2025

Giant’s Burn Wind Farm

Appendix 7.2: Collision Risk Modelling

Natural Research Projects,
Brathens Business Park,
Hill of Brathens,
Glassel,
Banchory
AB31 4BY

01330 826880

May 2025

Natural Research (Projects) Ltd. Company registered in Scotland: SC213640
Registered Office: 14 Carden Place, Aberdeen, AB10 1UR

Report Quality Assurance Log

Date	Version	Created by	Checked by
09/05/2025	1.0	Blair Urquhart	Alex Ash
19/05/2025	Issue		

CONTENTS

Introduction

1.1. Birds that are not displaced by the proposed development would be potentially vulnerable to collision with the turbines. The level of collision with wind turbines is presumed to be dependent on the level of flight activity over the proposed development and the ability of birds to detect and manoeuvre around rotating turbine blades. Birds that collide with a turbine are likely to be killed or fatally injured. This may in turn affect the maintenance of bird populations.

1.2. Further studies in the field of bird-windfarm research are required to establish with certainty the extent to which birds can avoid collision with wind turbines, although an increasing body of evidence suggests that avoidance capacity is very high (Whitfield & Madders, 2006[1]; Urquhart & Whitfield, 2016[2]; SNH, 2018[3]). The indications from studies are that collisions are rare events (e.g., Fielding *et al*., 2021)[4] and occur mainly at sites where there are unusual concentrations of birds and turbines, or where the behaviour of the birds' concerned leads to high-risk situations (e.g., Gill *et al*., 1996[5]; Percival, 1998[6]; de Lucas *et al.,* 2007[7]). Examples include migration flyways, and where the food resource, and therefore level of bird activity, is exceptional.

Collision Risk Modelling

1.3. The Band collision risk model (CRM) (Band *et al*., 2007)[8] is used to estimate the potential number of bird collisions likely to occur at wind farm proposals. The model requires input data based on species biometrics and flight characteristics, turbine specification and data on flights observed at the site of the wind farm proposal.

1.4. NatureScot guidance (SNH, 2000[9]; Band *et al*., 2007[8]) on collision risk modelling is a three-stage process, which involves:

1) An assessment of the probability of a collision, based on a bird flying through an operational turbine; and
2) An estimation of the number of birds passing through the swept zone of the turbine blades.

Multiplying stages 1 and 2 provides an estimate of collision risk with the turbines, assuming no avoidance action. After, the third stage is applied:

[1] Madders, M. & Whitfield, D.P. (2006). Upland raptors and the assessment of wind farm impacts. Ibis, 148, pp 43-56.
[2] Urquhart, B. & Whitfield, D.P. (2016). Derivation of an avoidance rate for red kite *Milvus milvus* suitable for onshore wind farm collision risk modelling Natural Research Information Note 7. Available at https://www.natural-research.org/ecological-research-charity/our-publications
[3] Scottish Natural Heritage (SNH). (2018). Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model. SNH Information and Guidance Note. Scottish Natural Heritage, Battleby.
[4] Fielding, A.H., Anderson, D., Benn, S., Dennis, R., Geary, M., Weston, E. & Whitfield, D.P. (2021). Non-territorial GPS-tagged golden eagles *Aquila chrysaetos* a two Scottish wind farms: Avoidance influenced by preferred habitat distribution, wind speed and blade motion status. PLoS ONE 16(8): e0254159. https://doi.org/10.1371/journal.pone.0254159
[5] Gill, J.P., Townsley, M. & Mudge, G.P. (1996). Review of the impacts of wind farms and other aerial structures upon birds. SNH Review 21: 68pp.
[6] Percival, S.M. (1998). Birds and Turbines: managing potential planning issues. Proc. of the 20th BWEA Conference 1998: pp 345-350.
[7] de Lucas, M., Janss, G.F.E. & Ferrer, M. (eds). (2007). Birds and Wind Power: Risk Assessment and Mitigation. Quercus, Madrid.
[8] Band, W., Madders, M., & Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: de Lucas, M., Janss, G.F.E. & Ferrer, M. (Eds.) Birds and Wind Farms: Risk Assessment and Mitigation, pp. 259- 275. Quercus, Madrid.
[9] SNH. (2000). Windfarms and Birds: Calculating a theoretical collision risk assuming no avoiding action. SNH Information and Guidance Note. Scottish Natural Heritage, Battleby.

3) An avoidance rate is applied (where known) to account for the fact that many species will take avoidance action.

1.5. The result of the model provides an estimate of the number of collisions that can be expected over a year or for the lifetime of the wind farm.

Viewsheds

1.6. Flight data were obtained from a total of two Vantage Points (VPs) that overlooked the seven-turbine layout. Viewsheds were estimated using a Digital Elevation Model (DEM) and a 35 m vertical offset above the ground surface (lowest point of rotor sweep at 35 m) (**Figure 1**). Other details of the viewshed calculation are given in **Table 1**.

Table 1. Vantage point survey effort and visible areas within the 500 m buffer drawn around the turbines.

VP No.	Visible area with 500m turbine buffer (ha)	Hours of observation between September and March (hrs)	Hours of observation between April and August (hrs)	Total hours of observation (hrs)
1	168.1	69.00	111.00	180.00
6	56.7	42.00	36.00	78.00

Flight activity within 500 m of turbines

1.7. A summary of flight activity recorded within 500 m of the proposed turbines is given in **Table 2**. All flights that passed within 500 m of the proposed turbines are shown in **Figure 2**.

Table 2. Summary of flight activity recorded within 500 m of the proposed turbines.

Species	Total flights	'At-risk' flights	No. individuals 'at-risk'	CRM undertaken
Golden plover	2	2	17	No
Goshawk	3	3	6	No
Hen harrier	10	5	5	No
Merlin	2	0	0	No
Peregrine	4	4	4	No
White-tailed eagle	1	0	0	No
Woodcock	1	0	0	No

1.8. An 'at–risk' flight is one which passes into the 500 m turbine buffer with at least part of its flight at an altitude between 20 m and 200 m. Professional judgement was used as to whether a CRM was undertaken for each species, based on the Nature Conservation Importance of the species and the number of 'at-risk' flights or the number of individuals potentially 'at-risk'.

1.9. Details of all flights for consideration under a CRM are shown in **Table 3**.

Table 3. Flight durations recorded within GVP viewsheds and clipped to 500 m survey buffer. Part, or all, of these flights at a height of 20 – 200 m agl places them at risk of a collision with the turbine blades (shaded columns).

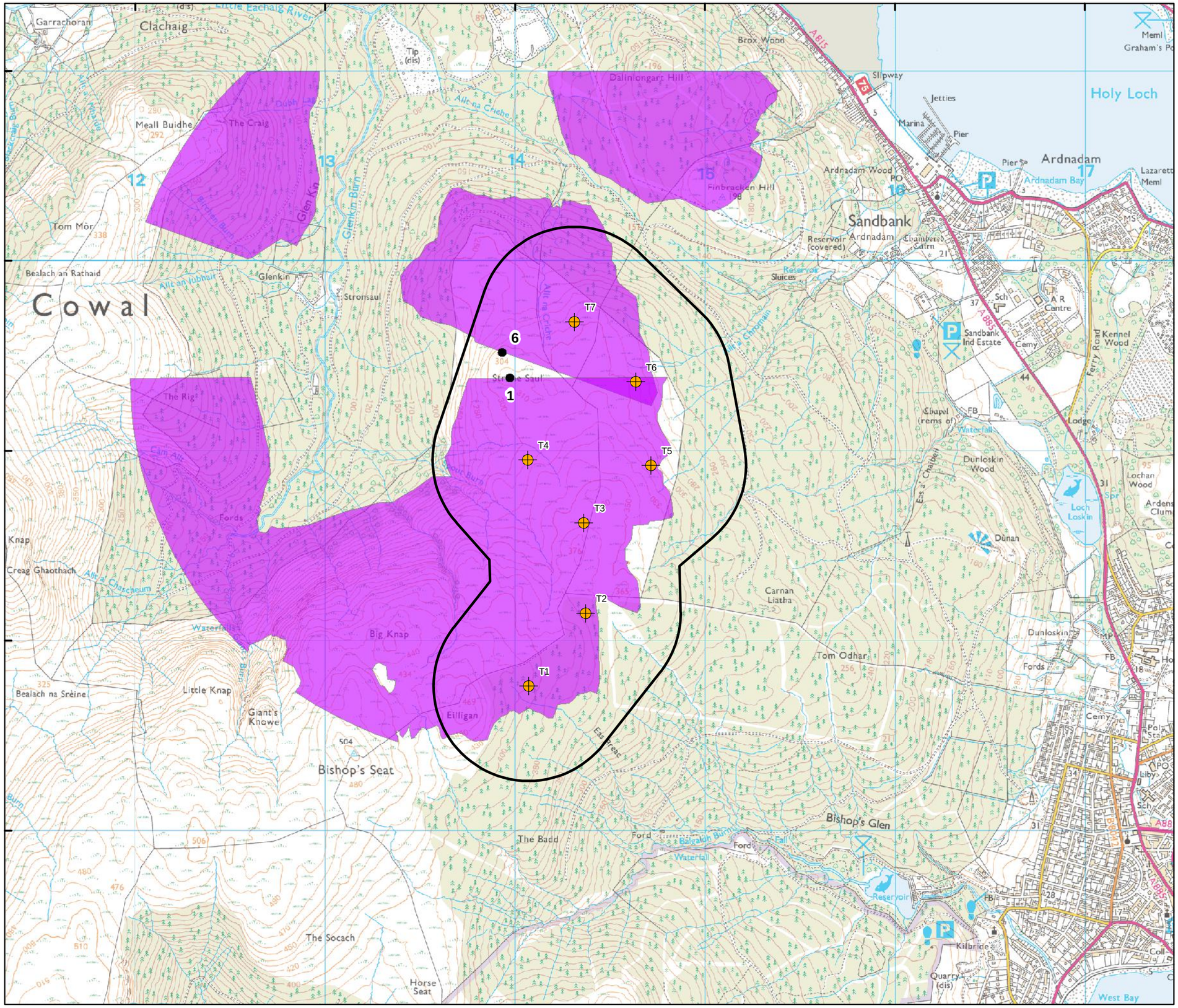
Species	Season	GVP No.	Flight ID	No. of birds	Total flying time (sec)	Time in height category (sec)					
						<20m	20-50m	50-100m	100-150m	150-200m	>200m
Golden plover	Sep-Mar	GVP1	GTB_221118_001_B006	16	1072			1072			
Golden plover Total				16	1072			1072			
Goshawk	Apr-Aug	GVP1	GTB_210415_001_B003	2	107			78	29		
			GTB_210415_001_B004	3	253				253		
			GTB_210727_001_B002	1	737		45	60	632		
Goshawk Total				6	1097		45	138	914		
Hen harrier	Apr-Aug	GVP1	GTB_210727_001_B001	1	120	30	90				
			GTB_230626_001_B001	1	80	15	65				
	Sep-Mar	GVP1	GTB_220926_001_B003	1	5	5					
			GTB_221004_001_B001	1	47	31	16				
			GTB_221004_001_B002	1	97			97			
			GTB_221130_001_B001	1	47	47					
		GVP6	GTB_220926_002_B001	1	16	16					
			GTB_220926_002_B002	1	82	61	21				
			GTB_220926_002_B003	1	64	64					
			GTB_230131_002_B001	1	24	24					
Hen harrier Total				10	582	293	192	97			
Merlin	Sep-Mar	GVP1	GTB_220926_001_B001	1	8	8					
			GTB_220926_001_B002	1	48	48					
Merlin Total				2	56	56					
Peregrine	Apr-Aug	GVP1	GTB_210415_001_B002	1	31	31					
			GTB_220622_001_B001	1	119			16	49	32	22
	Sep-Mar	GVP1	GTB_220915_001_B001	1	173	15	61	97			
			GTB_220915_001_B002	1	20		20				
Peregrine Total				4	367	70	81	113	49	32	22
White-tailed eagle	Apr-Aug	GVP1	GTB_210409_001_B001	1	59						59
White-tailed eagle Total				1	59						59
Golden plover	Apr-Aug	GVP1	GTB_210827_001_B001	1		*	*				
Golden plover Total				1		*	*				
Woodcock	Sep-Mar	GVP1	GTB_221118_001_B001	1		*					
Woodcock Total				1		*					

Conclusion

1.10. Although these species were present, they were recorded infrequently, and in small numbers (see **Appendix 7.1**). Hence, their reliance on airspace in the vicinity of the Proposed Development was considered low, and the Proposed Development will pose no significant risk of collision on relevant populations of these species

212000 213000 214000 215000 216000 217000

681000 680000 679000 678000 677000



nrp NATURAL RESEARCH PROJECTS LIMITED

Key

- Turbine locations
- Flight Activity Survey Area
- Vantage Points
- Viewsheds

Date produced: 12/05/2025

Source: NRP LTD

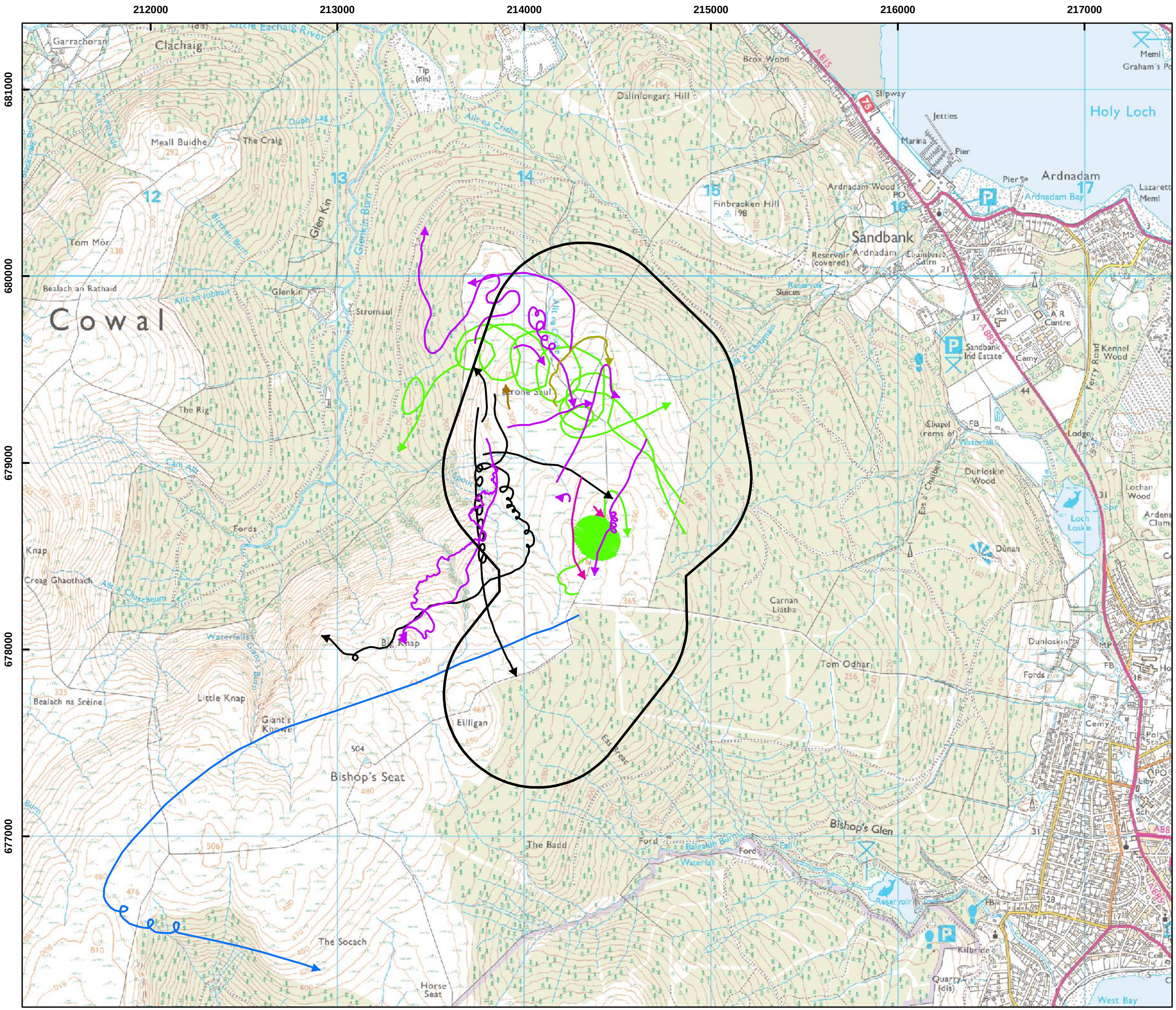
N

0 0.25 0.5 1 km

Figure 1.

Vantage Points and viewsheds used in Collision Risk Modelling

Giant's Burn



Key

Flight Activity Survey Area

Flight lines

- Goshawk
- Hen harrier
- Merlin
- Peregrine
- Golden plover
- Woodcock
- White-tailed eagle

Date produced: 19/05/2025

Source: NRP LTD

N

0 0.25 0.5 1 km

Figure 2.

Flight activity used in Collision Risk Modelling

Giant's Burn