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# SUMMARY RESULTS

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## **Investigating Impacts of Wind Power Development in the M-KMA – Composite Maps for High Wildlife & Wilderness Values**

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## INTRODUCTION

The purpose of this document is to acknowledge the delivery of a series of composite maps used to identify portions of the Muskwa-Kechika Management Area (M-KMA) with high wildlife and wilderness values and where wind power development is, or is not, constrained by physical terrain elements.

The maps were delivered in fulfillment of deliverable 5<sup>1</sup> of the contract CFSAL1102 (*Investigating Impacts of Wind Power Development in the M-KMA*) undertaken by Wildlifeinfometrics Inc. for the Muskwa-Kechika Advisory Board.

The Composite Maps section lists all maps submitted for both the existing Investigative Use Permits (IUPs) and the potential wind power development areas (PWPDA). A key map is provided to assist in locating each of the composite maps.

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<sup>1</sup> Excerpt from contract: "5. Create composite map(s) showing physical feasibility with the wildlife/habitat values and wilderness values in the M-KMA to spatially determine where potential wind farm development might overlap with high wildlife or wilderness values."

## Composite Maps

Please see Table 1 below for a listing of the composite maps associated with this report and Figure 1 for the key map identifying the location of each composite map.

Table 1. Composite Map Listing

<b>Filename</b>	<b>Source</b>
MKMA_Deliverable_5_Existing_IUP_1	
MKMA_Deliverable_5_Existing_IUP_2	
MKMA_Deliverable_5_Existing_IUP_3	
MKMA_Deliverable_5_Existing_IUP_4	
MKMA_Deliverable_5_Existing_IUP_5	
MKMA_Deliverable_5_Potential_IUP_1	
MKMA_Deliverable_5_Potential_IUP_2	
MKMA_Deliverable_5_Potential_IUP_3	
MKMA_Deliverable_5_Potential_IUP_4	
MKMA_Deliverable_5_Potential_IUP_5	
MKMA_Deliverable_5_Potential_IUP_6	
MKMA_Deliverable_5_Potential_IUP_7	
MKMA_Deliverable_5_Potential_IUP_8	
MKMA_Deliverable_5_Potential_IUP_9	
MKMA_Deliverable_5_Potential_IUP_10	
MKMA_Deliverable_5_Potential_IUP_11	WII
MKMA_Deliverable_5_Potential_IUP_12	
MKMA_Deliverable_5_Potential_IUP_13	
MKMA_Deliverable_5_Potential_IUP_14	
MKMA_Deliverable_5_Potential_IUP_15	
MKMA_Deliverable_5_Potential_IUP_16	
MKMA_Deliverable_5_Potential_IUP_17	
MKMA_Deliverable_5_Potential_IUP_18	
MKMA_Deliverable_5_Potential_IUP_19	
MKMA_Deliverable_5_Potential_IUP_20	
MKMA_Deliverable_5_Potential_IUP_21	
MKMA_Deliverable_5_Potential_IUP_22	
MKMA_Deliverable_5_Potential_IUP_23	
MKMA_Deliverable_5_Potential_IUP_24	
MKMA_Deliverable_5_Potential_IUP_25	
MKMA_Deliverable_5_Potential_IUP_26	

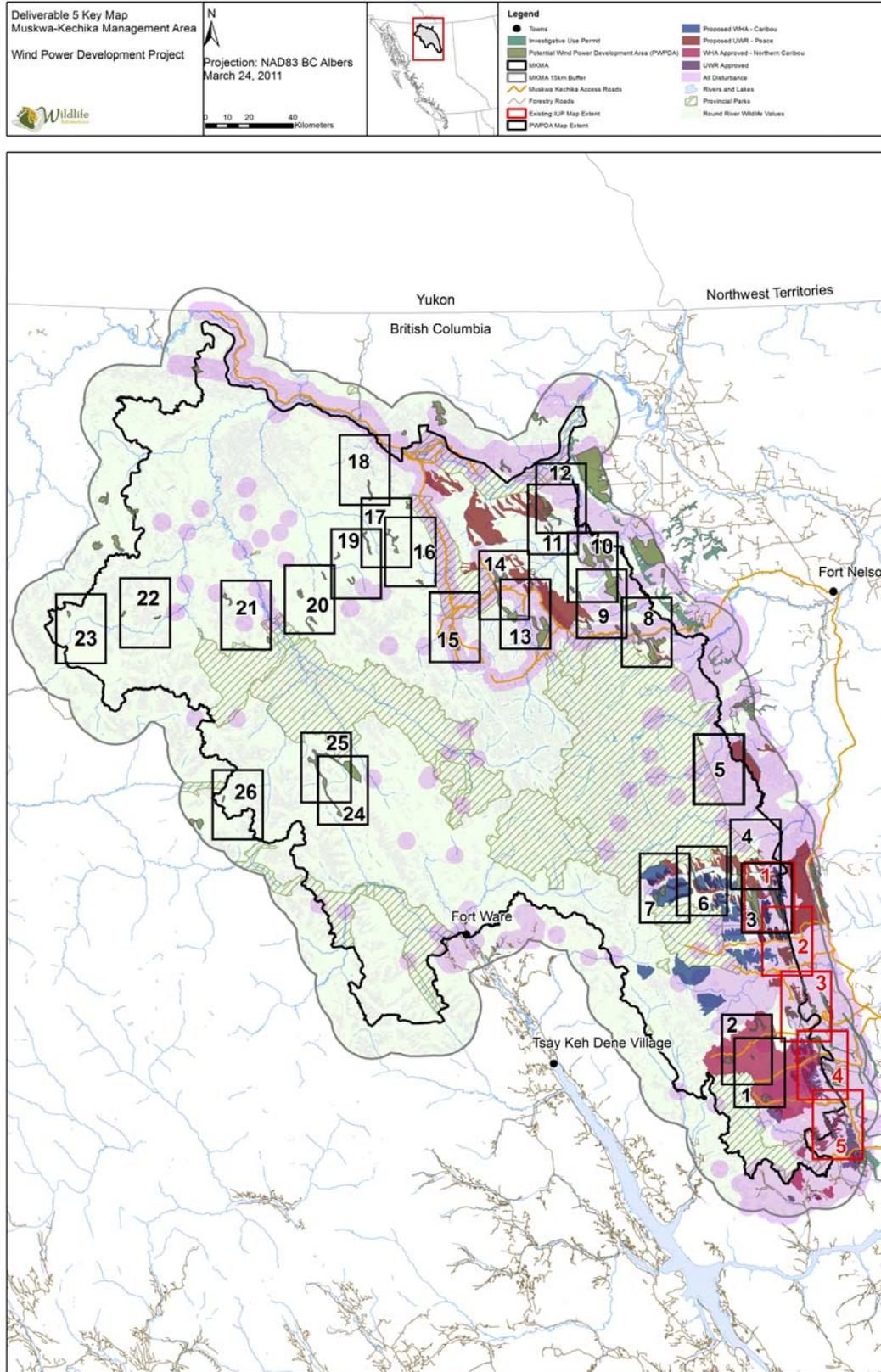


Figure 1. Key Map for the deliverable 4 composite maps.

## METHODS

### Assessment of Wildlife Values

Wildlife habitat spatial data were obtained from three sources as listed below:

- the BC Ministry of Natural Resource Operations (MoNRO) provided both approved and proposed Wildlife Habitat Areas and Ungulate Winter Range within the M-KMA
- Round River Conservation Studies<sup>2</sup> provided habitat model results for seven terrestrial species (woodland caribou, Stone's sheep, moose, gray wolf, grizzly bear, mountain goat, and elk) from the Conservation Area Design for the Muskwa-Kechika Management Area (Heinemeyer et al. 2004)
- Kathy Parker from the University of Northern British Columbia (UNBC) provided the results and reports from two studies; one for woodland caribou (Gustine and Parker 2008) and the other for Stone's sheep (Walker et al. 2007)

Upon receipt of the spatial data, we converted all files to an ESRI GRID format (ESRI 2010) and the Round River data was clipped to the buffered study area of the M-KMA.

The Round River habitat model data provided complete coverage of the M-KMA buffered study area whereas the two UNBC studies (Gustine and Parker 2008, Walker et al. 2007) focused on the Besa-Prophet area; therefore, the Round River data was used to represent habitat suitability. Figure 2 shows the extent of the UNBC studies in the Besa-Prophet area. From the Round River data, habitat ratings 8, 9, and 10 were selected to represent the most suitable habitat; each seasonal grid for each species was re-classed so the three ratings equalled 1 and all other ratings including NoData cells equalled 0. Subsequently, all re-classed seasonal grids for all species were added together to create one grid illustrating the area with the most suitable habitat.

We compared the woodland caribou habitat model results from both Round River and Gustine and Parker (2008) to ensure our selection of the Round River habitat ratings adequately represented the most suitable habitat. We completed three comparisons, selecting habitat suitability ratings from all of the seasonal grids associated with each study. The rating selections were:

- Round River ratings 8, 9, and 10; Gustine and Parker (2008) ratings 1 and 2
- Round River ratings 9 and 10; Gustine and Parker (2008) ratings 1 and 2
- Round River ratings 9 and 10, Gustine and Parker (2008) ratings 1

The same process used to add the Round River species and seasonal grids together was followed for the woodland caribou comparison. For each comparison, two grids were created; one for the Round River woodland caribou model and one for Gustine and Parker (2008) woodland caribou model. By adding the Round River and Gustine and Parker (2008) grids together, we identified and calculated the area of overlap between the two models; we then calculated the remaining area where no overlap occurred for each study.

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<sup>2</sup> <http://www.roundriver.org/index.php/m-k>

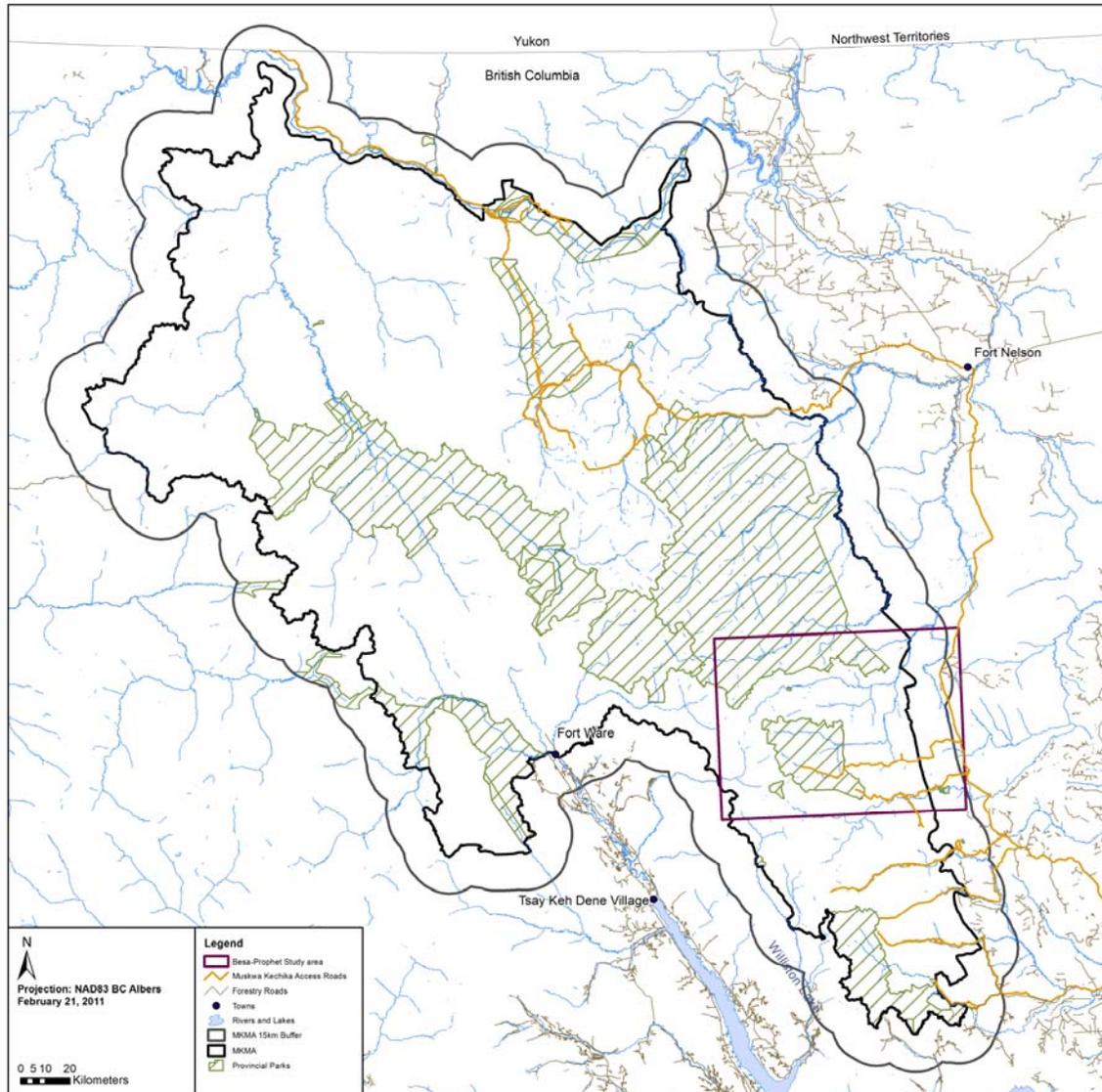


Figure 2. Extent of the UNBC woodland caribou and Stone's sheep studies in the Besa-Prophet area.

### Wildlife Habitat Areas and Ungulate Winter Ranges

Both approved and proposed Wildlife Habitat Areas (WHA) and Ungulate Winter Ranges (UWR) were provided by the MoNRO. The species accounted are:

- Proposed WHA – Caribou (RATA)
- Approved WHA – Caribou (RATA)
- Proposed UWR – Elk (CEEL), Thinhorn Sheep (OVDA), Caribou (RATA), Mountain Goat (ORAM), and Moose (ALAL)
- Approved UWR – Thinhorn Sheep (OVDA) and Caribou (RATA)

## Wilderness Values

Wilderness values were defined as the area of the M-KMA not affected by anthropogenic features. In order to define this area, we obtained both Tantalus and Terrain Resource Inventory Mapping (TRIM) data from the MoNRO. We categorized the data into eleven groupings as listed in Table 2.

Table 2. Disturbance features

<b>Category</b>	<b>Feature</b>
Agriculture	Grazing and extensive agriculture use
Buildings	building, barn, dock/pier/wharf, garbage dump, fence and designated area; designated areas represent unclassified human disturbances such as but not limited to: autowrecker, campground, mine, golf course, cemetery, sewage treatment area
Commercial B	Unspecified commercial property
Energy	gas well, oil well, transmission tower, transmission line
Industrial	Unspecified industrial property
Institutional	Wasted disposal, public works and local/regional park
Quarry	Sand and gravel, rip rap, rock for crushing, peat and soil, miscellaneous
Seismic	Seismic lines from Oil and Gas Commission
Timber Harvesting	harvested blocks from TRIM and harvesting reported to the Reporting Silviculture Updates and Land Status Tracking System (RESULTS); the RESULTS data was downloaded from the LRDW website
Transportation	airstrip/field/port, roads
Utility	Gas and oil pipeline, telecommunication line

Initial disturbance maps illustrating the location of these features were supplied to the members of the M-KMA board for review. Comments from one board member, Wayne Sawchuk, were received identifying the removal and addition of some features. The changes made included; 1) 'buildings' and 'camps' were added to the 'Buildings' category, 2) 'Industrial' and 'Timber Harvesting' categories both had identified features removed, and 3) all "roads overgrown" and "roads" unimproved were removed from the "Transportation" category.

For the "Energy and Transmission" category, we selected to not use the cutline data from TRIM instead we used the Oil and Gas Commission (OGC) publicly available Geographic Information Systems (GIS) data<sup>3</sup> for seismic lines. The OGC data came in three separate shapefiles:

- 2006 – present; this dataset included the most current and complete data from the OGC (all 2006 submissions were required to be completed online)
- 2002 – 2006; incomplete dataset containing data from oil and gas clients prior to 2006
- 1996 – 2004; incomplete dataset obtained from oil and gas clients prior to 2006

<sup>3</sup> <http://www.bcogc.ca/publiczone/gis.aspx>

The comment we received requested we distinguish between heli-portable and cat-cut seismic lines since the heli-portable does not create long lasting impacts; the TRIM data did not distinguish between either and the OGC data did not include heli-portable as a cut type.

Once the updates were completed each feature was buffered by 3.83km to represent the impact it had on the M-KMA wilderness values. All buffered features were appended and dissolved to form an overall disturbance layer.

## **RESULTS**

### **Wildlife Values**

The comparison, where Round River ratings 8, 9, and 10 and Gustine and Parker (2008) ratings 1 and 2 were selected, resulted in the best overlap between the two studies. Therefore we chose to represent wildlife values in the M-KMA with the top three habitat suitability ratings from the Round River study. The selected Round River ratings overestimated the amount of suitable habitat compared to the Gustine and Parker (2008); we decided an overestimation was more appropriate than an underestimation had we only selected Round River ratings 9 and 10.

### **Disturbance**

From our evaluation of the TRIM and OGC datasets we found the TRIM data overrepresented the amount of seismic line and the OGC data underrepresented the amount of seismic due to being incomplete for years 1996-2006. We took into consideration the age of the OGC seismic lines and the amount of overlap between the two data sources and concluded the OGC datasets better represented seismic line disturbance.

## SPATIAL DATA SUMMARY

Please see Table 3 below for a listing of spatial outputs associated with this report.

Table 3. Spatial Data Listing

<b>Spatial Data – Grids</b>				
<b>Filename</b>	<b>Source</b>	<b>Purpose</b>		
car_grow_mk	WII (original from Round River)	Northern ecotype of Woodland Caribou, growing season		
car_wint_mk		Northern ecotype of Woodland Caribou, winter season		
elk_grow_mk		Rocky mountain elk, growing season		
elk_wint_mk		Rocky mountain elk, winter season		
got_grow_mk		Mountain goat, growing season		
got_wint_mk		Mountain goat, winter season		
gzz_ge_mk		Grizzly bear, early season		
gzz_gl_mk		Grizzly bear, late season		
gzz_gm_mk		Grizzly bear, mid season		
moo_grow_mk		Moose, growing season		
moo_wint_mk		Moose, winter season		
shp_grow_mk		Stone's sheep, growing season		
shp_wint_mk		Stone's sheep, winter season		
wlf_grow_mk		Gray wolf, growing season		
wlf_wint_mk	Gray wolf, winter season			
car_grow_re2	WII	Round River Ratings 8, 9 and 10 reclassified as value 1, all other ratings and NoData reclassified as 0.		
car_wint_re2				
elk_grow_re2				
elk_wint_re2				
got_grow_re2				
got_wint_re2				
gzz_ge_re2				
gzz_gl_re2				
gzz_gm_re2				
moo_grow_re2				
moo_wint_re2				
shp_grow_re2				
shp_wint_re2				
wlf_grow_re2				
wlf_wint_re2				
all_spp_p_re2			WII	Grid contains Round River data for the seven terrestrial species for all seasons. Includes the top three ratings (values 8, 9 and 10) representing habitat suitability.
s_ew_avg_int			WII	Stone's sheep early winter season,

	(original	integer version
s_fal_avg_int	data from UNBC)	Stone's sheep fall season, integer version
s_lam_avg_int		Stone's sheep lambing season, integer version
s_lw_avg_int		Stone's sheep late winter season, integer version
s_rut_avg_int		Stone's sheep rut season, integer version
s_sum_avg_int		Stone's sheep summer season, integer season
breed_04		Woodland caribou breeding season
calv_04		Woodland caribou calving season
fall_04		Woodland caribou fall season
late_winter_04		Woodland caribou late winter season
sum_04		Woodland caribou summer season
winter_04		Woodland caribou winter season

### Spatial Data - Shapefiles

Filename	Source	Purpose
a_agriculture	WII	Tantalis data; used for identifying human disturbance
a_agriculture_buffer	(original	
a_commercial_B	data from	
a_commercial_B_buffer	MoNRO)	
a_energy_prod		
a_energy_prod_buffer		
a_Industrial		
a_Industrial_buffer		
a_institutional		
a_institutional_buffer		
a_quarrying		
a_quarrying_buffer		
a_utility		
a_utility		
tcu_arc_merge_selection_Buildings	WII	TRIM data; used for identifying human disturbance
tcu_arc_merge_selection_Buildings_buffer	(original	
tcu_arc_merge_selection_EnergyTra	data from	
n	MoNRO)	
tcu_arc_merge_Selection_EnergyTran buf		
tcu_arc_merge_selection_Industrial		
tcu_arc_merge_selection_Industrial_buffer		

tcuI_point_merge_selection_Buildings_amended		
tcuI_point_merge_selection_Buildings_amended_buffer		
tcuI_point_Merge_Selection_EnergyTran		
tcuI_point_merge_selection_energytr		
tcuI_point_Merge_selection_Industrial_amended	WII (original	TRIM data; used for identifying human disturbance
tcuI_point_Merge_selection_Industrial_amended_buffer	data from MoNRO)	
tcvr_arc_merge_selection_Amended		
tcvr_arc_merge_selection_Amended_buffer		
ttrn_arc_merge_selection_Amended		
ttrn_arc_merge_selection_Amended_buffer		
ageo_bc_Clip	WII (original	OGC data for identifying seismic line disturbance
agphys1996_2004_Clip	from	
agphys2002_2006_Clip	OGC)	
OGC_bc_clip_all_buffer		

## LITERATURE CITED

- ESRI. 2010. ArcMap. Environmental Systems Research Institute, Redlands, California.
- Gustine, D.D. and K.L. Parker. 2008. Variation in the seasonal selection of resources by woodland caribou in northern British Columbia. *Canadian Journal of Zoology*. 86: 812-825.
- Heinemeyer, K., R. Tingey, K. Ciruna, T. Lind, J. Pollock, B. Butterfield, J. Griggs, P. Iachetti, C. Bode, T. Olenicki, E. Parkinson, C. Rumsey and D. Sizemore. 2004. Conservation Area Design for the Muskwa-Kechika Management Area. Prepared for the BC Ministry of Sustainable Resource Management.
- Walker, A.B.D. K.L. Parker, M.P. Gillingham, D.D. Gustine, R.J. Lay. 2007. Habitat selection by female Stone's sheep in relation to vegetation, topography, and risk of predation. *Ecoscience*. 14(1): 55-70.