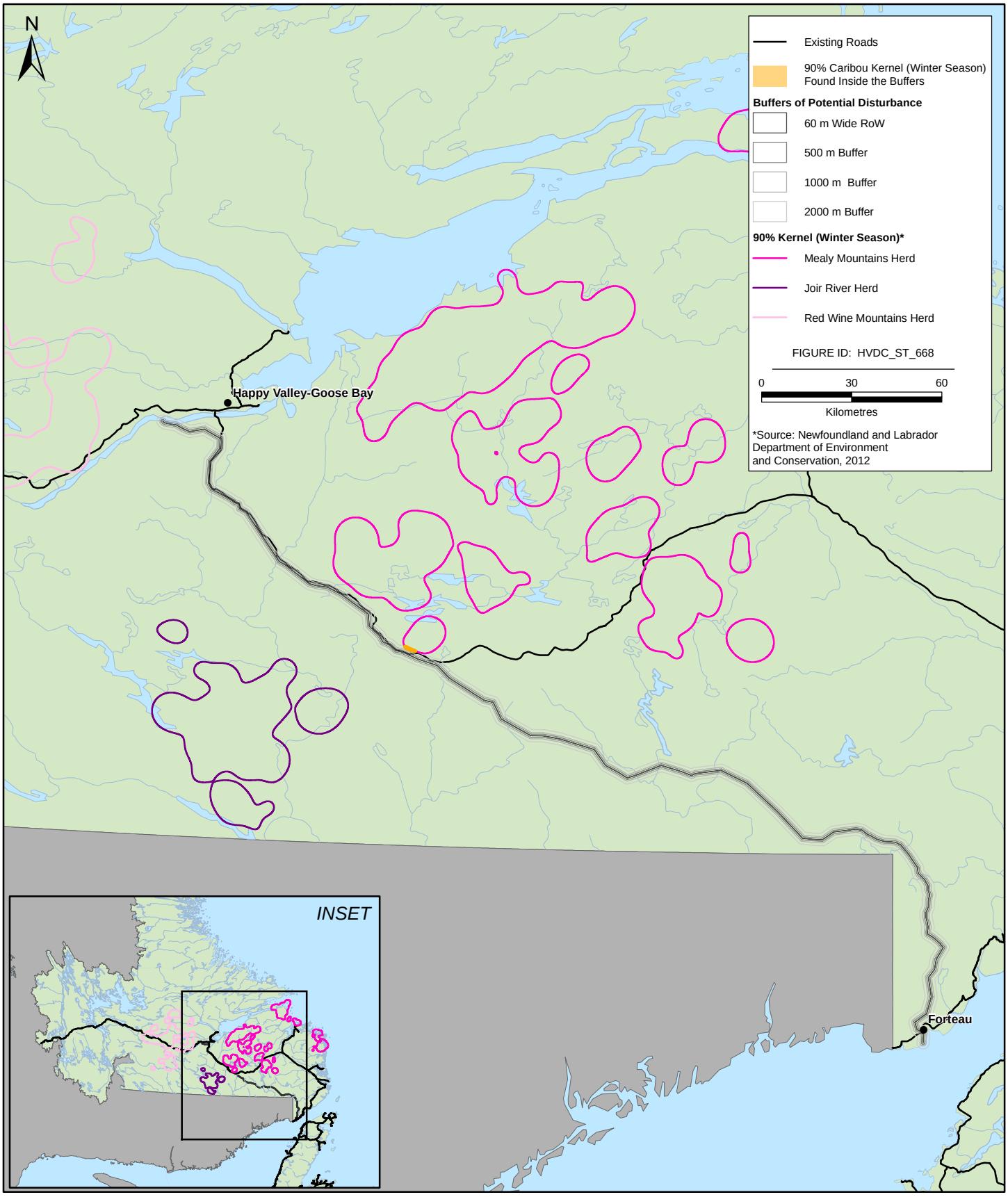

FIGURE WD 2-2

Winter Caribou occurence in the Southeastern Labrador Region and assessment area buffers

The Labrador – Island Transmission Link EIS examined an assessment area with a 500 m buffer that is consistent with Dyer et al. (2001) and the Recovery Strategy for Woodland Caribou, Boreal Population (Environment Canada 2012). Environment Canada (2012) defines 'undisturbed habitat' as that beyond 500 m from disturbances. The analyses of the additional buffer widths (i.e., 1,000 m and 2,000 m buffers) also indicate that effects on caribou habitat may be of low magnitude.

Studies have indicated a wide range of avoidance distances of man-made, linear features by caribou, with the avoidance distances typically being greater for features with higher levels of vehicle and/or human activity. Nalcor provided references to several studies that reflect these avoidance distance ranges under different scenarios (see Table 12.3.5-1 and Table 12.3.6-1 for Existing Knowledge on Project-related effects on caribou). In an additional study, Polfus et al. (2011) found avoidance by mountain caribou of high-use roads by 2 km and low-use roads by 1 km. However, mountain caribou may respond differently to disturbance than woodland caribou, either due to actual behavioural differences or due to the effects of terrain amplifying sensory disturbance (for example, the effects of acoustics and increased visibility on slopes adjacent to valley bottom roads). In Quebec, Leblond et al. (2012) detected apparent avoidance of roads by woodland caribou within 5 km through the use of a Resource Selection Function (RSF). However, logistic regression parameters from a RSF are difficult to interpret directly and are highly sensitive to error (Johnson and Gillingham 2008). In addition, maximum detectable avoidance distances must be interpreted with caution, because although the high samples sizes inherent in modern GPS telemetry collar studies allows the detection of avoidance at great distances, degrees of avoidance at those distances may not be biologically meaningful. For example, Rudolph et al. (2012) used a RSF to detect caribou avoidance of roads beyond 2,000 m in northern Quebec, but showed that the relative probability of occurrence declined exponentially. This analysis suggested that areas 500 m and 1,000 m from roads had relative probabilities of caribou occurrence about 60% and 80% of maximum, respectively (estimated from Figure 13 in Rudolph et al. 2012). Therefore, although avoidance may be detected at greater distances from roads, most habitat out to those maximum distance is not lost to caribou.

Potential disturbance (i.e., indirect effects on habitat) was evaluated in the EIS by quantifying all habitat within a 500 m buffer around the 2 km wide corridor rather than the right-of-way, plus the EIS included a 20% contingency for disturbance area calculations when assessing direct effects. This 3 km wide corridor is expected to conservatively reflect potential effects resulting from the Project that appropriately reflect the range of avoidance distances by caribou reported in the literature. The assessment considered the mitigation proposed by Nalcor (e.g., following existing access to the extent practical) to limit the potential for adverse effects on woodland caribou.

Taking all available information into account, including new information presented by the Wildlife Division, Nalcor believes that this approach is sufficiently precautionary to result in a reasonable estimation of the effects of the Project.

The additional information presented by Nalcor in this response supports the predictions and findings of the environmental assessment as it relates to woodland caribou in Labrador and the conclusion that "The effects of the Project relative to baseline are not likely to affect the viability or recovery of

woodland Caribou populations in Central and Southeastern Labrador and Newfoundland. Therefore, the Project is not likely to result in significant adverse environmental effects on Caribou." As such, the mitigation and follow-up programs proposed in the EIS are considered appropriate and no changes are proposed by Nalcor.

References:

Dyer, S.J., J.P. O'Neill, S.M. Wasel and S. Boutin. 2001. Avoidance of Industrial Development by Woodland Caribou, Journal of Wildlife Management 65: 531-542.

Environment Canada. 2012. Recovery Strategy for Woodland Caribou (*Rangifer tarandas caribou*), Boreal population, in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. xi + 138 pp.

Johnson, C.J. and M.P. Gillingham. 2008. Sensitivity of species-distribution models to error, bias, and model design: An application to resource selection functions for woodland caribou. Ecological Modelling 213: 143-155.

Leblond, M., C. Dussault and J.-P. Oullet. 2012. Avoidance of roads by large herbivores and its relation to disturbance intensity. Journal of Zoology, published online August 22, 2012. 9pp.

Polfus, J.L., M. Hebblewhite and K. Heinmeyer. 2011. Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou. Biological Conservation 144: 2637-2646.

Rudolph, T.D., P. Drapeau, M.-H. St. Laurent and L. Imbeau. 2012. Status of woodland caribou (Rangifer tarandus caribou) in the James Bay Region of northern Quebec. Woodland Caribou Recovery Task Force Scientific Advisory Group Nord-Du-Quebec.

Requesting Organization: Department of Environment and Conservation

Information Request No.: DEC, Wildlife Division - 3

Reference: Caribou and Their Predators Component Study; Volume 2B, Section 12.3 Caribou

Information Requested: **Evaluate potential avoidance of the actual ROW by caribou**

To examine the potential indirect effects of the Project on woodland caribou habitat due to sensory disturbance, Nalcor considered a 2 km wide LSA (representing the proposed corridor) plus a 500 m buffer either side for a total width of 3 km. However, this is a precautionary approach, as avoidance due to sensory disturbance will not be absolute, there is no expected avoidance of roads beyond 500 m of the disturbance, and much of the LSA will remain undisturbed by the Project. As the final ROW alignment had not been finalized at the time of the assessment, the ROW was considered to be along the centreline of the corridor and an additional 20% contingency was added to allow for deviations of the ROW within the corridor, and clearing for access and other Project components whose locations had not yet been identified. With the current ROW now available, Nalcor proposes to complete the following using the information provided by the Wildlife Division:

- Calculate the amount of direct habitat altered/loss as a result of the actual clearing (i.e., 60 m wide ROW). There is no need for an additional 20% and the ROW will reflect the recent adjustment near the Churchill River;
- Calculate the amount of potential indirect habitat loss due to avoidance of sensory disturbance within the 1.06 km wide assessment area by overlaying the recently updated MCPs of relevant Labrador caribou herds on the current 60 m wide ROW and associated 500 m wide buffer on each side to quantify the area and percentage of each herd range potentially affected. This will include an examination of data gaps in winter range use east of the Kenamu River;
- Examine the overlap of the Project in the vicinity of the indicated area of interchange between caribou from the Joir River and Mealy Mountain Herds (considered jointly in the EIS); and
- Describe implications of this additional information on the environmental assessment predictions in the EA.
- Indirect habitat loss will be calculated and discussed for the seasonal ranges (wintering and calving/post-calving); in addition to the total herd ranges. This will also include a summary of the total amount of linear features within the seasonal ranges and the total herd ranges, and a discussion of the potential indirect effects of the roads and transmission lines based on literature.

Response:

In the EIS, Nalcor completed a regional analysis with respect to direct (i.e., habitat alteration / loss) and indirect (e.g., reduced habitat suitability resulting from disturbance) effects of the Project on caribou habitat by delineating the Regional Study Area (RSA) for the environmental assessment as the range (i.e., Minimum Convex Polygon [MCP]) of each woodland caribou herd in Southeastern Labrador, as provided by the Wildlife Division. Recent information from the Wildlife Division includes seasonal (i.e., calving / post-calving, winter) 90% probability of occupancy kernels for each of these herds (Figures WD3-1 and WD3-2). Please refer to Nalcor's response to the Wildlife Division's request WD-4 for additional information related to the potential effects of the Project on woodland caribou habitat in Labrador from a regional perspective.

The potential clearing associated with the Project overlaps the ranges of the Red Wine Mountains (RWM) and Mealy Mountains (MM) Caribou Herds (Figures WD3-1 and WD3-2). The MCP calculated for the Joir River (JR) Herd does not overlap the Project, although the Wildlife Division considers this 'subpopulation' to be associated with the MM Herd. This potential clearing for the right-of-way overlaps the 90% kernels only in the case of the calving / post-calving kernel for the MM Herd and does not affect the RWM herd range. Clearing for the Project will not occur within the 90% occupancy kernel of the RWM range because, in response to concerns raised by regulators and Aboriginal groups regarding caribou, Nalcor has proposed to re-route the HVdc transmission line along the existing access road to the proposed Muskrat Falls generating facility. This action is not based on new information or analyses, but has been proposed as a precautionary approach to avoid the creation of additional disturbance and associated access through a portion of the RWM caribou range.

Table 1 presents the direct habitat alteration / loss that would likely occur as a result of the Project due to construction of the 60 m wide right-of-way. However, the amount of habitat directly affected will depend on the habitat type being crossed. For example, not all habitat types will require clearing of the vegetation within the right-of-way, and disturbance will be limited to the tower locations and the access trail within the right-of-way. As such, even the values presented in the following tables represent a conservative and precautionary estimate of the Project effects. The 60 m wide right-of-way will affect the 90% occupancy kernel of the MM herd only (0.02%), and only during the calving / post-calving season (Table 1).

Table 1. Caribou herd range in Southeastern Labrador – Direct Habitat Alteration / Loss associated with the 60 m wide right-of-way (reference Figure WD3-1 and WD3-2).

Caribou Herd	Herd Range MCP			90% Kernel		
	Total Area (km^2)	In Assessment Area		Total Area (km^2)[(a)]	In Assessment Area	
		(km^2)	(%)		(km^2)	(%)
Red Wine Mountains	46,970	4	0.01	C/PC = 9,267 W = 6,956	0 0	0 0
Mealy Mountains	44,213	8	0.02	C/PC = 8,338 W = 9,321	20	0.02 0
Joir River	8,436	0	0	C/PC = 1,323 W = 1,776	00	0 0

[(a)] C/PC = calving/post calving, W = winter.

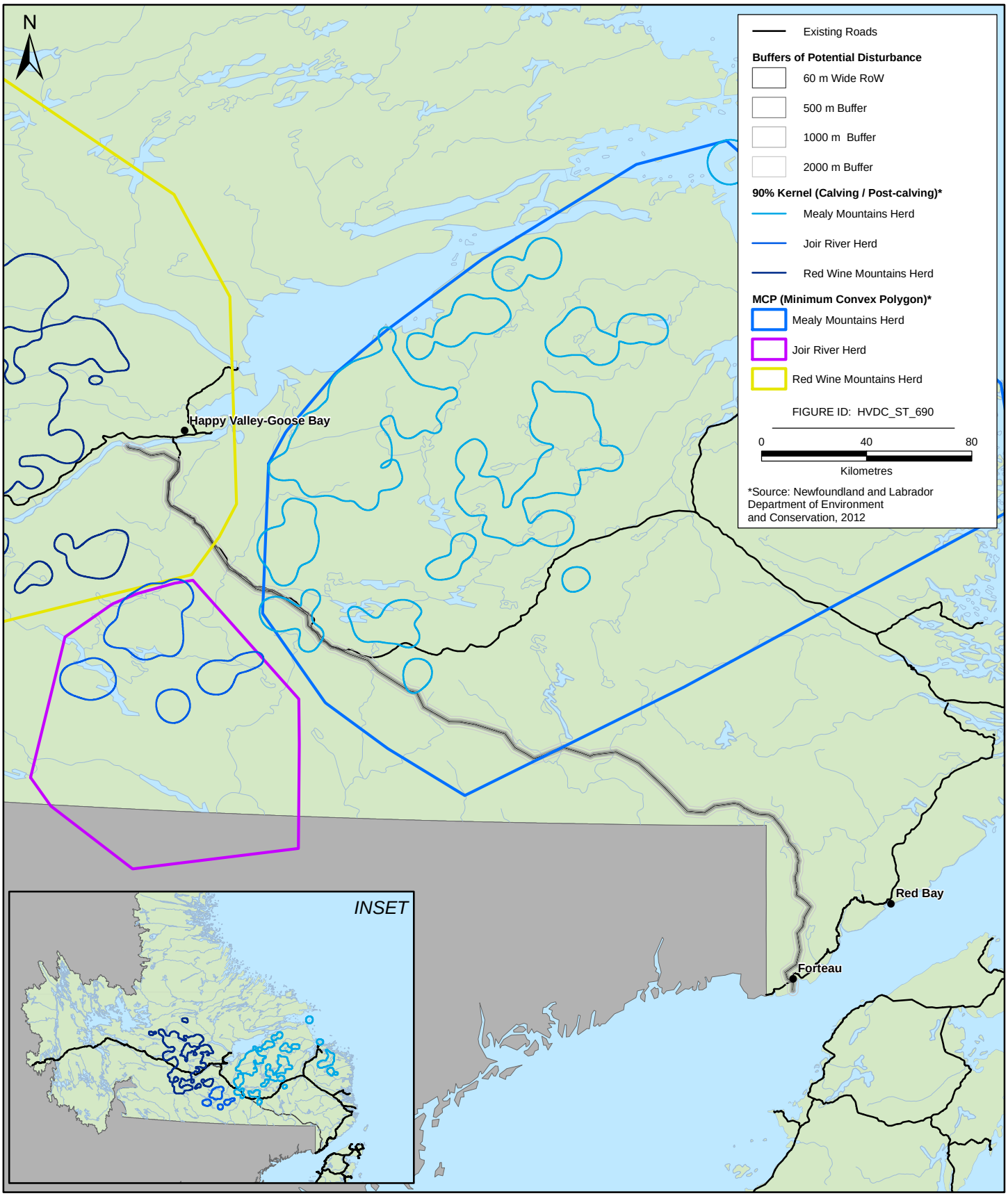

FIGURE WD 3-1

Caribou herd range (MCP) in Southeastern Labrador and assessment area buffers during calving/post-calving

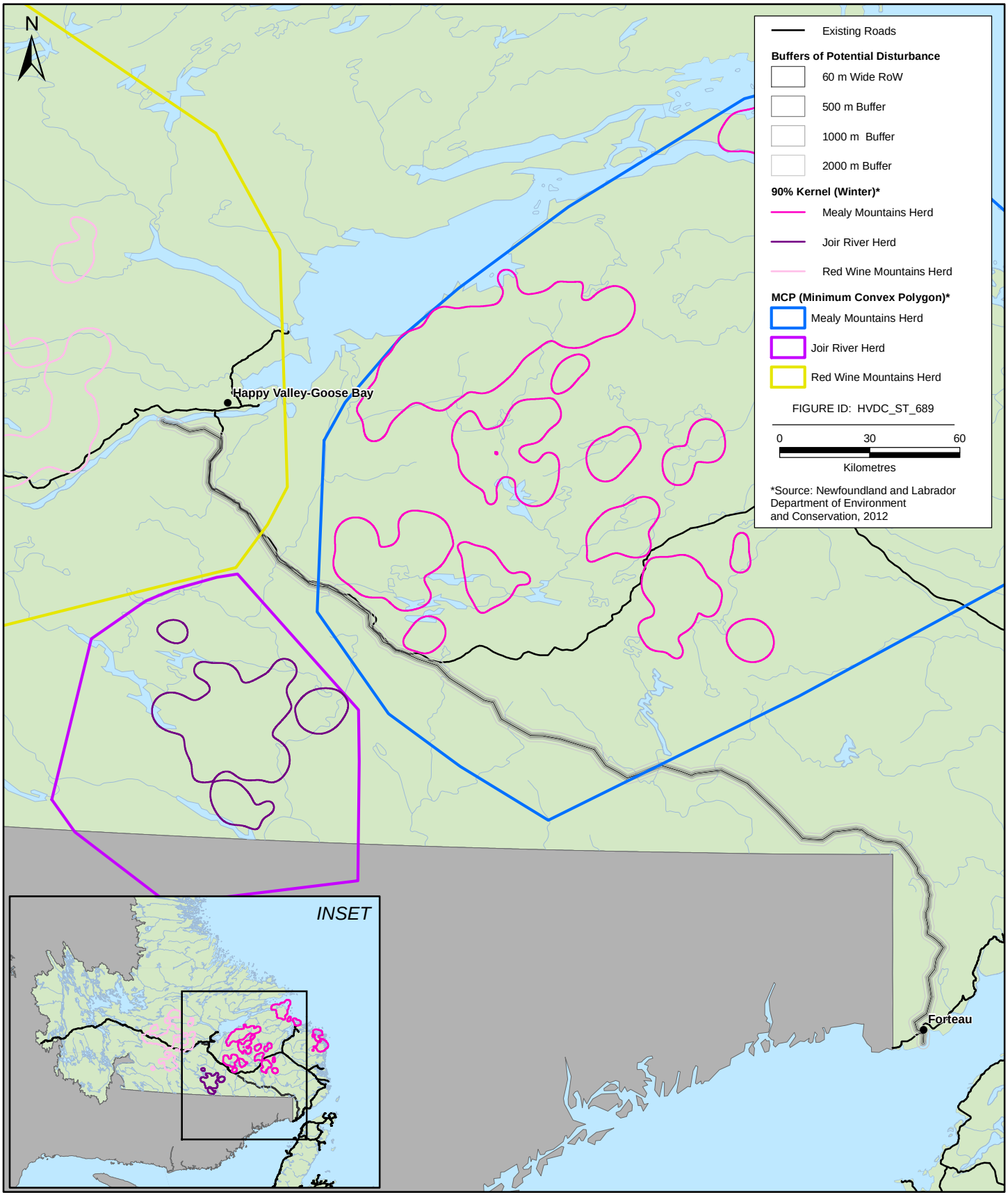

FIGURE WD 3-2

Caribou herd range (MCP) in Southeastern Labrador and assessment area buffers during winter

Table 2 examines the habitat altered / lost due to indirect effects using an assessment area of a 500 m buffer around the right-of-way. This approach is consistent with Dyer et al. (2001) and the woodland caribou recovery strategy released by Environment Canada (Environment Canada 2012). This 1.06 km wide assessment area would only overlap with the calving / post-calving 90% kernel of the MM Herd (0.3%).

Table 2. Caribou herd range in Southeastern Labrador – Indirect Habitat Alteration / Loss associated with the 60 m wide right-of-way + 500 m buffer (reference Figure WD3-1 and WD3-2).

Caribou Herd	Herd Range MCP			90% Kernel		
	Total Area (km^2)	In Assessment Area		Total Area (km^2)[(a)]	In Assessment Area	
		(km^2)	(%)		(km^2)	(%)
Red Wine Mountains	46,970	66	0.1	C/PC = 9,267 W = 6,956	00	0 0
Mealy Mountains	44,213	143	0.3	C/PC = 8,338 W = 9,321	27.6 0	0.3 0
Joir River	8,436	0	0	C/PC = 1,323 W = 1,776	0 0	0 0

[(a)] C/PC = calving/post calving, W = winter.

If the buffer around the 60 m wide right-of-way is increased to 1,000 m (i.e., 2.06 km), the overlap of the assessment area with the MCP ranges is shown in Table 3. The only overlap is with the calving/post-calving 90% kernel of the MM Herd (0.6%).

Table 3. Caribou herd range in Southeastern Labrador – Indirect Habitat Alteration / Loss associated with the 60 m wide right-of-way + 1,000 m buffer (reference Figure WD3-1 and WD3-2).

Caribou Herd	Herd Range MCP			90% Kernel		
	Total Area (km^2)	In Assessment Area		Total Area (km^2)[(a)]	In Assessment Area	
		(km^2)	(%)		(km^2)	(%)
Red Wine Mountains	46,970	129	0.3	C/PC = 9,267 W = 6,956	0 0	0 0
Mealy Mountains	44,213	277	0.6	C/PC = 8,338 W = 9,321	51 0	0.6 0
Joir River	8,436	0	0	C/PC = 1,323 W = 1,776	0 0	0 0

[(a)] C/PC = calving/post calving, W = winter.

If the buffer is 2,000 m (i.e., 4.06 km), the overlap of the assessment area with the MCP ranges is shown in Table 4. Again there is overlap with the calving/post-calving 90% kernel of the MM Herd (1.2%). In addition, with this buffer there is a potential indirect effect on the 90% kernel for the MM Herd during winter (0.01% of the kernel). There is still no overlap with seasonal 90% kernels for the RWM or JR Herds.

Table 4. Caribou herd range in Southeastern Labrador – Indirect Habitat Alteration / Loss associated with the 60 m wide right-of-way + 2,000 m buffer (reference Figure WD3-1 and WD3-2).

Caribou Herd	Herd Range MCP			90% Kernel		
	Total Area (km^2)	In Assessment Area		Total Area (km^2)[(a)]	In Assessment Area	
		(km^2)	(%)		(km^2)	(%)
Red Wine Mountains	46,970	258	0.5	C/PC = 9,267 W = 6,956	0 0	0 0
Mealy Mountains	44,213	544	1.2	C/PC = 8,338 W = 9,321	99 1	1.2 0.01
Joir River	8,436	0	0	C/PC = 1,323 W = 1,776	0 0	0 0

[(a)] C/PC = calving/post calving, W = winter.

The analyses indicate that direct habitat loss is limited in the MCPs of the RWM and MM herd ranges. Habitat affected by the 60 m wide right-of-way represents ≤0.02% of the RWM and MM ranges, and affects 0.02% of the 90% occupancy kernel for MM Herd during calving / post-calving only. The Project does not affect any habitat within the 90% occupancy kernel for the RWM range, because, in response to concerns raised by regulators and Aboriginal groups regarding caribou, Nalcor has proposed to re-route the HVdc transmission line along the existing access road to the proposed Muskrat Falls generating facility. In addition, unauthorized use of the existing road (e.g., for hunting) is not allowed, as there is a 24/7 manned gate at the entrance. These actions are not based on new information or analyses, but have been proposed as a precautionary approach to avoid the creation of additional disturbance and associated access through a portion of the RWM caribou range.

Indirect habitat loss is predicted due to sensory disturbance within the recognized 500 m wide buffer (Dyer et al. 2001; Environment Canada 2012). The analyses of the additional buffer widths (i.e., 1,000 m and 2,000 m buffers) also represent potentially affected areas that are small relative to the size of the ranges (i.e., ≤0.5 % for the RWM Herd, ≤1.2 % for the MM Herd, and no overlap with the JR 'subpopulation'); and <1.2% of the 90% occupancy probability kernel during calving / post-calving and ≤0.01% during winter for the MM Herd. Due to the right-of-way realignment, habitat within the 90% occupancy kernel for the RWM herd will not be directly or indirectly affected by the Project. Polfus et al. (2011) found avoidance by mountain caribou of high-use roads by 2 km and low-use roads by 1 km. However, mountain caribou may respond differently to disturbance than woodland caribou, either due to actual behavioural differences or due to the effects of terrain amplifying sensory disturbance (for example the effects of acoustics and increased visibility on slopes adjacent to valley bottom roads).

Studies have indicated a wide range of avoidance distances of man-made, linear features by caribou, with the avoidance distances typically being greater for features with higher levels of vehicle and/or human activity. Nalcor provided references to several studies that reflect these avoidance distance ranges under different scenarios (see Table 12.3.5-1 and Table 12.3.6-1 for Existing Knowledge on Project-related effects on caribou).

In Quebec, Leblond et al. (2012) detected apparent avoidance of roads by woodland caribou within 5 km through the use of a Resource Selection Function (RSF). However, logistic regression parameters from a

RSF are difficult to interpret directly and are highly sensitive to error (Johnson and Gillingham 2008). In addition, maximum detectable avoidance distances must be interpreted with caution, because although the high samples sizes inherent in modern GPS telemetry collar studies allows the detection of avoidance at great distances, degrees of avoidance at those distances may not be biologically meaningful. For example, Rudolph et al. (2012) used a RSF to detect caribou avoidance of roads beyond 2,000 m in northern Quebec, but showed that the relative probability of occurrence declined exponentially. This analysis suggested that areas 500 m and 1,000 m from roads had relative probabilities of caribou occurrence about 60% and 80% of maximum, respectively (estimated from Figure 13 in Rudolph et al. 2012). Therefore, although avoidance may be detected at greater distances from roads, most habitat out to those maximum distances is not lost to caribou. Potential disturbance (i.e., indirect effects on habitat) was evaluated in the EIS by quantifying all habitat within a 500 m buffer around the 2 km wide corridor rather than the right-of-way, plus the EIS included a 20% contingency for disturbance area calculations when assessing direct effects. This 3 km wide corridor is expected to conservatively reflect potential effects resulting from the Project that appropriately reflect the range of avoidance distances by caribou reported in the literature. The assessment considered the mitigation proposed by Nalcor (e.g., following existing access to the extent practical) to limit the potential for adverse effects on woodland caribou.

Taking all available information into account, including new information presented by the Wildlife Division, Nalcor believes that this approach is sufficiently precautionary to result in a reasonable estimation of the effects of the Project.

Note that the Wildlife Division recently identified ‘large groups of caribou outside core wintering areas’ for the MM Herd indicating that the 90% kernels are not fully defined in this area, based on the results of this most recent 2012 census (J. Fenske, pers. comm.). While a concern, these sightings occurred north and east of the Trans-Labrador Highway, which is located between the Project and these caribou.

The Wildlife Division provided information indicating an ‘area of exchange’ where caribou are known to travel between the MM and JR Herds (J. Fenske 2012, pers. comm.). The Project would occur in this area. For this and other environmental considerations, Nalcor designed its alignment to occur along the existing Trans-Labrador Highway right-of-way for much of the Labrador-Island Transmission route through the Central and Southeastern Labrador region. This was completed so that a single ‘service corridor’ would remain in this area, and coincidentally through most of this area of exchange, thereby limiting the potential for habitat fragmentation and avoiding increased access in this area. This approach is expected to limit the potential for disturbance resulting from the Project to animals from both the MM and JR herds in the area of exchange. However, Nalcor acknowledges that although following existing access will help mitigate the effects of the Project, it will not eliminate them entirely. For example, research by Dyer et al. (2002) and Leblond et al. (2012) suggest that the frequency that caribou cross linear disturbances decreases as disturbance intensity increases.

The EIS considered and assessed the likely effects of habitat fragmentation and the likely effects on woodland caribou herds in Labrador potentially affected by the Project, including the MM Herd and the JR Herd (considered jointly in the EIS), and the RWM Herd. The potential effects of the Project on woodland caribou habitat fragmentation and proposed mitigation were discussed in detail for the construction phase

(Chapter 12, Section 12.3.5.1). For example, caribou in the boreal forest require large tracts of relatively undisturbed, older forest habitat to spread out so they are harder for predators and hunters to locate, and to avoid the linear corridors used by predators and hunters. Alteration of habitat, specifically the creation of early successional, shrub habitat that may occur as a result of forest clearing, may also lead to an increase in moose numbers resulting in increased predation pressure (Fortin et al. 2008; Mahoney and Virgil 2003). Indirect mortality is also possible as a result of increased access to previously remote areas. This is a particular concern for sedentary Labrador caribou herds listed under the *Species at Risk Act* (SARA) and the *Newfoundland and Labrador Endangered Species Act* (NLESA). Both the RWMH and the MMH have experienced illegal hunting activities, and increased access could contribute to this existing problem.

The effects of the Project on woodland caribou populations were assessed in detail in the EIS, including the potential effects of direct and indirect habitat loss on the abundance and productivity of caribou, the effects of increased access on mortality due to hunting and predation, the effects of increased moose habitat leading to increases in moose and predator populations, and the effects of direct mortality (Chapter 12, Section 12.3.3.1). Development of the ROW is not likely to substantially increase forage availability for moose. As moose numbers along the corridor are not likely to increase measurably, it is predicted that there will be little or no increase in the local predator populations (e.g., wolves in Central and Southeastern Labrador, and coyotes or black bears in Newfoundland) and subsequent predation on caribou (chapter 12, Section 12.3.6.3). Mortality of caribou due to vehicle collisions along access roads could occur and would be highest during construction when vehicle activity is greatest. Caribou mortality would be most likely during the winter when animals occur between snow berms along roads. Adherence to appropriate speed limits applicable to the size and class of the access roads and signage in known caribou crossing areas, together with increased awareness training for Project personnel, are likely to minimize the incidence of vehicle collisions (Chapter 12, Section 12.3.5.3). During operations, vehicle use will typically be sporadic along the ROW, isolated and of short duration. Therefore any risk of caribou mortality from vehicle collision is likely to be minimal (Chapter 12, Section 12.3.6.3). Project access roads as well as the ROW could increase access for various land use activities, such as hunting and trapping. Wildlife mortality due to enhanced access will be mitigated through measures such as employee education, a policy of no harvesting for all on-site Project personnel, access control measures, decommissioning of temporary access roads when they are no longer required, as appropriate. In addition, the ROW will follow existing linear disturbances, where possible, to minimize the creation of new access. Additionally, work areas and access roads will be off limits to unescorted non-Project personnel, including during hunting season when work sites are active (Chapter 12, Section 12.3.5.3).

The likely residual environmental effects of the Project on Caribou are as follows (Chapter 12, Section 12.3.5.3):

- Adverse, because there will be habitat alteration and/or loss, temporary sensory disturbances, potential for direct or indirect mortality (vehicle collision, or increased predation / hunting), the possibility of reduced forage availability or access and the potential for changes in migration or movement routes;

- Of low magnitude for Central and Southeastern Labrador and Newfoundland caribou as habitat alteration and / or loss is expected to affect less than 5% of Caribou herd ranges (Labrador) or Primary Core area (Newfoundland);
- Limited to the RSA, because although the effects to habitat are within the LSA, sensory disturbance and avoidance could extend beyond the LSA; and
- Of medium-term to far future duration because although many Construction-related effects (e.g., sensory disturbance) are expected to be limited to the Construction period, habitat alteration / loss and avoidance along the ROW is expected to continue through the life of the Project.

The effects of the Project relative to baseline (i.e., the contribution of the Project to the existing conditions) are not likely to affect the viability or recovery of woodland caribou populations in Central and Southeastern Labrador and Newfoundland. Therefore, the Project is not likely to result in significant adverse environmental effects on caribou (Section 12.3.7.2, page 12-134). The information presented in this response does not affect the mitigation, findings or confidence in the conclusions of the EIS.

References:

Dyer, S.J., J.P. O'Neill, S.M. Wasel and S. Boutin. 2001. Avoidance of Industrial Development by Woodland Caribou, Journal of Wildlife Management 65: 531-542.

Dyer, S.J., O'Neill, J.P., Wasel, S.M. & Boutin, S. (2002). Quantifying barrier effects of roads and seismic lines on movements of female woodland caribou in northeastern Alberta. Canadian Journal of Zoology 80, 839–845.

Environment Canada. 2012. Recovery Strategy for Woodland Caribou (*Rangifer tarandas caribou*), Boreal population, in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. xi + 138 pp.

Fortin, D., R. Courtois, P. Etcheverry, C. Dussault and A. Gingras. 2008. Winter selection of landscapes by woodland caribou: behavioural response to geographical gradients in habitat attributes. Journal of Applied Ecology 45: 1392-1400.

Johnson, C.J. and M.P. Gillingham. 2008. Sensitivity of species-distribution models to error, bias, and model design: An application to resource selection functions for woodland caribou. Ecological Modelling 213: 143-155.

Leblond, M., C. Dussault and J.-P. Oullet. 2012. Avoidance of roads by large herbivores and its relation to disturbance intensity. Journal of Zoology, published online August 22, 2012. 9pp.

Polfus, J.L., M. Hebblewhite and K. Heinmeyer. 2011. Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou. Biological Conservation 144: 2637-2646.

Mahoney, S.P. and J.A. Virgil. 2003. Habitat Selection and Demography of a Nonmigratory Woodland Caribou Population in Newfoundland. Canadian Journal of Zoology 81: 321-334.

Rudolph, T.D., P. Drapeau, M.-H. St. Laurent and L. Imbeau. 2012. Status of woodland caribou (Rangifer tarandus caribou) in the James Bay Region of northern Quebec. Woodland Caribou Recovery Task Force Scientific Advisory Group Nord-Du-Quebec.

Requesting Organization: Department of Environment and Conservation

Information Request No.: DEC, Wildlife Division - 4

Reference: Caribou and Their Predators Component Study; Volume 2B, Section 12.3 Caribou

Information Requested: **Range fragmentation**

- Include a discussion on the effects of range fragmentation. Investigate whether the northern and southern components of the Red Wine Mountains range may become isolated from each other since the proposed transmission line will run parallel with the TLH and the river, thus potentially reducing connectivity between these portions of the range.
- Conduct a regional analysis for Labrador caribou herds to determine if there are any regional effects to caribou resulting from the project.

Response:

The EIS considered and assessed the likely effects of habitat fragmentation on woodland caribou herds in Labrador potentially affected by the Project, including the Mealy Mountains (MM) Herd and the Joir River (JR) Herd (considered jointly in the EIS), and the Red Wine Mountains (RWM) Herd. The potential effects of the Project on woodland caribou habitat fragmentation and proposed mitigation were discussed in detail for the construction phase (Chapter 12, Section 12.3.5.1). For example, caribou in the boreal forest require large tracts of relatively undisturbed, older forest habitat to spread out so they are harder for predators and hunters to locate, and to avoid the linear corridors used by predators and hunters. Alteration of habitat, specifically the creation of early successional, shrub habitat that may occur as a result of forest clearing, may also lead to an increase in moose numbers resulting in increased predation pressure (Fortin et al. 2008; Mahoney and Virgil 2003). Indirect mortality is also possible as a result of increased access to previously remote areas. This is a particular concern for sedentary Labrador caribou herds listed under the *Species at Risk Act* (SARA) and the *Newfoundland and Labrador Endangered Species Act* (NLESA). Both the RWMH and the MMH have experienced illegal hunting activities, and increased access could contribute to this existing problem.

To limit the potential for habitat fragmentation and increased access, Nalcor used standard, accepted routing considerations to follow existing disturbance corridors to the extent practical within Labrador (i.e., direct route from Muskrat Falls to coincide with the orientation of the TLH3) (see Figure 12.3.2-1 in the EIS). Nalcor's route presented and assessed in the EIS (see Figure 12.3.2-1 in the EIS) crosses a small portion of the south-east portion of the RWM Herd range on the south side of the Churchill River, avoids the JR Herd range, and follows the TLH3, on the south side, through much of where the right-of-way crosses the western extent of the MM Herd range. The majority of the northern third of the Project transmission line right-of-way assessed in the EIS lies adjacent to an existing disturbance corridor, thereby minimizing the amount of habitat fragmentation caused by the Project.

Existing linear disturbance in the RWM herd range is limited (e.g., the TLH3 and the TLH1 from Goose Bay west to Labrador West). Since the submission of the EIS, Nalcor has changed the northern portion of the route to follow a forestry access road off the TLH3 that has been extended to access the Lower Churchill Hydroelectric Generation Project. The Project right-of-way then follows the TLH3 at the south-east edge of the RWM Herd's range. As such, it is not expected that the northern and southern components of the RWM Herd's range (see Figure 12.3.2-1 in the EIS) will become isolated (i.e., there is limited overlap of the Project and the RWM Herd's reported range). This is supported by the discussion that follows regarding Nalcor's evaluation of Project overlap with the most recent caribou winter and calving season habitat polygons provided by the Wildlife Division. Further, as shown in the 12.3.2-1 of the EIS, the Project crosses a small portion of the south-east quadrant of the RWM Herd's range, and is not expected to result in a split of the range as the Project follows existing access (i.e., access to Muskrat Falls and the TLH3) to the extent practical in this area.

To further evaluate potential regional effects of the Project on Labrador caribou, Nalcor mapped the 90% probability of occupancy kernels for the caribou calving/post-calving season (Figure WD 4-1) and the winter season (Figure WD 4-2) (see the response to WD-2 and WD-3). Figure WD-4-1 and Figure WD 4-2 show that the Project right-of-way does not affect the seasonal 90% occupancy kernels for the RWM Herd or the JR Herd, and does not affect the winter 90% kernel for the MM Herd. Where the Project right-of-way lies in proximity to the winter season 90% kernels for the MM Herd, the right-of-way is on the south-west side of the TLH3 while the winter habitat use areas are to the north-east of the TLH3. The 60 m wide right-of-way does cross the calving/post-calving season 90% kernel for the MM Herd where the Project is routed along the TLH3 (i.e., an existing disturbance corridor) to avoid additional habitat fragmentation.

The Wildlife Division provided information indicating an 'area of exchange' where caribou are known to travel between the MM and JR Herds (J. Fenske 2012, pers. comm.). The Project would occur in this area. For this and other environmental considerations, Nalcor designed its alignment to occur along the existing Trans-Labrador Highway right-of-way for much of the Labrador-Island Transmission route through the Central and Southeastern Labrador region. This was completed so that a single 'service corridor' would remain in this area, and coincidentally through most of this area of exchange thereby limiting the potential for habitat fragmentation and increased access (see the response to WD-3). Nalcor acknowledges that although following existing access will help mitigate the effects of the Project, it will not eliminate them entirely. For example, research by Dyer et al. (2002) and Leblond et al. (2012) suggest that the frequency that caribou cross linear disturbances decreases as disturbance intensity increases. Dyer et al. (2002) found that although 5 to 9 m wide seismic lines did not affect caribou movement, caribou crossed roads up to six times less frequently than undisturbed areas. It is reasonable to assume that the effects of the ROW on caribou movement will be greater than those of a seismic line due to the greater width, and particularly during construction due to sensory disturbance. However, although caribou may cross the ROW less frequently than undisturbed areas, the ROW will not present a meaningful impediment to caribou movement. The effects on caribou movement of the Project ROW adjacent to a highway may be greater than the effects of the highway alone, but the additional effects are predicted to be relatively small, and the overall effects of the ROW will not be significant.

Based on the above information, and referring to Figure WD-4-1 and Figure WD-4-2 to provide a visual representation of the minimal overlap of the Project right-of-way with habitat during the sensitive periods of calving/post-calving and winter (see also the response to Information Request WD-2 and Information Request WD-3), regional effects (e.g., habitat fragmentation) are not likely to affect caribou populations on a regional scale (Table 12.3.7-1). The effects of the Project relative to baseline conditions are not likely to affect the viability or recovery of woodland caribou populations in Central and Southeastern Labrador and Newfoundland. Therefore, the Project is not likely to result in significant adverse environmental effects on caribou (Section 12.3.7.2, page 12-134). The information presented in this response does not affect the mitigation, findings or confidence in the conclusions of the EIS.

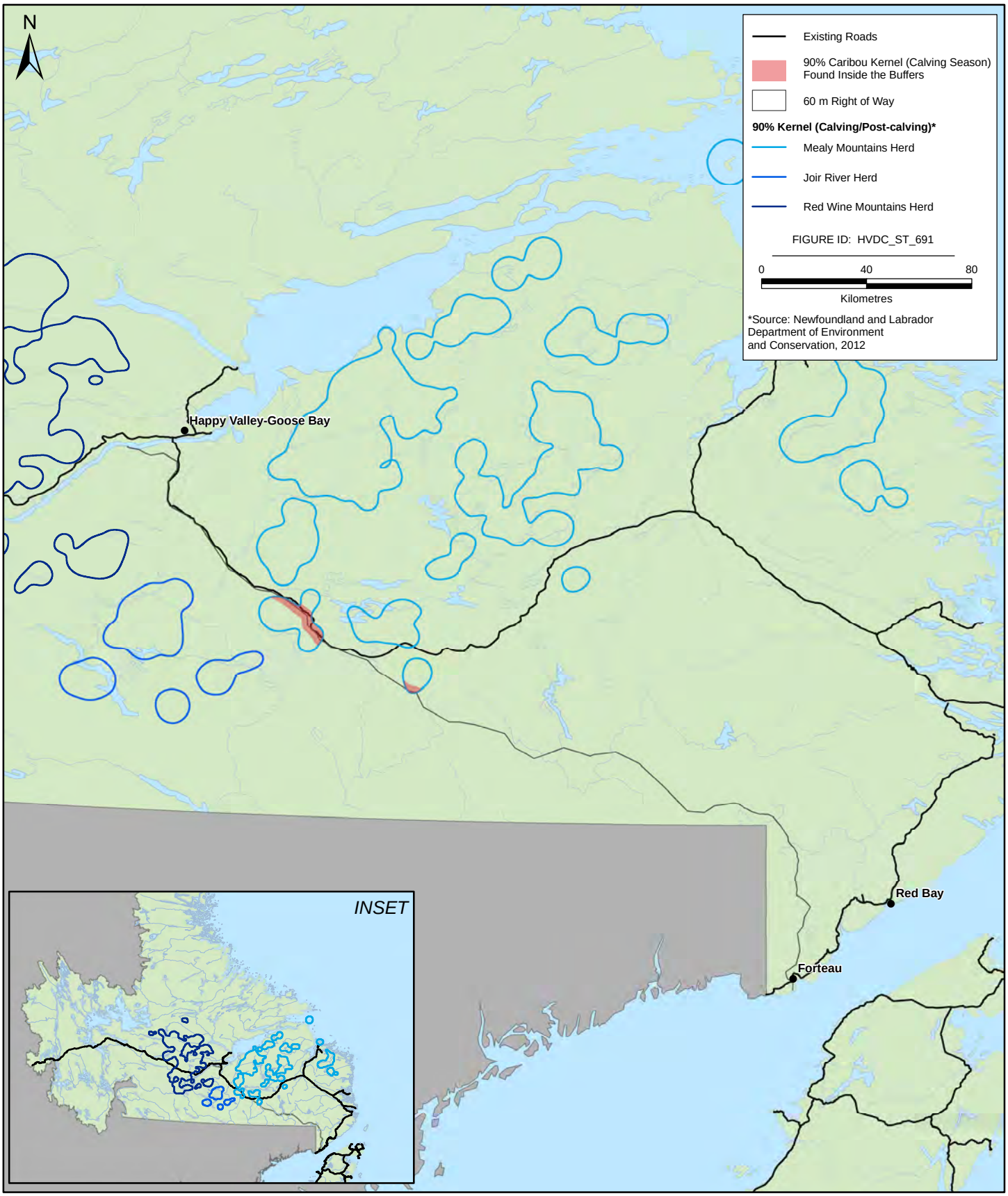

FIGURE WD 4-1

Caribou Calving/Post-calving 90% kernel in Southeastern Labrador

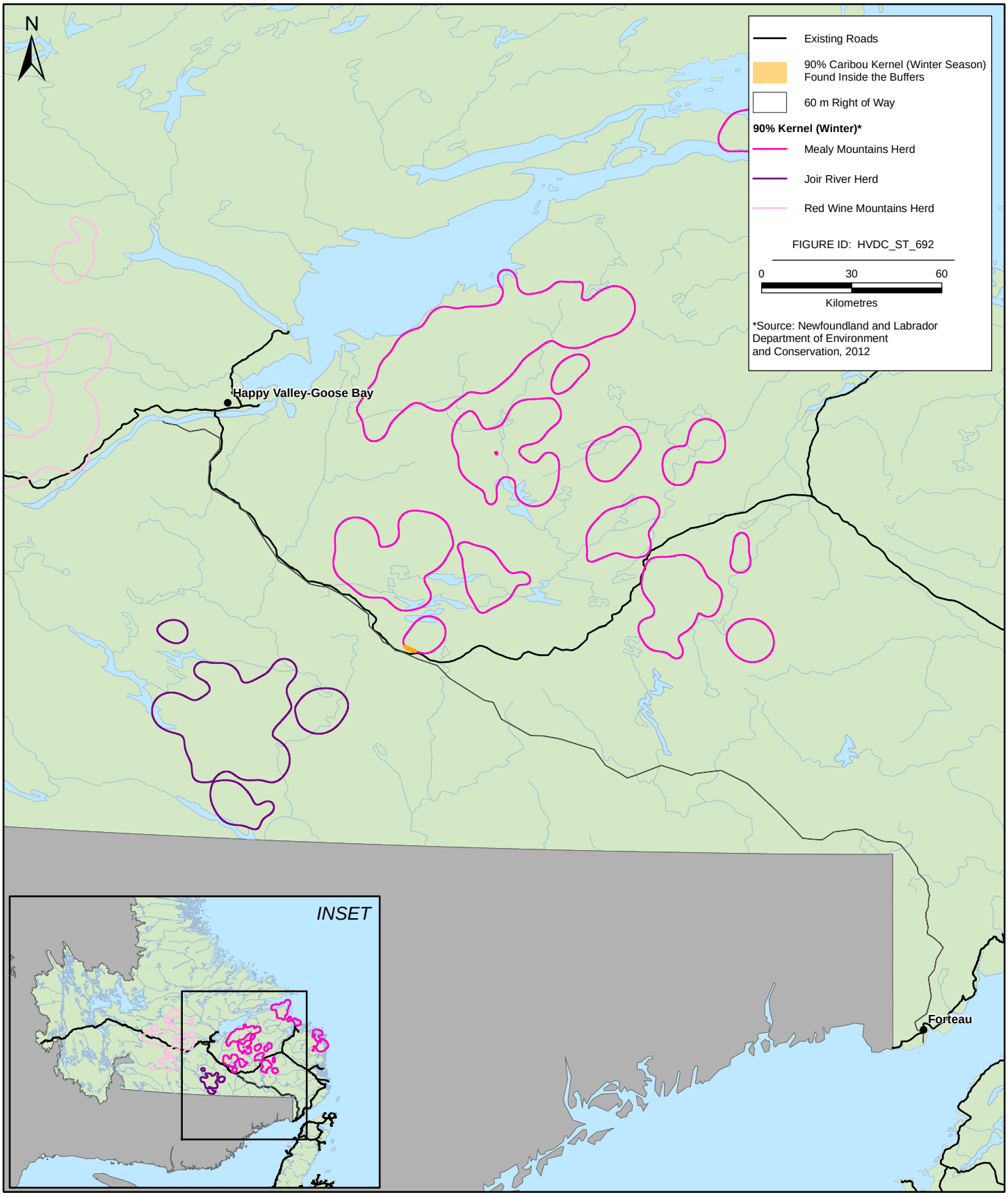

FIGURE WD 4-2

Caribou Winter 90% kernel in Southeastern Labrador

References

Dyer, S.J., O'Neill, J.P., Wasel, S.M. & Boutin, S. (2002). Quantifying Barrier Effects of Roads and Seismic Lines on Movements of Female Woodland Caribou in Northeastern Alberta. Canadian Journal of Zoology 80: 839–845.

Fortin, D., R. Courtois, P. Etcheverry, C. Dussault and A. Gingras. 2008. Winter Selection of Landscapes by Woodland Caribou: Behavioural Response to Geographical Gradients in Habitat Attributes. Journal of Applied Ecology 45: 1392-1400.

Mahoney, S.P. and J.A. Virgil. 2003. Habitat Selection and Demography of a Nonmigratory Woodland Caribou Population in Newfoundland. Canadian Journal of Zoology 81: 321-334.

5 COMMITMENTS AND SUMMARY

5.1 Commitments

Throughout the EIS, Nalcor has committed to continue consultation with the relevant regulators for the Project. Specifically, commitments were made for the Avifauna valued environmental component (VEC) and the Furbearers VEC.

As stated in Section 12.4 of the EIS, "Habitat alteration or loss due to Project Construction is predicted to have the greatest potential effects on Furbearer KIs… As the final alignment of the ROW may occur anywhere within the transmission corridor, this approach is used to provide an estimate of Project effects. In specific areas where identified Newfoundland Marten habitat overlaps the transmission corridor, Nalcor will consult with the NLDEC Wildlife Division to identify the most suitable route for the ROW." Section 12.4 also commits to consultation with the NLDEC Wildlife Division in the design to limit the loss and fragmentation of primary habitat for marten. Access control measures (e.g., signage, gates) to address off highway vehicle use of access roads and trails required for Project Operations and Maintenance will be examined and discussed with NLDEC Wildlife Division and applied as applicable, and will be described in the Environmental Protection Plan.

As stated in Section 12.5, Nalcor has committed to implement mitigation involving placement of artificial nests where nests must be cleared, if appropriate, in consultation with the NLDEC Wildlife Division.

Nalcor is willing to continue to work with the relevant regulators for this Project, to identify appropriate pre-construction surveys, mitigation and follow-up programs, and to comply with terms and conditions that are associated with the environmental assessment decision for the Freshwater Fish VEC or any other relevant VEC.

5.2 Summary

Through the Information Request (IR) process, Nalcor has responded to the issues, concerns and/or questions raised by the relevant federal and provincial regulatory agencies responsible for the Project. As committed in the EIS, Nalcor has welcomed the opportunity to continue to work with regulators to answer questions, to introduce updated Project information resulting from ongoing engineering and in response to concerns raised during the EA process, and to consider and incorporate updated information on woodland caribou provided by the provincial regulators. Nalcor's consultation with applicable regulators will continue throughout the Project as outlined throughout the EIS.

This approach is in keeping with one of the main principles of environmental assessment: that environmental assessment is a planning tool. This IR and response process has confirmed that Nalcor's EIS was adequate, appropriate, and conservative/precautionary (i.e., no changes are required to the EIS), and fully addressed the Guidelines and Scoping Document (Government of Newfoundland and Labrador and the Government of Canada 2011). The information and analyses presented in the various IR responses provide clarification by Nalcor on the various issues, but they do not affect the findings or Nalcor's confidence in the conclusions of the EIS. As such, the follow-up programs proposed in the EIS are considered appropriate and no changes are proposed by Nalcor.

In the EIS and the IRs, Nalcor has demonstrated adherence to the basic principles of environmental assessment as outlined in Section 2 of the EIS Guidelines and Scoping Document (Government of Newfoundland and Labrador and the Government of Canada 2011). These principles are: using environmental assessment as a planning tool; Aboriginal and public participation is a central objective; collection and consideration of Aboriginal traditional and community knowledge; promotion of sustainable development; and applying a precautionary approach (as per the Precautionary Principle) in the planning and assessment of the Project.

The conclusion of the EIS, supported by the information and analyses provided in the IR responses, is that the likely adverse residual environmental effects resulting from the Construction, Operations and Maintenance of the Project(after planned mitigation steps are taken) are not likely to be significant. Nalcor also notes that the

Project will result in substantial benefits, including the delivery of lower cost electricity to Newfoundland consumers and a substantial reduction in GHG emissions from power generation within the Province.

Considering this, and the commitments made in the EIS, Nalcor respectfully submits that the Project will be constructed, and operated and maintained in an environmentally responsible manner, respecting the principles of sustainable development. The Project will preserve ecosystem integrity, respect the right of future generations to the sustainable use of renewable and non-renewable resources, and enhance the lives of all Newfoundlanders and Labradorians.

Nalcor Energy
Hydro Place. 500 Columbus Drive
P.O. Box 12800. St. John's. NL
Canada A1B 0C9

T. 709.737.1833 or 1.888.576.5454
F. 709.737.1985
nalcorenergy.com/lowerchurchillproject.com

nalcor energy
LOWER CHURCHILL PROJECT