PRELIMINARY ASSESSMENT OF BIRD STRIKE POTENTIAL AT WIND FARM SITE – BURWASH LANDIN, YT

INTERIM REPORT: 2012 TO 2014

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D. Mossop
Yukon Research Centre
Yukon College
dmossop@yukoncollege.yk.ca

Report to:

Kluane First Nation
Natural Resources Branch
Burwash Landing, YT
Environment@kfn.ca

YUKON RESEARCH CENTRE
Yukon College

Preliminary Assessment of Bird Strike potential at Wind Farm site– Burwash Landing, YT
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Purpose: The Kluane First Nation is planning to install three wind turbines to produce electric power for the community. The elders of the community have expressed concern that the Burwash wind turbine site is within a known major bird migration corridor both spring and fall. A large percentage of the world population of trumpeter swans passes the site. As well a large assemblage of vulnerable birds of prey including the much localized race of buteo hawk, the Harlan's hawk, potentially use that route. A small amount of migration watch survey has been conducted in the past. It shows a sizeable movement of birds along the shoreline of Kluane Lake.

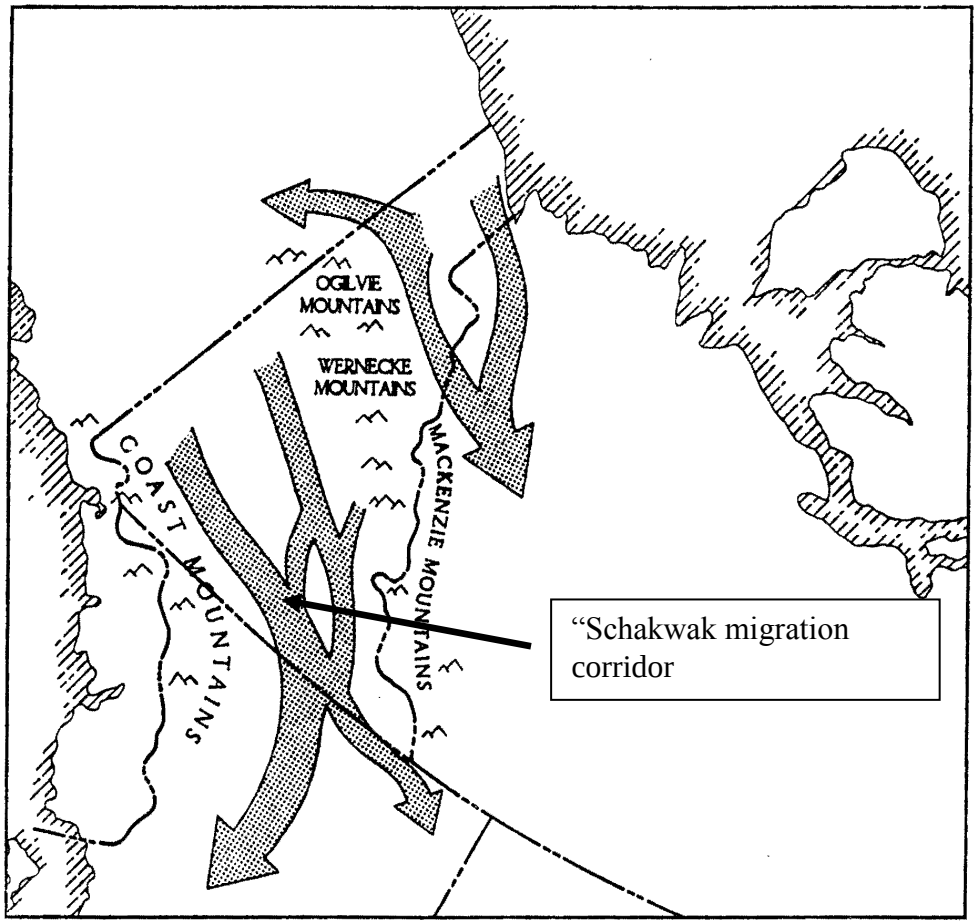


Fig 1: Major migration corridors across the Yukon; the Schakwak route, heavily used by birds principally moving to and from Alaska (and Siberia) lies directly astride the Burwash site.

The potential for bird deaths by collision is real. Even though its effect at the population level may possibly be negligible, its perceived effect could be devastating to the project. It is going to be necessary to plan this project very much as an experiment: (If the chosen site proves unfavorable, moving probably should be planned.)

In the fall of 2012 the author and students from Yukon College began a migration watch project with objectives to:

a) quantify the magnitude of bird movements past the site
b) measure altitudes and timing of movements: notably during fall and spring
c) quantify potential strikes
d) develop a monitoring protocol for tracking problems in the future.

Site work: Field work has involved weekly field trips of 2-3 days each timed to peak south and northward migration. Initial survey technique involved a fair amount of field testing to see what will be most effective for developing a longer term meaningful data set. We now have a full year's data covering one fall migration periods0 (2013) and thwo spring migration periods (2013 and 2014).

a) We did extensive preliminary ground assessment of the site to gain a general impression of bird habitats of the area, an idea of species richness, and potential attractive features that may attract and concentrate birds especially during migration.

b) We conducted standard site observation of bird movements: We were at the site observing for half hour sessions through daylight periods but focusing primarily on sunrise and sunset periods. All species were identified as they passed although smaller passerines sometimes had to be lumped into identifiable groups. We were comfortable that most water bird and bird of prey movements were quantified accurately by this method.

c) All bird movements through the site were mapped as accurately as possible including the flight direction and height. (The 60 meter Meterological ('Met") tower at the site was used to estimate height of passing birds.)

d) We conducted extensive ground search for bird carcasses below the site 'Met' research towers as well as others in the region (The Donjek microwave, the airport towers).

e) We constructed a semi-permanent observation camp accommodation at the site to allow easier round-the-clock observations.

Preliminary findings:

General assessment of the site: Clearly the site sits astride a well known major migration corridor for many thousands of birds moving mostly into Alaska and Siberia along the 'shakwak' migration route. The site is adjacent an attractive lagoon on the shore of Kluane lake that adds risk for birds transiting the site. We have identified 91 species of birds using the general area. In 20 field trips we have observed a total of 4,726 individual birds in the general area of the turbine site.

For most of the 2012 fall period, the research 'Met' tower had not been erected so assessing its effect on birds was really not possible. The spring and fall migration periods in 2013 were more informative. Unfortunately the spring of 2014 displayed an unusually protracted movement of birds and was less representative of what can be expected over the long term.

The 'Met' research tower with its 20 plus guy wires should pose a formidable obstacle to moving birds, particularly at night. It is hard to imagine a more critical test of the site in terms of its hazard to migrating birds.

Ground searches: We conducted four extensive ground searches at each site (the navigational tower near the town of Burwash and the research 'met' tower at the proposed turbine site) in 2012. In 2013 and 2014 we searched the navigational tower only once, we restricted ground searches mostly to the tower at the turbine site. In total we have searched that site 22 times

Bird specimens found in searches below towers (F= feathers only)

Species	Nav tower (n=5)	Turbine site(n=18)
Unid duck	1(F)	
Sharp-shinned hawk		1(F)
Hawk-owl	1	
Sharp-tailed grouse	1(F)	
Dark-eyed junco		1
Tree swallow	1	

Observed Impacts: The searches under the turbine site 'met' tower yielded only two specimens: (1 dark-eyed junco and feathers from one Sharp-shinned hawk. The navigational tower closer to Burwash Landing was apparently killing more birds (5 specimens).

However, at the turbine site we observed birds hit the 'Met' tower or wires 5 times (1 Canada goose, 1 American pipit, 1 Spruce grouse, 1 3-toed woodpecker, 1 American robin). None of these birds were injured or even lost feathers. (The guy wires on the present tower are extremely loose and birds were seen to simply bounce off unhurt.) Consequently our searches under the site tower are probably only indicative for suggesting mortality frequency that can be expected when the turbine towers are in place with far tighter wires.

Fig 2. Canada geese transiting the turbine site in near darkness, guy wires visible to the left. One of these birds collided with the wires but was not injured.

Bird movement observations past turbine site: We have now carried out half-hour observations from late September 2012 through May 2014. All were conducted in early morning or evening when bird migration movement was observed to be peaking. (By mid to late September, some major portion of migration by most species was found to be finished. In 2013 and 2014 we started observations earlier -- by the beginning of September and began spring observation in mid April.)

(Flight lines are estimates based on direct observation of birds passing the site. We used the 'Met' tower sections to help estimate height and guy wire bases to help estimate lateral track.

We now have logged 116 half-hour observation periods; and we have observed and mapped 304 transits of the site by 1,688 individual birds.

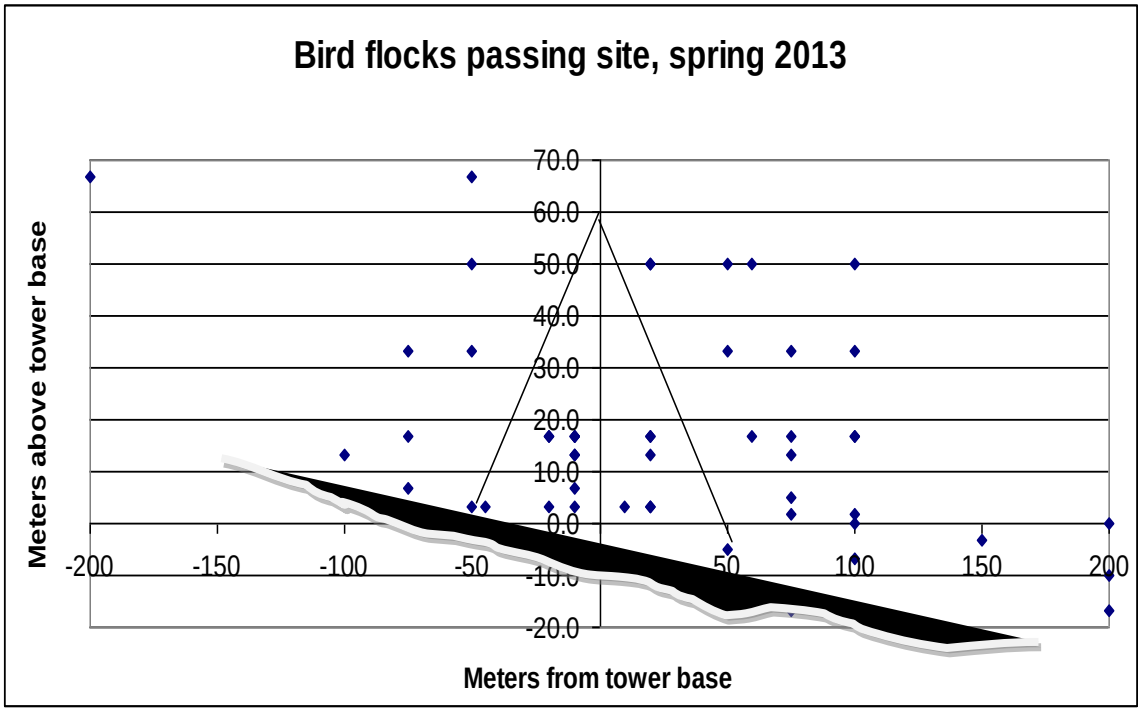
Birds per hour passing site: (at dusk, morning and evening)

	2012 fall	2013 spring	2013 fall	2014 spring
average	**75.6**	**98.3**	**18.6**	**5.1**
Range:	**18-290**	**2-322**	**0-174**	**0-35**

The average bird movement past the site lumping all summer and fall migration periods is 29.1 birds per hour: range, 0-322

Bird species observed passing within 150 meters of turbine site

	Fall 2012	Spring 2013	Fall 2013	Spring 2014
Trumpeter swan	26	6		14
Tundra swan		30		
Canada goose		210	137	
White-fr. Goose		4		10
Herring gull	8	5	51	8
Mew gull		1		11
Mallard		3		9
Wilson's snipe		8		
Pectoral sandpiper		1		
Lesser Yellowlegs				1
Long-billed dowitcher		5		
Upland sandpiper		1		
Golden plover		1		
Bald eagle	2			
Harlan's hawk			2	3
N. harrier	3	5	3	1
Sharp-shinnned hawk	4		7	
Merlin	3		2	
Peregrine falcon				1
Spruce grouse			2	1
Tree-toed woodpecker			1	
Northern flicker				5
Common redpoll	249	71	10	8
American pipit	18		12	
American robin	8		94	28
Common raven	16	9	3	36
Gray jay		2	2	2
Pine siskin	10			
White-winged crossbill	1			
Pine grosbeak				1
Dark-eyed junco	3	5		8
Lapland longspur		160	34	
Snow bunting		25		
White-crowned sparrow		1	1	
Tree sparrow	1			
Yellow-rumped warbler		12	1	5
Unidentified waterfowl		30	20	2
Unidentified shorebird			40	5
Unidentified song bird	107	70	20	3
Totals	**459**	**630**	**449**	**156**
	2012 fall	**2013 spring**	**2013 fall**	**2014 spring**



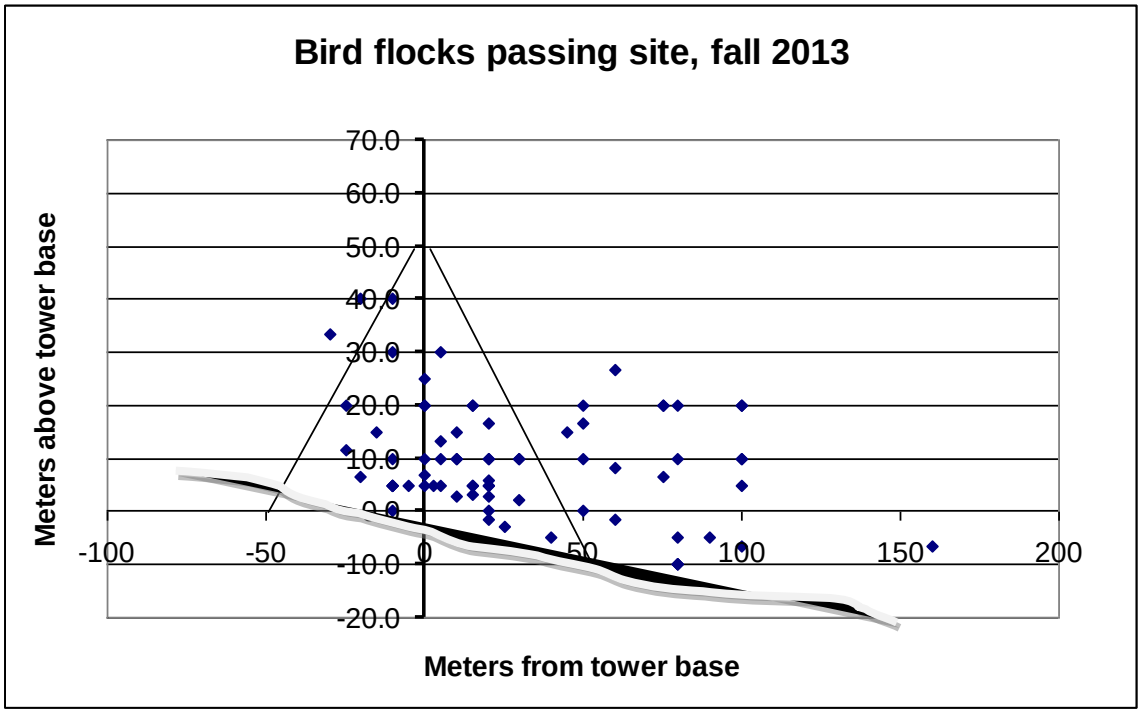


Fig 3. Observed bird transits of the site and the 'Met' tower; values based on estimates from the base of the tower at the site.

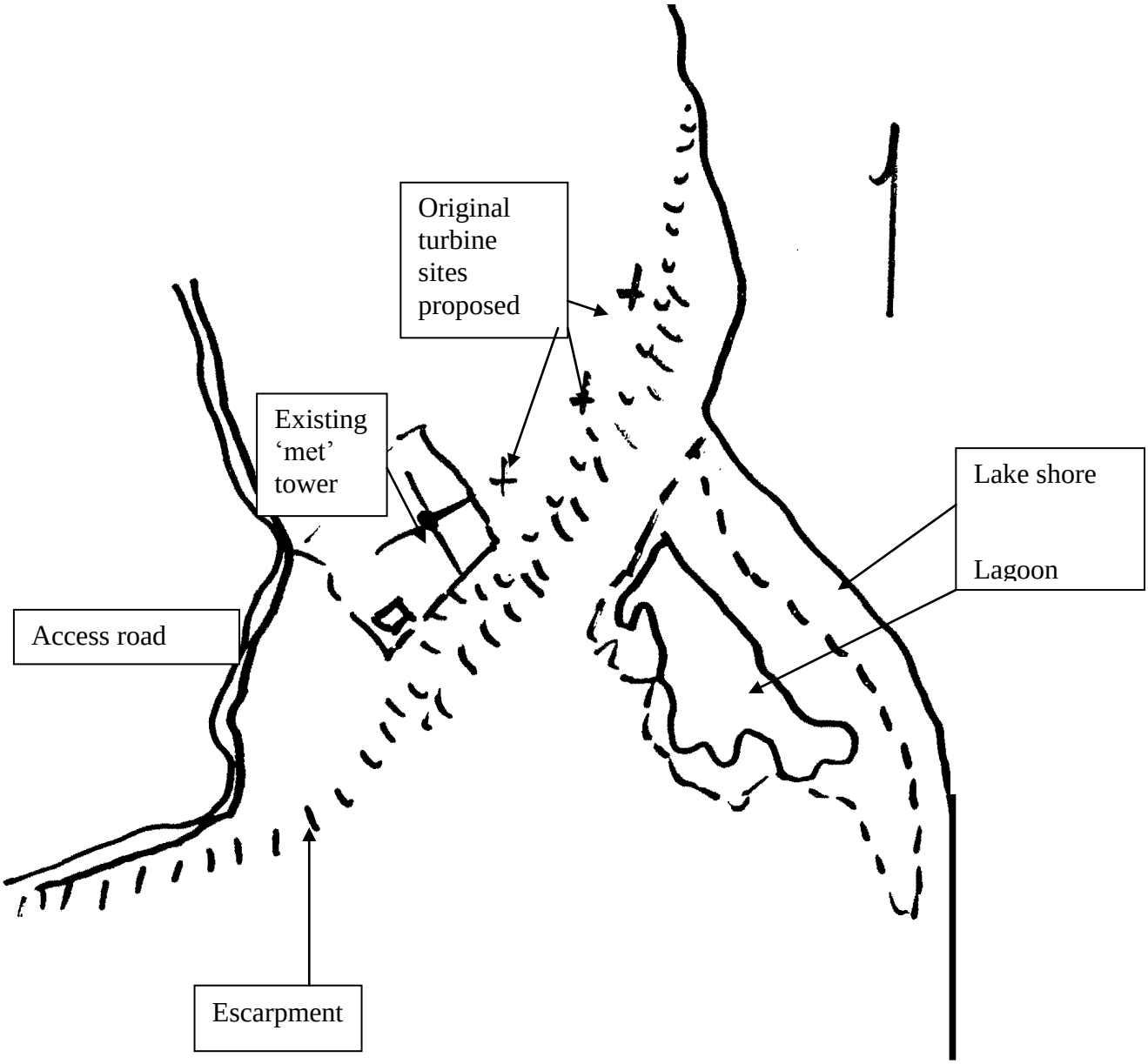


Fig 4. Field sketch site map used to plot bird movements past the study site.

Transits of the site by birds tended to be slightly lake-side of the 'Met' tower (average -24 meters to lake-side) but with a very large variation (Standard deviation: ± 63.4 meters). Height above the base of the 'Met' tower averaged 12 meters but again a large variation (Standard deviation ±21 meters).

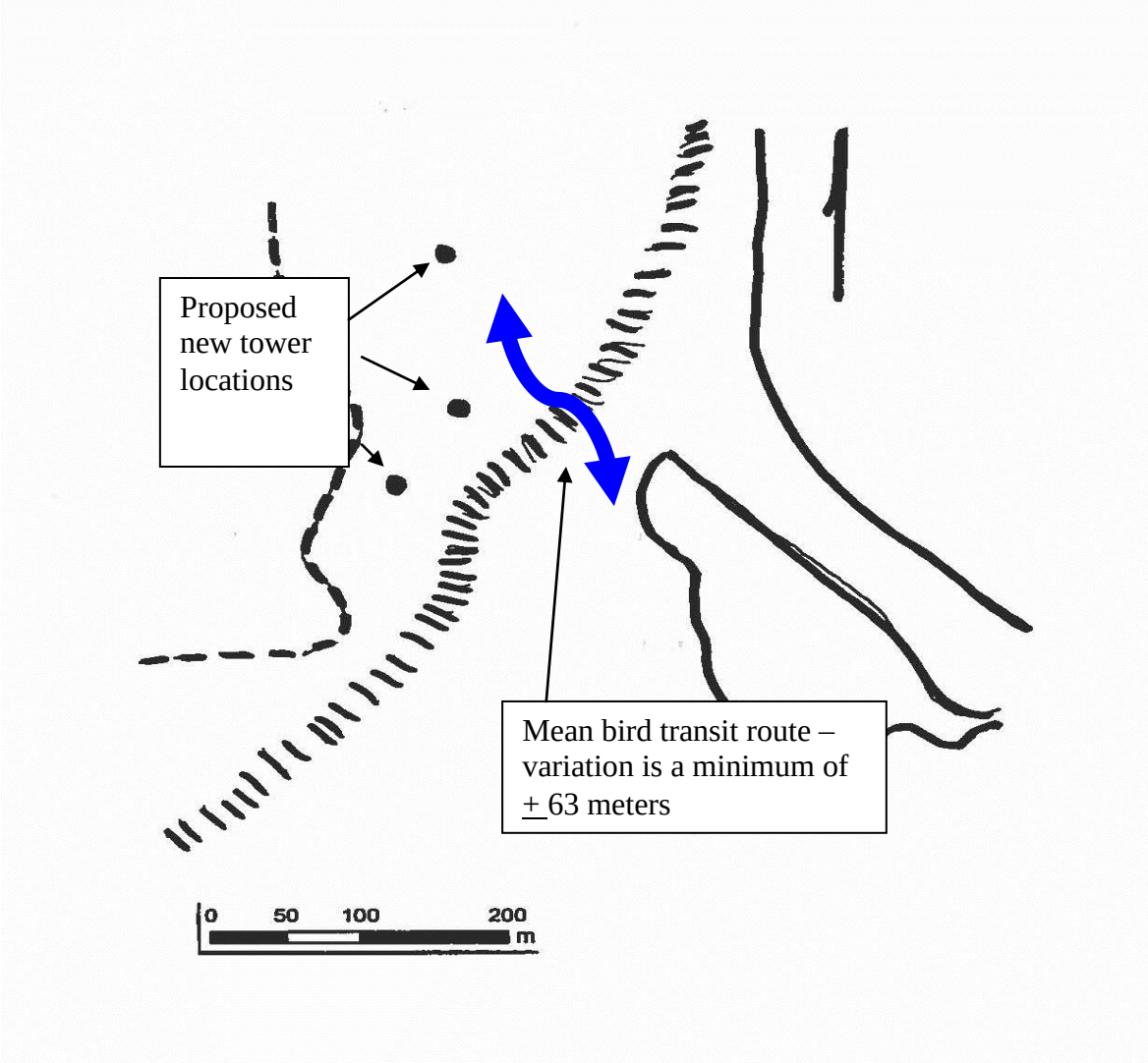


Fig 5, Turbine site location showing the mean transit route by birds observed 2012-14 and the proposed new tower locations.

Preliminary conclusions:

a) **Wire impact:** It is clear that impact with guy wires presents the most likely scenario at the site. In the dusk periods and on misty days the wires literally disappear from sight. Dusk and night movements of most birds tends to be the norm when wires cannot be seen even on clear nights.

b) **Location of towers:** There is some significant difference between flight lines observed spring and fall. In general spring migrants seemed to be moving past the site at higher altitude. The array of flight lines laterally seem to be basically the same; most passages are to the lake side of the site and most of the larger birds are transiting across the lower terrain between the lake and the site.

   (Note: based in part on the apparent risk to birds transiting the site, the plan to move the towers from locations as in fig 4, further from the lake as in fig 5, has been adopted). Moving the proposed tower sites away from the lake and uphill on the plateau above the escarpment should reduce (but not eliminate) the likelihood of impact.

   Interestingly many **water birds** (gulls, geese, swans) were observed to pass the site well below the top of the escarpment on which the turbines will be located. By far the majority of larger birds were passing on the lake-side of the tower and usually below the tower base. If this persists, they should be mostly safe from collision. Commonly water birds (gulls, geese, swans, some ducks) were transiting the area at tree-top level and tended to be attracted by the lagoon that is strategically located directly in front of the site. They tended to be moving along the lake shore except at this site when they often swept inland -- but seemed to maintain a flight line between the tower and the lake shore.

   In terms of numbers at risk, clearly small song birds outranked all others. Their height above ground level put them at risk from literally all the guy wires.

c) **Lattice tower construction:** It is known, that birds can be attracted to cleared sites and in particular it has been shown that birds of prey are attracted to "lattice" towers and seem to want to land on them. Birds of prey were the largest birds that were seen to transit the site well within the sweep of guy wires and could potentially present the greatest threat for impact. The species most at risk appear to be falcons (notably Merlin) and small accipiters (Sharp-shinned hawk). Both of these show fast, straight-line flight lines; others like Harlan's (Red-tailed) hawks and eagles tend to circle the site and unless they are attracted for some reason, are not likely to transit the wires.

d) **Lights:** Most observations of birds transiting the site were made in periods of dusk and darkness when wires and the tower itself were difficult to see. It is clear

that the turbine towers located as they will be, on a commonly used flight path (in particular on the approach path to the Burwash Airport) will be required to carry lights. Constant, white lights are known to be confusing to birds; if used they can probably be expected to cause increased collisions.

Fig 6. The lagoon immediately below the escarpment where towers are planned is a powerful attractant for moving birds during spring and fall; they tend to traverse the site immediately to the right of the "met" tower.

Acknowledgements:
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Appendix: Bird species observed in the general area of the Burwash turbine site 2012-2014; relative abundance by percent of individuals observed.

2012-14	TOTAL ROLL UP	% OF TOTAL
AMERICAN WIGEON	1417	29.98
CANADA GOOSE	556	11.76
AM. GREEN-W.TEAL	263	5.56
AMERICAN ROBIN	225	4.76
SNOW GOOSE	201	4.25
LAPLAND LONGSPUR	186	3.94
AMERICAN PIPIT	182	3.85
MALLARD	169	3.58
GR. WHITE-FR. GOOSE	160	3.39
COMMON REDPOLL	138	2.92
NORTHERN PINTAIL	124	2.62
NORTHERN SHOVELER	65	1.38
DARK-EYED JUNCO	65	1.38
YEL-RUMPED WARBLER	60	1.27
HERRING GULL	58	1.23
COMMON RAVEN	58	1.23
HORNED LARK	50	1.06
TRUMPETER SWAN	46	0.97
SNOW BUNTING	45	0.95
MEW GULL	44	0.93
PECTORAL SANDPIPER	40	0.85
BOHEMIAN WAXWING	36	0.76
GRAY JAY	34	0.72
WILSON'S SNIPE	33	0.70
CACKLING GOOSE	26	0.55
TREE SWALLOW	26	0.55
WHITE-CRND SPARROW	24	0.51
NORTHERN HARRIER	23	0.49
RUBY-CRND KINGLET	23	0.49
AM.GOLDEN PLOVER	21	0.44
TUNDRA SWAN	20	0.42
LESSER YELLOWLEGS	19	0.40
RING-NECKED DUCK	18	0.38
KILLDEER	15	0.32
SWAINSON'S THRUSH	14	0.30
SHARP-SH. HAWK	13	0.28
VARIED THRUSH	13	0.28
LESSER SCAUP	12	0.25
SPOTTED SANDPIPER	12	0.25
LON-BILLED DOWITCHER	11	0.23
N.FLICKER	11	0.23
BUFFLEHEAD	10	0.21

PINE SISKIN	10	0.21
HARLAN'S HAWK	9	0.19
BANK SWALLOW	8	0.17
HARLEQUIN DUCK	7	0.15
RED-BR. MERGANSER	6	0.13
MERLIN	6	0.13
WHITE-W. CROSSBILL	6	0.13
AM. TREE SPARROW	6	0.13
BARROW'S GOLDENEYE	5	0.11
RUSTY BLACKBIRD	5	0.11
PINE GROSBEAK	5	0.11
WHITE-WINGED SCOTER	4	0.08
LEAST SANDPIPER	4	0.08
SPRUCE GROUSE	4	0.08
SHARP-T. GROUSE	4	0.08
NORTHERN GOSHAWK	4	0.08
GOLDEN EAGLE	4	0.08
BLACK-B. MAGPIE	4	0.08
WILSON WARBLER	4	0.08
RUDDY DUCK	3	0.06
UPLAND SANDPIPER	3	0.06
SEMIPALMATED PLOVER	3	0.06
BALD EAGLE	3	0.06
AMERICAN KESTREL	3	0.06
OL.-SIDED FLYCATCHER	3	0.06
SAVANNAH SPARROW	3	0.06
TOWNSEND'S SOLITAIRE	3	0.06
HORNED GREBE	2	0.04
RED-NECKED PHALAROPE	2	0.04
RUFFED GROUSE	2	0.04
THREE-TOED WODPECKER	2	0.04
GOLDEN-CRND SPARROW	2	0.04
FOX SPARROW	2	0.04
YELLOW WARBLER	2	0.04
BOREAL CHICKADEE	2	0.04
RED-NECKED GREBE	1	0.02
ARCTIC TERN	1	0.02
EURASIAN WIGEON	1	0.02
HUDSONIAN GODWIT	1	0.02
SOLITARY SANDPIPER	1	0.02
PEREGRINE FALCON	1	0.02
NORTHERN HAWK-OWL	1	0.02
BELTED KINGFISHER	1	0.02
SAY'S PHOEBE	1	0.02
CHIPPING SPARROW	1	0.02
LINCOLN'S SPARROW	1	0.02
BARN SWALLOW	1	0.02
VIOLET-GREEN	1	0.02

SWALLOW		
OR. CRND. WARBLER	1	0.02
BLACK C. CHICKADEE	1	0.02