

TECHNICAL APPENDIX 7.4: Balgray Wind Farm Wintering Bird Surveys 2022-23



Report to Fred Olsen Renewables Ltd

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BALGRAY WIND FARM: WINTERING BIRD SURVEYS 2022-23

Introduction

1. This report describes the wintering bird survey work carried out for a proposed wind farm at Balgray, Dumfries and Galloway. It provides a second wintering season's baseline data on the bird populations, activity and flight paths within the vicinity of the wind farm site, to inform subsequent ornithological impact assessment.
2. The surveys have been designed with reference to current NatureScot survey guidance on bird surveys for wind farms (SNH 2017). The surveys were undertaken by Dan Haywood, a highly experienced bird surveyor.

Study Area

3. The site is located about 7km north-east of Lockerbie in Dumfries and Galloway. The wintering bird survey areas were chosen to include all areas within the possible zone of ornithological influence of the wind farm (Figure 1). This included the wind farm site, plus a 500 m buffer for the main winter walkover surveys (the core survey area, following NatureScot guidance, SNH 2017) and a 2 km buffer for the wider wintering waterfowl surveys (the wider survey area), where access/viewing was possible and where there was potentially suitable habitat (Figure 1). The main core survey area covered a total area of 15.1 km² and the wider survey area 44.3 km². It comprised predominantly upland moorland habitat, currently used mainly for grazing sheep, surrounded by commercial conifer plantation and agriculturally improved grassland.

Wintering Bird Survey Methods

4. The aim of the autumn/winter field survey work was to obtain data on the ornithological importance of the wind farm site and its surrounds at that time of year, and on the flight lines of key target species. It included walkover surveys of the site and vantage point surveys of bird flight activity. The surveys were undertaken between November 2022 and March 2023, so do not include the main autumn (September/October) period.

Autumn/Winter Walkover Surveys

5. Walkover mapping surveys of the wintering birds within the site and a 500 m buffer took place in accordance with NatureScot guidance (SNH 2017). The survey focused on key target species which included all EU Birds Directive Annex 1 species, Wildlife & Countryside Act (1981) Schedule 1 species and Red-listed birds of Conservation Concern (Stanbury *et al.* 2021), as per NatureScot (SNH 2017).
6. As well as counting and mapping each species, the behaviour of each flock was also recorded, e.g. feeding/roosting. The surveys included work at dawn and dusk to check the area specifically for roosting hen harriers and other important raptors. A total of

10 surveys were undertaken at approximately fortnightly intervals between November 2022 and March 2023.

Goose Feeding Distribution Surveys

7. Additional surveys were undertaken twice-monthly of all possible habitats that could be used by wintering waterfowl (including pink-footed geese, greylag geese and whooper swans) as feeding/roosting sites within 2 km of the site (to give contextual information about where goose feeding flocks were located and provide further information on possible linkage to SPAs). The site lies within the potential SPA connectivity distance from the Castle Loch SPA (for which pink-footed geese are a qualifying feature) and within a known goose feeding area (Mitchell 2012, SNH 2013),

Vantage Point Surveys

8. Vantage Point surveys were carried out to determine bird flight activity within the wind farm site to assess collision risk. The surveys quantified the bird numbers that could potentially be at risk of collision (including roost flight observations at dawn/dusk). All flight lines of target species were mapped, and the flight height of each flock recorded. Target species were the same as those set out above for the walkover surveys.
9. The specific aim of the VP surveys was to collect data on key target species flight activity to enable estimates of:
 - The time spent flying over the survey area
 - The relative use made of different parts of the survey area
 - The proportion of flying time spent at different elevations above the ground.
10. Two vantage points were used to cover the wind farm site. The computer-generated viewsheds (using Global Mapper v21) are shown in Figure 1. For each VP, a total of 48 hours' VP surveys were carried out during the autumn/winter from each VP (as set out in NatureScot guidance, SNH 2017), spread evenly across the winter season. As the site lies within the potential SPA connectivity distance from the Castle Loch SPA (for which pink-footed geese are a qualifying feature) and within a known goose feeding area (Mitchell 2012, SNH 2013), this includes additional surveys in November and February-March to provide extra coverage in the goose migration season.
11. All key target species flights (and any other species of specific nature conservation interest) were recorded, irrespective of their distance from the vantage point. Observations were carried out throughout daylight hours but not in periods of severely reduced visibility (<3km).
12. During the VP surveys, all key target species flights were mapped and cross-referenced to a standard recording form using a numbering system, and the flight height of each recorded. Heights were estimated as accurately as possible using available reference structures and recorded as a raw estimate rather than being summarised to height classes. Below 10 m estimates were made to 1 m, between 10 and 20 m to 2 m, between 20 m and 50 m to 5 m, and above 50 m to 10 m. When birds were observed over an extended period, estimates of flight height were

recorded every 30 seconds. The activity during each flight was also recorded. Particular attention was paid to any observations of birds at rotor height.

Wintering Bird Survey 2022-23 Results

Autumn/Winter Walkover Survey Results

13. The bird populations found within the survey area during each of the monthly walkover surveys are summarised in Table 1. The Table shows the peak numbers recorded during each month, and the overall peak counts. Overall, only low numbers of birds were recorded using the site during these surveys as in the previous winter survey, though the larger lochs did support a range of wintering waterfowl (with higher peak numbers of the two most abundant species, teal and mallard, in 2022-23).

Table 1. Autumn/winter bird populations recorded in the Balgray survey area during the November 2022 - March 2023 walkover surveys (monthly peak counts).

Species	Nov	Dec	Jan	Feb	Mar	Peak 2022-23	Peak 2021-22
Mute Swan	7	7	7	5	5	7	11
Whooper Swan	6	0	6	0	0	6	6
Canada Goose	0	0	0	0	6	6	4
Wigeon	2	2	2	0	0	2	2
Teal	170	84	52	21	12	170	60
Mallard	58	42	62	7	6	62	37
Tufted Duck	2	0	5	0	1	5	9
Goosander	2	0	0	0	0	2	0
Red Grouse	1	0	0	0	0	1	0
Little Grebe	4	0	0	1	0	4	3
Grey Heron	1	1	1	0	1	1	2
Red Kite	1	1	2	1	1	2	13
Hen Harrier	0	0	0	1	0	1	1
Sparrowhawk	1	0	0	0	0	1	1
Buzzard	6	3	3	1	16	16	16
Kestrel	1	3	2	2	2	3	4
Peregrine	1	0	0	0	0	1	0
Moorhen	4	3	2	2	2	4	0
Lapwing	0	0	0	8	6	8	13
Snipe	2	4	3	3	4	4	14
Common Gull	0	2	0	0	0	2	0
Barn Owl	0	0	1	2	0	2	0
Short-eared Owl	0	0	0	0	2	2	2
Raven	4	1	2	2	0	4	1

Species	Nov	Dec	Jan	Feb	Mar	Peak 2022-23	Peak 2021-22
Common Crossbill	0	11	3	5	7	11	6

Autumn/Winter Wider Area Goose Feeding Distribution Survey Results

14. The bird populations found within the survey area during each of the fortnightly goose distribution surveys are summarised in Table 2. The Table shows the peak numbers recorded during each month, and the overall peak counts (with those from 2021-22 also given for comparison). Like 2021-22, there were no records of any geese feeding within the survey area.

Table 2. Autumn/winter bird populations recorded in the wider (2km buffer) Balgray survey area during the November 2022 - March 2023 goose feeding distribution surveys (monthly peak counts).

Species	Nov	Dec	Jan	Feb	Mar	Peak 2022-23	Peak 2021-22
Greylag Goose	0	0	0	0	2	2	0
Teal	4	0	5	3	2	5	0
Mallard	3	2	4	2	0	4	24
Goldeneye	0	0	0	0	1	1	0
Grey Heron	2	4	0	1	2	4	4
Red Kite	2	10	3	1	2	10	23
Buzzard	2	3	0	0	2	3	25
Peregrine	0	0	0	0	1	1	0
Oystercatcher	0	0	0	2	1	2	2
Lapwing	0	0	0	2	0	2	0
Curlew	0	0	0	0	1	1	1
Common Gull	2	15	0	14	0	15	0
Herring Gull	0	1	0	0	0	1	6
Great Black-backed Gull	1	1	0	0	0	1	2

Vantage Point Survey Results: Autumn/Winter 2022-23

15. The rates of bird flight movement observed across the survey area during the vantage point surveys are summarised in Table 3. This gives the flight rate per hour recorded in each month and the total number of flights recorded. Flight rates over the survey area were generally low, as they had been in the previous winter (Table 4), though the site was regularly used by wintering red kites. There were also occasional records of several other key raptors (red kite, hen harrier, goshawk, golden eagle, merlin, peregrine and short-eared owl), and pink-footed geese.
16. Table 3 also gives the percentage of flights of each species that were recorded at rotor height (taking rotor height conservatively as between 21 m and 200 m above ground level).

Table 3. Bird flight rates recorded over the Balgray survey area during the November 2022 - March 2023 vantage point surveys. N = 48 hours total observation from each of the two VPs.

Species	Nov	Dec	Jan	Feb	Mar	Total number of birds overflying	% flights at rotor height
Mute Swan	-	-	-	-	0.1	2	100%
Whooper Swan	0.2	0.2	0.5	0.5	0.6	41	89%
Pink-footed Goose	2.7	-	15.9	1.1	4.9	399	100%
Greylag Goose	0.1	-	0.3	0.3	-	14	100%
Canada Goose	-	-	-	-	0.2	4	100%
Teal	1.3	5.5	3.8	-	0.8	156	50%
Mallard	0.2	-	2.8	0.2	0.3	49	57%
Tufted Duck	-	-	0.4	-	-	5	100%
Goldeneye	-	-	-	0.1	-	2	100%
Goosander	-	0.4	-	-	-	4	100%
Red Kite	0.6	0.6	0.9	1.3	1.5	98	56%
Hen Harrier	-	0.1	0.3	0.2	-	10	0%
Goshawk	-	0.1	0.1	0.2	0.2	13	77%
Sparrowhawk	-	-	0.1	0.2	0.1	9	38%
Buzzard	0.8	0.3	1.1	1.6	0.3	78	67%
Kestrel	0.9	0.8	0.9	0.8	0.5	70	19%
Merlin	-	-	-	-	-	2	50%
Peregrine	-	-	-	0.1	-	4	100%
Oystercatcher	-	-	-	0.1	-	3	100%
Golden Plover	0.5	-	-	-	0.3	20	100%
Lapwing	0.1	2.2	-	5.4	0.3	165	92%
Snipe	-	0.4	0.2	-	0.3	13	67%
Woodcock	-	-	-	-	-	1	0%
Curlew	-	-	-	0.1	-	2	100%
Common Gull	1.2	1.6	-	-	-	46	100%
Great Black-backed Gull	0.1	-	-	0.3	-	8	67%
Short-eared Owl	-	-	-	-	0.1	3	0%

Table 4. Bird flight rates recorded over the Balgray survey area during the September 2021 - March 2022 vantage point surveys. N = 72 hours total observation from each of the two VPs.

Species	Flight rate (birds/hour)					Feb	Mar	Total number of birds overflying	% flights at rotor height
	Sep	Oct	Nov	Dec	Jan				
Mute Swan	-	-	-	-	0.5	0.1	0.1	25	0%
Pink-footed Goose	-	63.3	-	1.4	0.4	0.4	1.5	3237	54%
Canada Goose	-	0.1	-	-	-	-	-	7	50%
Mallard	0.2	-	-	-	-	-	0.1	17	17%
Goosander	-	0.1	-	-	-	-	-	4	0%
Cormorant	-	0.1	-	-	-	-	-	6	0%
Grey Heron	-	-	-	-	-	-	-	7	40%

Species	Flight rate (birds/hour)					Feb	Mar	Total number of birds overflying	% flights at rotor height
	Sep	Oct	Nov	Dec	Jan				
Red Kite	0.6	0.6	2.1	1.2	1.5	1.9	0.2	323	85%
Hen Harrier	0.1	0.1	-	-	-	0.1	0.1	21	29%
Goshawk	0.1	0.1	0.1	-	-	0.1	-	16	44%
Sparrowhawk	0.1	0.1	-	-	-	-	-	7	57%
Buzzard	1.0	1.0	0.9	0.8	0.6	1.7	1.8	336	61%
Golden Eagle	-	-	-	0.2	-	-	-	5	40%
Osprey	-	-	-	-	-	-	-	1	100%
Kestrel	0.7	0.7	0.5	0.3	0.4	0.1	-	112	48%
Merlin	0.1	-	-	-	-	-	-	4	50%
Peregrine	-	-	-	-	-	-	-	3	100%
Oystercatcher	-	-	-	-	-	-	-	1	0%
Golden Plover	0.1	0.6	-	-	-	-	0.6	61	33%
Lapwing	0.5	-	-	-	-	-	-	27	50%
Snipe	0.1	-	-	-	-	-	0.1	14	50%
Woodcock	-	-	-	-	-	-	-	2	0%
Redshank	-	-	-	-	-	-	-	1	100%
Lesser Black-backed Gull	0.1	0.1	-	-	-	-	1.4	84	77%
Herring Gull	-	-	-	-	0.3	-	-	11	75%
Great Black-backed Gull	-	-	-	0.3	-	0.1	-	14	86%
Short-eared Owl	-	-	-	-	-	0.1	-	7	20%

Conservation Evaluation of Wintering Bird Populations

- The conservation value of the wintering bird populations was determined using the criteria specified in Table 5 (from Percival 2007) and is summarised in Table 6. This includes the criteria adopted by NatureScot in Guidelines for Selection of Biological SSSIs (Drewitt *et al.* 2020), using 1% of the resource to define international and national importance (Frost *et al.* 2021). An additional category of regional importance was assigned for species approaching the threshold for national importance and those for which the survey area held a notable concentration in a county context. A further category of 'local importance' was used for species that did not reach regional importance but were still of some ecological value. This included all species on the red or amber lists of the 'Birds of Conservation Concern' (Stanbury *et al.* 2021) that did not reach national or regional importance at the development site. National (GB) and international wintering waterfowl baseline populations have been taken from the most recently published population figures (Frost *et al.* 2021) from the national Wetland Birds Survey and other species from Woodward *et al.* (2020). In addition, listing on Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act 1981, UK BAP priority species and Scottish BAP species were all considered in the evaluation process.

Table 5. Definition of terms relating to the sensitivity of the ornithological receptors at the site.

Conservation Value	Definition
VERY HIGH	Cited interest of SPAs, SACs and SSSIs. Cited means mentioned in the citation text for the site as a species for which the site is designated (SPAs/SACs) or notified (SSSIs).
HIGH	Other species that contribute to the integrity of an SPA or SSSI. A local population of more than 1% of the national population of a species. EU Birds Directive Annex 1, EU Habitats Directive priority habitat/species and/or W&C Act Schedule 1 species. Ecologically sensitive species, e.g. large birds of prey or rare birds (<300 breeding pairs in the UK).
MEDIUM	Regionally important population of a species, either because of population size or distributional context. UK BAP priority species (if not covered above).
LOW	Any other species of conservation interest, e.g. species listed on the Birds of Conservation Concern not covered above. Scottish BAP species (if not covered above).
NEGLIGIBLE	Green-listed species (Stanbury et al. 2021) of favourable conservation status

18. The conservation value of the wintering bird populations observed in the Balgray survey area during the wintering bird surveys has been summarised in Table 6 below. This included one very high sensitivity species (pink-footed goose – the birds seen could be ecologically linked to the Castle Loch SPA), 13 high sensitivity species (whooper swan, goldeneye, osprey, red kite, golden eagle, hen harrier, goshawk, peregrine, merlin, golden plover, green sandpiper, short-eared owl and common crossbill) that are EU Birds Directive Annex 1/Wildlife and Countryside Act Schedule 1 species, three medium sensitivity species (UK BAP priority/red listed species of conservation concern; lapwing, curlew and herring gull), and 12 low sensitivity species.

Table 6. Conservation evaluation of the wintering bird populations in the Balgray survey area, September 2021 – March 2022 and November 2022 – March 2023.

Species	Peak count (core)	Peak count (wider)	EU Birds Dir Ann 1	W and C Act Sch 1	Red [R]/ Amber [A] List	UK BAP priority sp	Scottish BAP sp	Conservation Value
Mute Swan	11	7						Negligible
Whooper Swan	6	8	✓	✓	A		✓	High
<i>Pink-footed Goose</i>	96	91			A			<i>Very high</i>
Greylag Goose	1	4			A			Low
Canada Goose	4	6						Negligible
Wigeon	2	2			A			Low
Teal	60	170			A			Medium
Mallard	37	62			A			Low
Tufted Duck	9	5						Negligible
Goldeneye	1	2		✓	R			High
Goosander	2	4						Negligible
Red Grouse	0	1				✓		Medium
Little Grebe	3	4						High
Cormorant	2	0						Negligible
Grey Heron	2	1						Negligible
Red Kite	13	10	✓	✓			✓	High
Hen Harrier	1	1	✓	✓	R		✓	High

Species	Peak count (core)	Peak count (wider)	EU Birds Dir Ann 1	W and C Act Sch 1	Red [R]/ Amber [A] List	UK BAP priority sp	Scottish BAP sp	Conservation Value
Goshawk	1	1		✓				High
Sparrowhawk	1	1			A			Low
Buzzard	16	16						Negligible
Golden Eagle	1	0	✓	✓			✓	High
Osprey	1	0	✓	✓	A		✓	High
Kestrel	4	3			A		✓	Low
Merlin	1	1	✓	✓	R		✓	High
Peregrine	2	1	✓	✓			✓	High
Moorhen	0	4			A			Low
Oystercatcher	2	2			A			Low
<i>Golden Plover</i>	20	13	✓				✓	<i>High</i>
Lapwing	13	74			R	✓	✓	Medium
Jack Snipe	1	0						Negligible
Snipe	14	4			A			Low
Woodcock	1	1			R		✓	Low
Curlew	1	1			R	✓	✓	Medium
Green Sandpiper	2	0		✓	A		✓	High
Redshank	1	0			A			Low
Common Gull	0	15			A			Low
Lesser Black-backed Gull	47	0			A			Low
Herring Gull	6	1			R	✓	✓	Medium
Great Black-backed Gull	2	1			A			Low
Barn Owl	0	2		✓			1	High
Short-eared Owl	2	2	✓		A		1	High
Raven	1	4						Negligible
Common Crossbill	6	11		✓				High

Note: species in italics seen over-flying only.

19. The key autumn/wintering birds recorded were as follows:

- **Pink-footed Goose** – a total of 3,237 flights were observed during the 2021-22 VP surveys, but 96% of those occurred during 6-8 October 2021. Fewer (399 flights) were recorded in 2022-23 (though that did not include the main October migration period). Apart from this brief period of activity, the only other records were of small numbers of migrant flocks over-flying the survey area. Their flight lines are shown in Figure 2. There were no records of any feeding flocks within the survey area in either winter. There was no evidence of any clear link to the Castle Loch SPA, with flights occurring in all directions across the site. As the wind farm site is clearly not within an important goose feeding area, the only impact of the development on this species would be collision risk, which, given the numbers observed, would be unlikely to be significant.
- **Teal** – regionally important numbers were recorded in 2022-23 (peak 170), though there had been fewer in the previous winter (peak 60). Most records were from Hallhills Loch in the northern part of the site, with a smaller number of records from the smaller loch just outside the south-eastern corner of the site.
- **Other wintering wildfowl** – the core walkover survey area was used by a range of other wintering waterfowl species but only in low (locally important) numbers.

This included **whooper swan, wigeon, mallard** and **goldeneye**. Most records were from Hallhills Loch in the northern part of the site, with a smaller number of records from the smaller loch just outside the south-eastern corner of the site.

- **Red Kite** – this species was observed regularly hunting and over-flying the site, with a total of 323 flights recorded in 2021-22 and 98 in 2022-23 (Figure 3). The site is clearly important for this species at this time of year.
- **Golden Eagle** – none were recorded during the 2022-23 surveys. However, five flights were observed during the 2021-22 VP surveys, all of the same juvenile bird and all between 10-16 December 2021. It is likely, given the location of the site, that this was a bird from the South Scotland Golden Eagle Project release scheme. Given the habitat present and the fact that it did not stay in the area, this would suggest that this area is not important for this species.
- **Hen harrier** – this species was regularly seen hunting over the site through the winter, with 21 flights in total in 2021-22 and 10 in 2022-23 (see Figure 4). No evidence was found of any night roost in the survey area in either winter, and most flights seen were below rotor height (so collision risk would be low).
- **Goshawk** – this species was observed regularly during the winter VP surveys, with 16 flights in total in 2021-22 and 13 in 2022-23 (Figure 5). It was seen mostly over the forestry rather than the open ground of the site itself.
- **Other scarce raptors and owls** – osprey, peregrine, merlin, barn owl and short-eared owl were all recorded during the winter surveys, but only infrequently in low numbers. Figure 6 shows the flight lines from the VP surveys in 2022-23 for the three of these species that were recorded during these surveys (merlin, peregrine and short-eared owl). There was no indication that the survey area was important to any of these species at this time of year.

Conclusions

20. The 2021-22 and 2022-23 wintering bird surveys found a range of wintering bird populations of conservation importance but generally (apart from red kite) only low numbers within/in proximity to the wind farm site in numerical terms and/or in the context of their regional (NHZ) populations.
21. Pink-footed geese had been initially considered a potentially important species in the area given the proximity to the Castle Loch SPA (within its SPA connectivity range, SNH 2017) and the potential feeding habitat (agricultural grassland and arable land) around the site. However, the goose feeding distribution surveys did not record any pink-footed geese at all feeding within 2 km of the site. There were some flocks seen over-flying the site, though most of these were seen during a short period in early October and there was no evidence of any clear link to the Castle Loch SPA.
22. Red kites were seen in regionally important numbers using the site and were recorded regularly during all the surveys. Flight activity overall was considerably higher than recorded in the summer (Percival *et al.* 2021 and Percival *et al.* 2022). Given their use of the site, further analysis was undertaken to more clearly define the areas of importance to inform the site design. Figure 7 shows a heatmap of red kite flight density across the VP survey area for the 2022-23 data. The core area (holding 50% of the survey records) is also shown, together with that from 2021-22. The main centre

of activity shifted slightly from the previous winter to the east. Overall, using both winters' data, the main area of red kite flight activity was in the central and south-western edge of the wind farm site, particularly over the slopes of Shielstead Hill, to the south of Hallhills Loch.

23. Other raptor species, including golden eagle, hen harrier, goshawk, osprey, peregrine, merlin, barn owl and short-eared owl, were recorded in lower numbers and less frequently.

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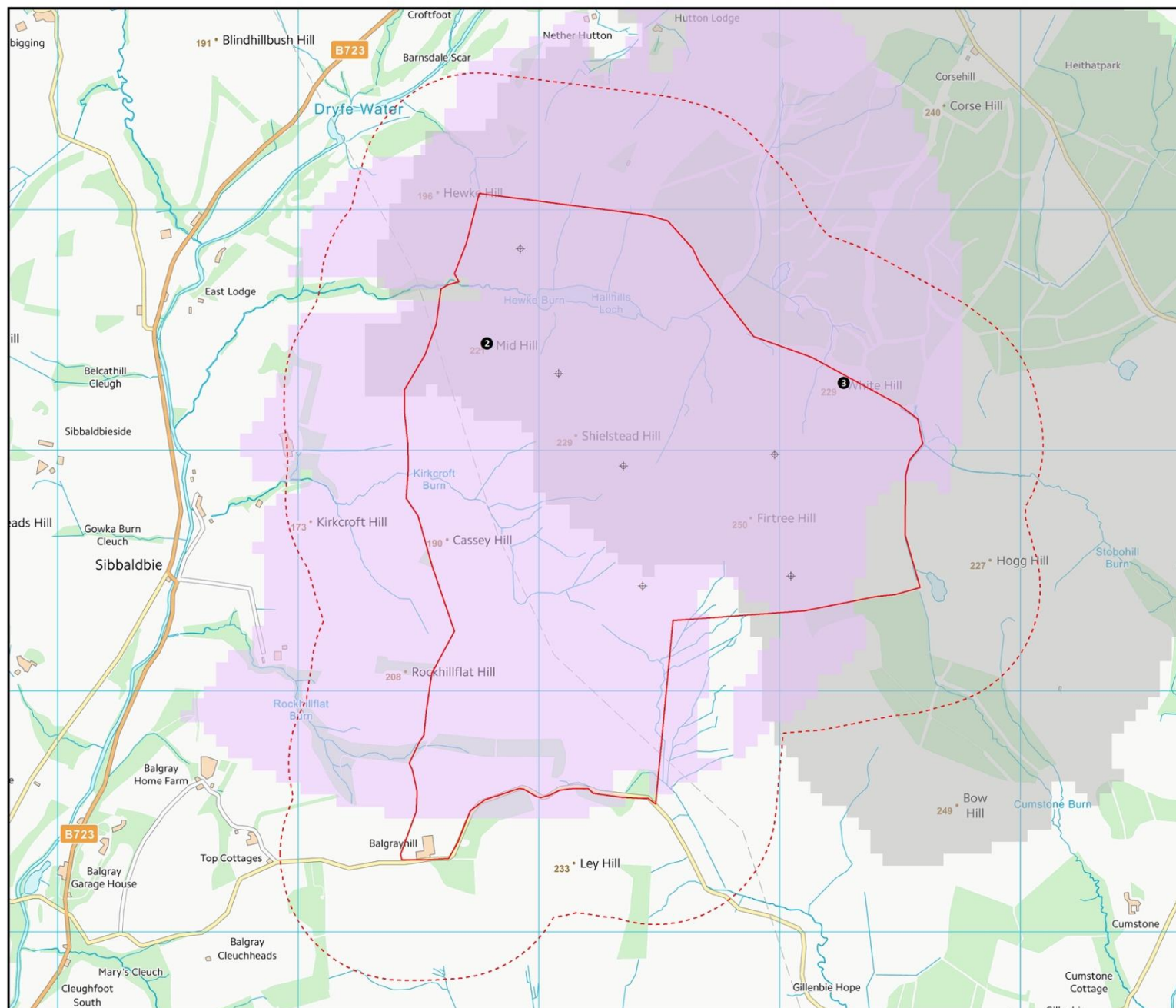
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Balgray Proposed Wind Farm

FIGURE 1

Core Winter Walkover and VP Survey Areas

KEY:

- Site Boundary
- Core 500m buffer survey area
- Proposed turbines
- Vantage points
- VP2 viewshed
- VP3 viewshed



Contains Ordnance Survey OpenData
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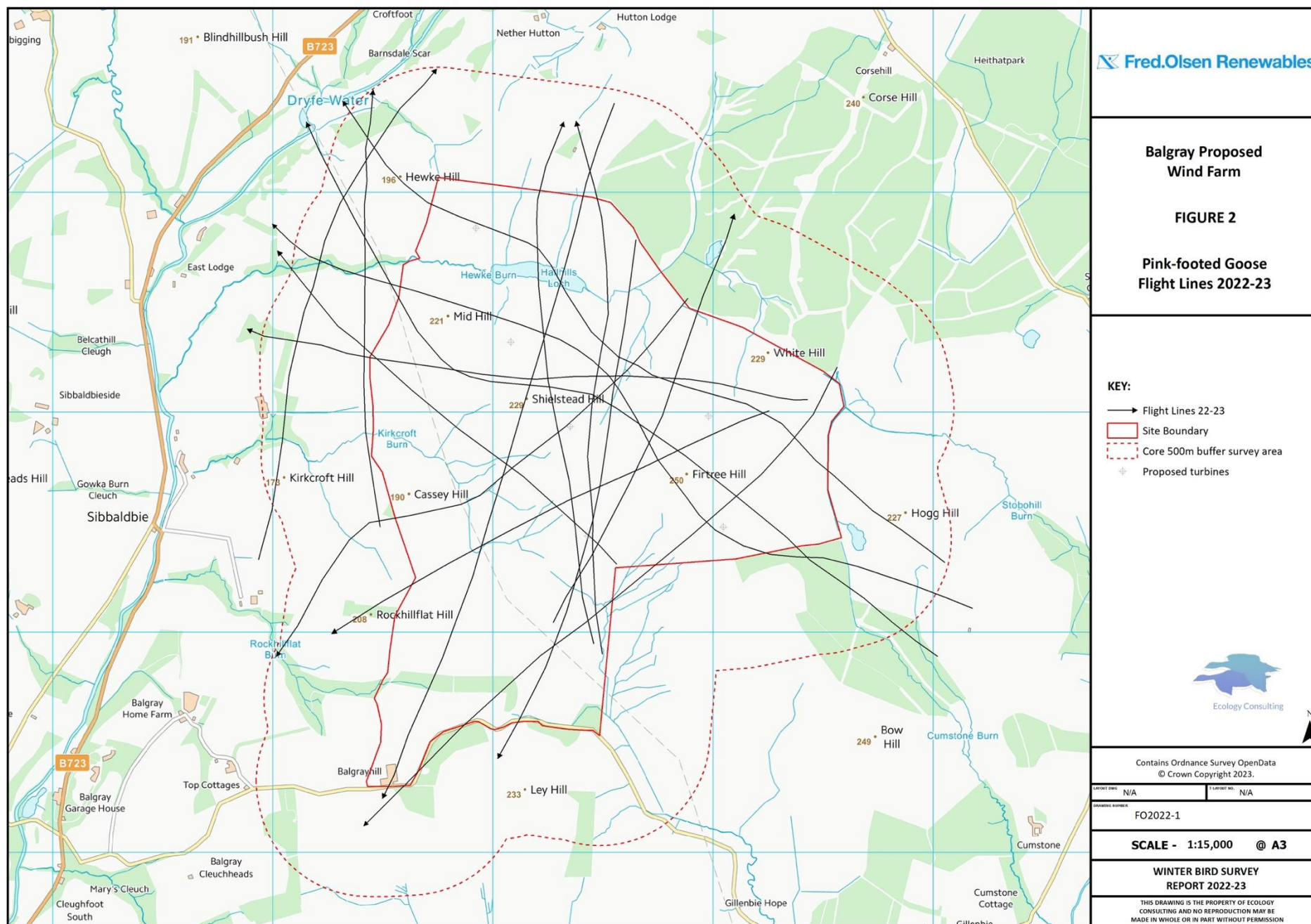
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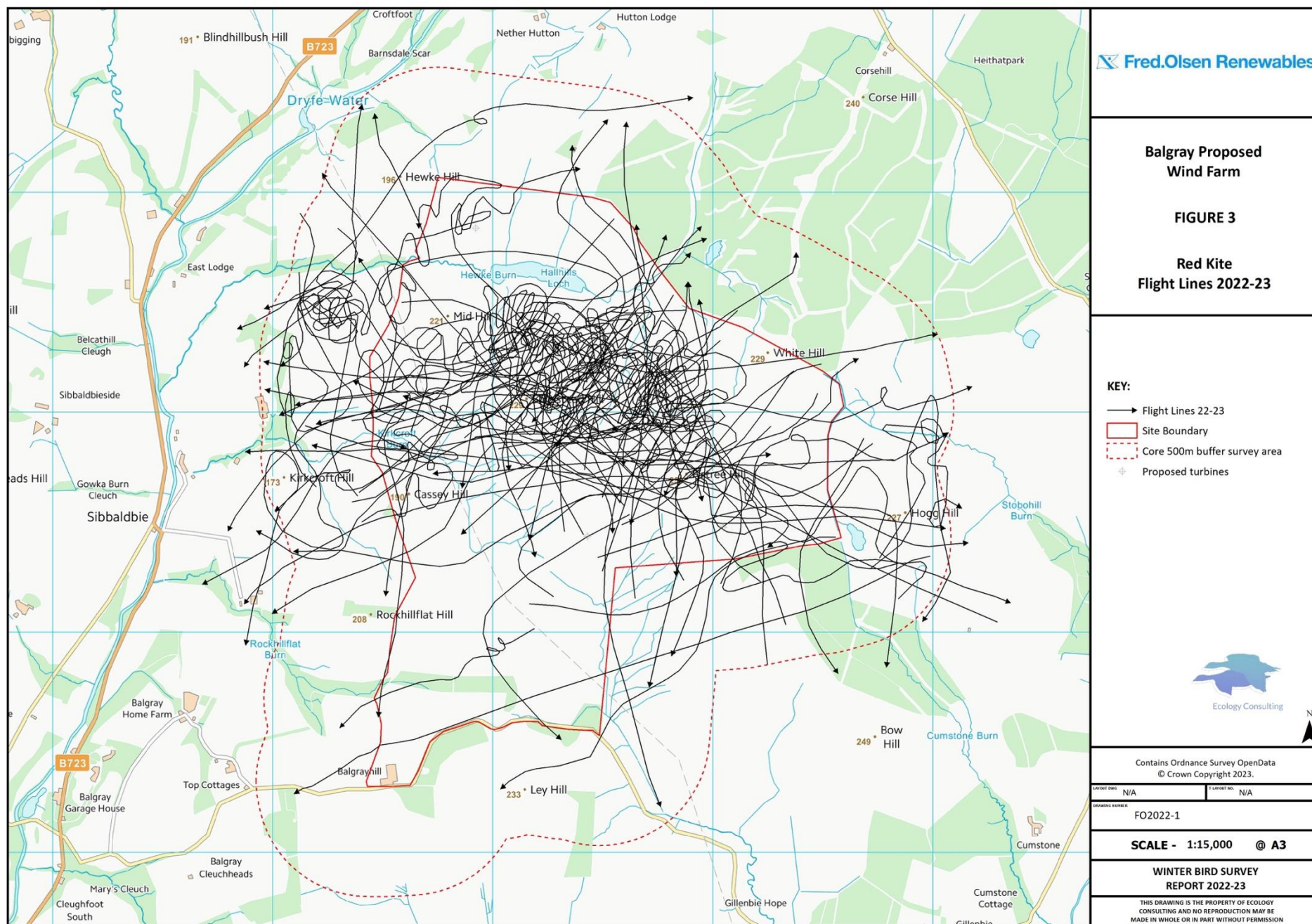
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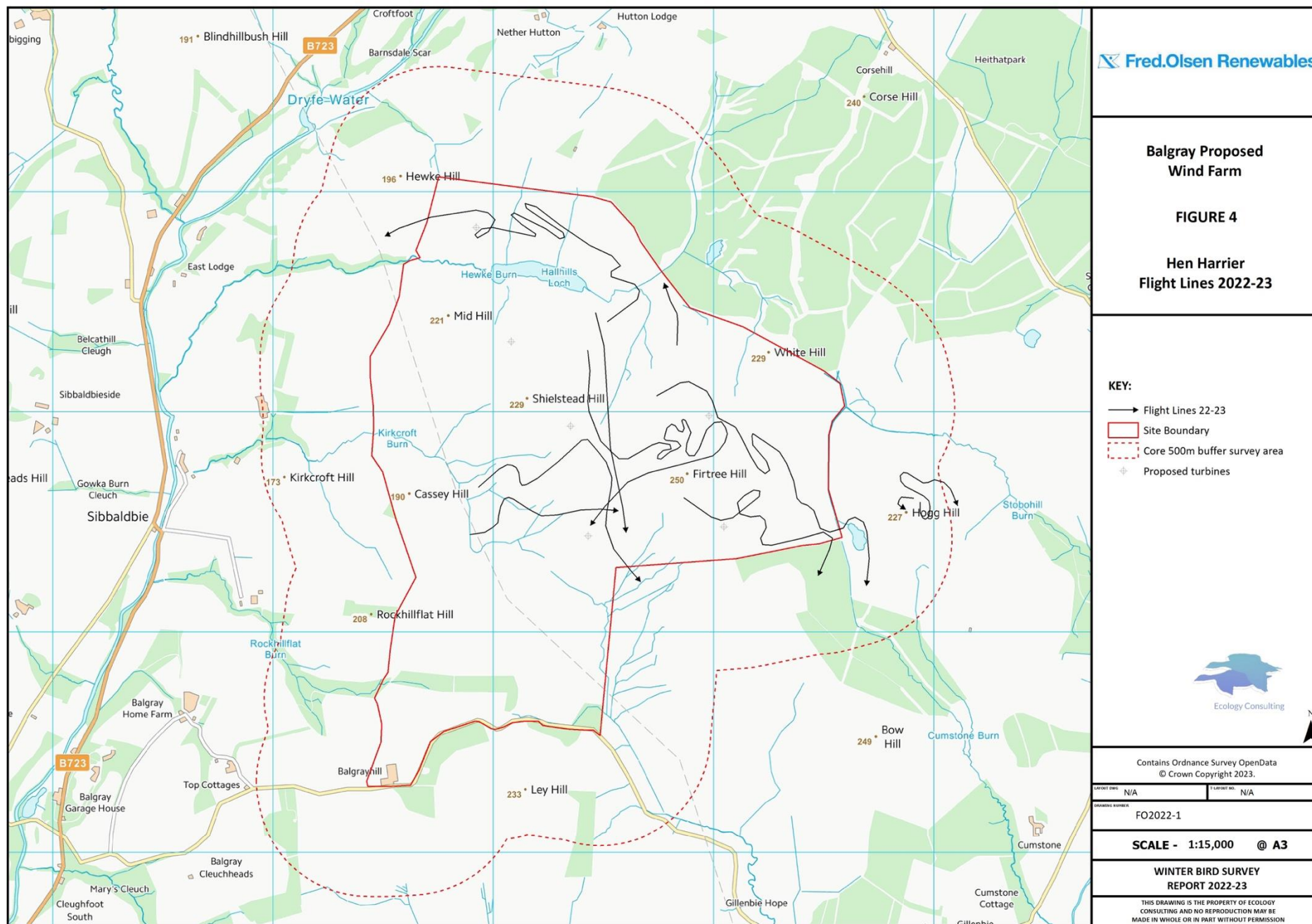
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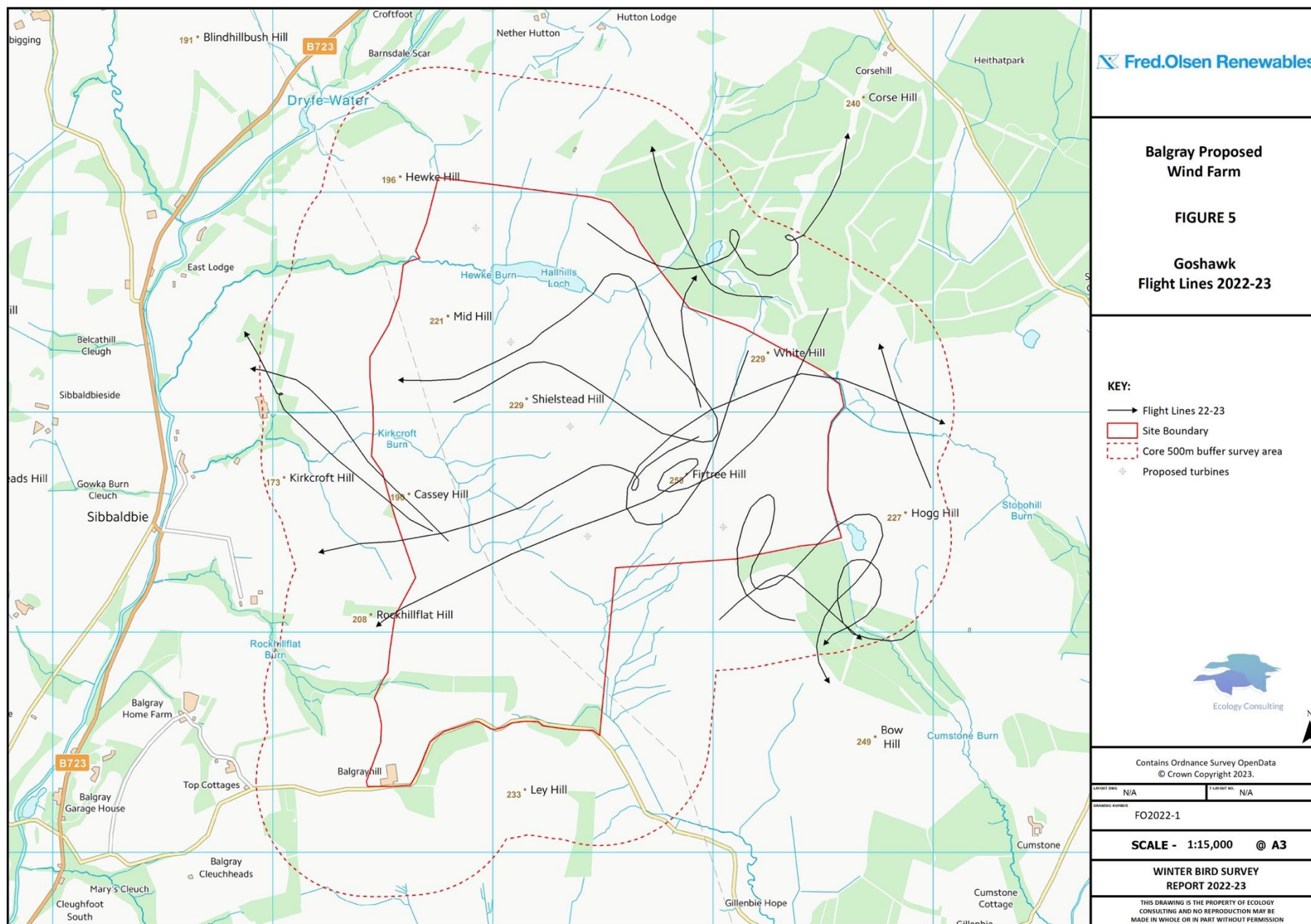
WINTER BIRD SURVEY
REPORT 2022-23

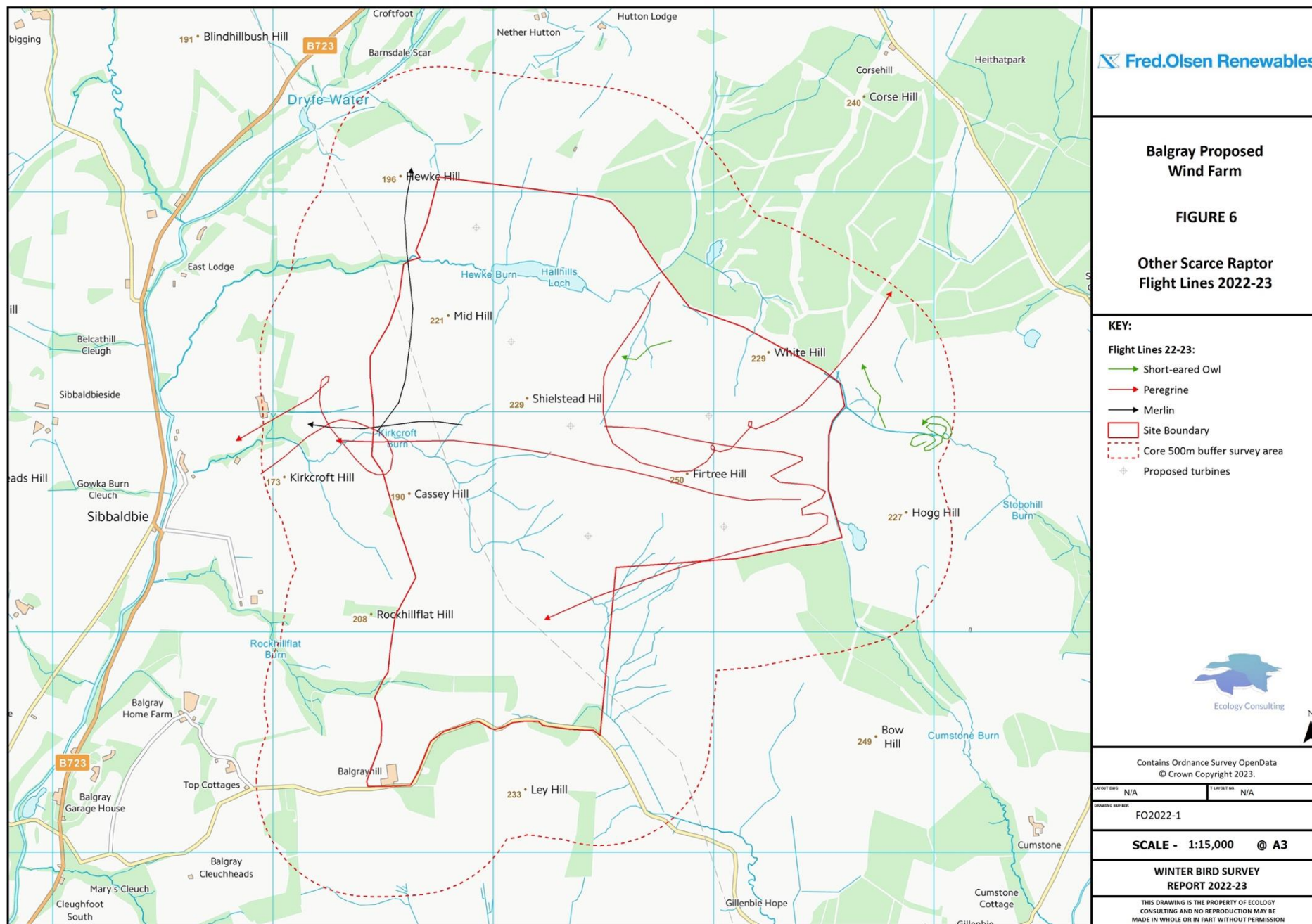
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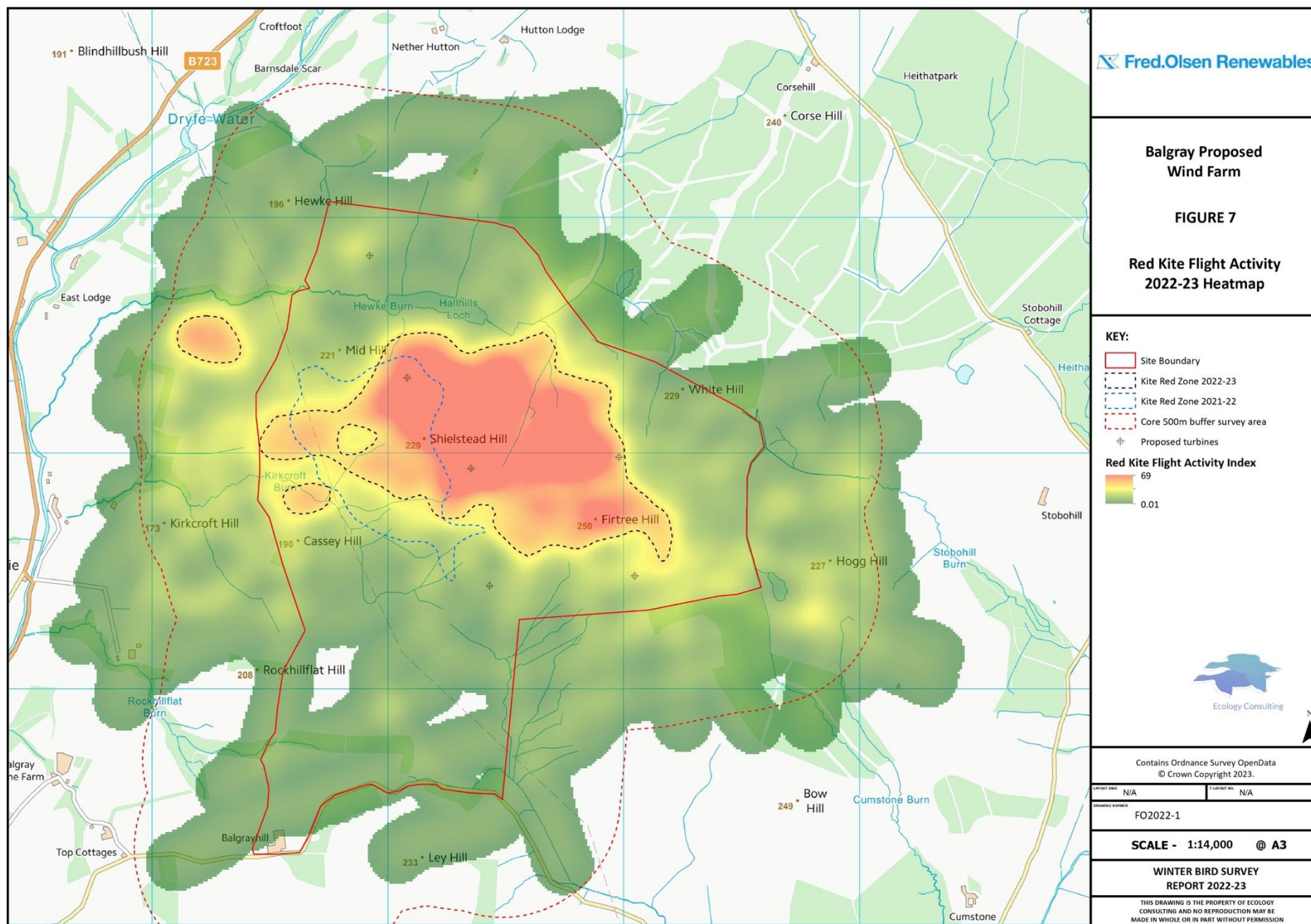












APPENDIX 1. VANTAGE POINT SURVEY DATA

Survey Information

Date	Vantage Point No	Start time	Finish time	Weather
16/11/2022	2	09:50	12:50	ESE 3-4. 2 oktas later 7, dry, 7 to 8C
16/11/2022	3	13:25	16:25	E 3-4, 7-8 oktas, dry, 7C
18/11/2022	3	08:30	11:30	NE 3, 6- oktas, dry, 5 to 6C
18/11/2022	2	12:15	15:15	NE 3-4, later NW 2-3, 7-8 oktas, showers, 6C
28/11/2022	2	09:20	12:20	ESE 1 - SE 2, 6-5 oktas, dry, 5.5 to 6.5C
28/11/2022	3	13:00	16:00	SE 2 > S 1, 5-6 oktas, dry, 8 to 7.5C
29/11/2022	3	09:15	12:15	S1, 3-5 oktas, dry, 1 to 2.5C
30/11/2022	2	13:20	16:20	SE 1-2, 8 oktas, dry, 4.5C
08/12/2022	2	13:10	15:10	W 2, 4 oktas, dry, 0.5 to -0.5C, heavy frost
09/12/2022	3	12:45	15:45	W 1, 2 oktas, dry, 0.5 to 1C
22/12/2022	2	09:25	12:25	SW 1-2, 7 oktas, dry, 3.5C
23/12/2022	3	09:00	12:00	NE 2-3, 7 oktas, occasional drizzle, 3.5C
12/01/2023	3	09:30	12:30	WSW 5, 6-7 oktas, heavy showers, 6C
13/01/2023	2	09:30	12:30	7 oktas, SW4, showers, 5C
24/01/2023	2	09:10	12:10	W 1, 8 oktas, some low cloud (c80m), dry, 5.5C
25/01/2023	3	09:40	12:40	NW 3 later NW 4, 7 oktas later 5, light showers at first, 5.5C
07/02/2023	3	09:40	12:40	SW 2, 8 oktas, dry, 7C
07/02/2023	2	13:15	16:15	SSW 2-3, 8 oktas, low cloud on higher ground at times, dry, 7.5C
09/02/2023	2	08:25	11:25	SW 2-3, 6 oktas, dry, 3-4C
09/02/2023	3	12:00	15:00	SW 3, 6 oktas, dry, 4 to 5C
22/02/2023	2	12:40	15:40	NNW 3, 6 oktas, occasional sleet showers, 5C
27/02/2023	3	09:30	12:30	NE 3-4, 6-7 oktas, dry, 6C
28/02/2023	3	09:40	12:40	N 3, 5 to 7 oktas, dry, 4C
28/02/2023	2	13:15	16:15	N 3, 7 oktas, light showers, 5C
07/03/2023	2	07:25	10:25	4-2 oktas, SE 2, dry, -3C to -1C
07/03/2023	3	10:45	13:45	3 oktas, E 1-2, mostly dry but one light snow shower, 1 to 3.5C
07/03/2023	2	14:15	17:15	4 oktas, ESE 1, wintry showers, 2.5C
08/03/2023	3	08:25	11:25	3-4 oktas, ENE 3, wintry showers, -2C
08/03/2023	2	11:55	14:55	4 oktas, ENE 3-4, wintry showers, -0.5C to 1.5C
23/03/2023	3	08:15	11:15	7-8 oktas, SSW 3-4, 5.5C to 6.5C, showers
23/03/2023	2	11:50	14:50	S 3-4, 8 oktas, showers, 7C
28/03/2023	3	08:35	11:35	SSE 3, 8 oktas, light to moderate showers, 6C

Key Species Data

Date	Time	Species	Count	Direction of flight	Flight height (m)	Activity	Time bird observed (sec)	Notes
16/11/2022	10:22	PG	16	W	75	fly	210	
16/11/2022	10:40	KT	1	N	60	hunt	1200	slowly circling N. Adult
16/11/2022	11:28	KT	3	SW	85	fly	400	slowly circling together
16/11/2022	11:47	GP	13	SW	120	fly	115	vocal flock
16/11/2022	12:38	T	5	N	70	fly	50	descending from 70m to land on loch
16/11/2022	13:33	WS	5	WNW	110	fly	150	2 ads and 3 juvs, highly vocal but no response from 6 WS on loch
16/11/2022	15:29	KT	1	NE	25	hunt	300	adult
18/11/2022	09:17	KT	2	WSW	100	fly	295	
18/11/2022	10:39	T	3	NW	30	fly	70	dropping onto Hallhills loch
18/11/2022	11:12	KT	1	E	25	hunt	600	slowly patrolling E
18/11/2022	11:26	KT	1	N	108	fly	300	
18/11/2022	12:39	PG	23	SW	80	fly	200	
18/11/2022	13:13	ML	1	W	8	fly	35	male
28/11/2022	10:29	KT	1		20	hunt	1230	patrolling W buffer
28/11/2022	11:47	GI	1	NW	18	fly	105	adult dropping NW over N plantation
28/11/2022	13:44	KT	1	E	50	fly	360	1cy slowly E
28/11/2022	14:19	KT	1	W	70	fly	330	probably the same as above WNW then WSW through core
28/11/2022	15:43	T	5	NE	35	fly	30	3 males, E buffer
29/11/2022	09:21	PG	26	SSW	100	fly	195	
29/11/2022	09:37	L	3	SW	90	fly	270	cold weather movement
29/11/2022	11:16	T	18	localized	10	fly	105	flock disturbed from loch - circled, settled
29/11/2022	11:43	KT	1	SW	28	fly	530	1 cy patrolling buffers
29/11/2022	12:15	PE	1	WNW	60	fly	135	juv plumage
30/11/2022	14:33	KT	1	E	35	hunt	240	patrolling W buffer
08/12/2022	13:46	L	13	WSW	40	fly	250	probably cold weather movement
08/12/2022	14:00	GI	1	N	20	fly	75	adult
08/12/2022	14:34	KT	1	localized	12	hunt	700	adult, patrolling then perched
08/12/2022	14:52	KT	1	W	35	fly	120	same as 3, away from core
09/12/2022	13:11	L	9	WNW	30	fly	300	cold weather movements
09/12/2022	14:07	L	2	NW	20	fly	270	
09/12/2022	14:26	T	60	localized	20	fly	375	spooked flock from unfrozen end of loch, circling then down
09/12/2022	15:10	KT	1	SW	35	hunt	650	slow, patrolling flight
22/12/2022	09:36	KT	1	localized	25	hunt	720	patrolling W core
22/12/2022	10:23	KT	1	W	40	fly	690	
22/12/2022	12:20	HH	1	ESE	20	fly	180	female - type in core area
23/12/2022	09:47	KT	1	N	45	hunt	1330	slowly and circuitously N through core
23/12/2022	10:34	WS	2	W	90	fly	210	adults
23/12/2022	11:20	KT	1	SW	70	fly	120	
12/01/2023	10:19	HH	1	SE	15	fly	285	female
12/01/2023	11:10	HH	1	localized	3	hunt	15	female, seen briefly in E buffer
12/01/2023	11:45	KT	1	NNE	80	fly	150	
12/01/2023	12:20	KT	1	ENE	35	fly	570	1st winter
13/01/2023	09:50	PG	61	SSW	100	fly	330	
13/01/2023	10:14	KT	1	E	15	hunt	285	
13/01/2023	11:02	T	45	localized	25	fly	180	disturbed by grazier sheepdog, circled Loch then re-settled
13/01/2023	11:02	WS	1	localized	20	fly	120	adult
13/01/2023	11:02	WS	5	localized	40	fly	375	adult & 5 juvs circle locally then high WSW
13/01/2023	11:12	KT	1	localized	5	hunt	1260	
13/01/2023	12:06	KT	1	WNW	10	hunt	720	
13/01/2023	12:20	KT	1	W	90	fly	315	1st plumage
13/01/2023	12:27	KT	1	localized	20	hunt	180	
24/01/2023	10:32	KT	1	WSW	5	hunt	405	
25/01/2023	09:51	PG	91	NW	120	fly	405	
25/01/2023	09:58	PG	24	N	150	fly	270	
25/01/2023	10:22	PG	2	NW	120	fly	420	
25/01/2023	10:37	PG	13	NW	90	fly	330	
25/01/2023	10:52	KT	1	NE	15	hunt	645	
25/01/2023	11:25	GI	1	NNW	25	fly	105	imm plum
25/01/2023	11:45	HH	1	NNW	3	hunt	120	female
25/01/2023	12:02	KT	1	NNE	12	hunt	420	
25/01/2023	12:27	KT	1	E	5	hunt	270	
07/02/2023	10:11	PG	26	NNE	75	fly	165	
07/02/2023	10:32	KT	1	WNW	5	hunt	375	
07/02/2023	10:40	KT	1	N	5	hunt	690	hunting core
07/02/2023	11:43	KT	1	N	22	hunt	295	
07/02/2023	12:20	HH	1	localized	3	hunt	315	female
07/02/2023	14:50	PE	1	E	50	hunt	165	adult hunting WP flock in buffer
09/02/2023	09:10	KT	1	localized	10	hunt	570	
09/02/2023	09:23	WS	3	NNW	125	fly	195	adults
09/02/2023	09:51	GI	1	NW	30	fly	135	imm plumage
09/02/2023	10:00	KT	1	ESE	8	hunt	1020	slowly working across core
09/02/2023	11:21	KT	1	NW	40	fly	255	adult
09/02/2023	12:21	KT	1	E	15	hunt	1150	
09/02/2023	14:23	KT	1	NNW	50	fly	270	
22/02/2023	13:16	KT	2	localized	10	hunt	645	hunting together, several brief dips into hillside - eating worms
22/02/2023	13:52	GI	1	WSW	25	fly	270	
22/02/2023	13:55	L	1	localized	25	fly	45	rose to mob GI
22/02/2023	14:01	KT	2	NE	60	fly	435	some display and vocalising
22/02/2023	14:50	KT	1	WNW	20	hunt	530	
22/02/2023	15:05	CU	2	NW	80	fly	180	vocal pair
22/02/2023	15:16	KT	3	SW	50	fly	90	in line
22/02/2023	15:32	KT	1	N	40	fly	360	

27/02/2023	09:41	WS	8 NW	70 fly	315	all ads
27/02/2023	09:58	KT	1 W	30 fly	375	
27/02/2023	10:11	L	6 E	40 fly	420	
27/02/2023	10:21	WS	2 SW	130 fly	255	ads
27/02/2023	10:34	HH	1 WNW	8 hunt	870	ad male, working slowly WNW
27/02/2023	10:50	KT	1 NNW	60 fly	810	adult slowly wheeling/soaring
27/02/2023	11:23	KT	1 N	10 hunt	480	searching E buffer
27/02/2023	11:42	PE	1 ESE	70 fly	315	ad
27/02/2023	12:10	KT	1 localized	5 fly	720	searching flight
27/02/2023	12:15	GN	2 SW	50 fly	255	
27/02/2023	12:13	KT	1 ENE	40 fly	500	
28/02/2023	09:40	KT	1 E	25 hunt	495	
28/02/2023	09:51	KT	2 NNE	15 hunt	360	closely interacting
28/02/2023	10:20	L	19 NW	40 fly	240	rising from lower ground to E of buffer as if spooked by pred
28/02/2023	10:30	GI	1 E	70 fly	360	imm plumage, soaring over core, some display elements
28/02/2023	10:42	GI	1 SW	45 display flight	255	ad, over SE plantation
28/02/2023	10:53	HH	1 S	5 hunt	480	ad male, quartering core
28/02/2023	11:13	KT	3 localized	10 hunt	375	3 ads hunting together, much interaction
28/02/2023	11:25	L	74 NW	80 fly	300	tight flock over core
28/02/2023	11:34	HH	1 S	12 fly	105	female
28/02/2023	11:47	L	27 W	35 fly	49	as 7
28/02/2023	12:30	KT	1 NE	90 fly	135	2cy
28/02/2023	13:20	KT	1 localized	15 hunt	720	
28/02/2023	14:02	GI	1 NW	15 fly	165	imm plumage
28/02/2023	15:13	L	3 NW	30 fly	270	
28/02/2023	15:50	KT	1 WNW	20 fly	650	adult
28/02/2023	15:59	HH	1 E	fly	120	ad male
07/03/2023	07:32	PG	19 NW	130 fly	250	
07/03/2023	08:51	L	4 N	100 fly	150	W buffer
07/03/2023	08:17	KT	2 WSW	10 fly	375	
07/03/2023	08:35	GI	1 SW	50 fly	255	imm, some display elements
07/03/2023	09:40	KT	1 N	20 hunt	735	ad hunting/patrolling
07/03/2023	10:04	PG	24 WSW	90 fly	210	
07/03/2023	10:11	KT	1 NNE	15 fly	270	ad patrolling - seeming to change course when seeing surveyor
07/03/2023	10:49	GI	1 localized	50 fly	270	imm plum, soaring in SE buffer some displaying
07/03/2023	11:12	KT	1 N	10 hunt	1200	slowly quartering core
07/03/2023	11:29	T	4 NW	15 fly	180	3 males, dropping onto unfrozen end of loch
07/03/2023	11:52	KT	2 WNW	60 fly	465	prob pair closely tracking each other
07/03/2023	12:43	KT	2 SW	70 fly	300	
07/03/2023	13:03	SE	1 localized	5 hunt	360	hunting E buffer
07/03/2023	13:31	KT	1 W	50 fly	375	
07/03/2023	14:55	KT	1 NNW	5 hunt	1020	
07/03/2023	15:17	ML	1 N	30 fly	90	female swooping down dramatically near Hewke Wd
07/03/2023	15:29	GI	1 WSW	25 fly	330	ad, prob female
07/03/2023	15:47	KT	3 E	40 fly	360	closely interacting
07/03/2023	16:10	KT	2 SW	25 fly	150	W buffer
07/03/2023	16:16	KT	1 NNE	25 fly	270	
07/03/2023	17:01	L	4 E	35 fly	495	loose flock
08/03/2023	08:40	KT	1 E	20 fly	330	
08/03/2023	09:10	PG	9 N	90 fly	270	
08/03/2023	09:25	PG	9 SW	100 fly	205	clearly same party as above!
08/03/2023	09:43	HH	1 SE	8 hunt	240	female
08/03/2023	10:10	KT	1 S	18 fly	135	
08/03/2023	11:09	KT	1 N	10 fly	420	
08/03/2023	11:16	GP	7 SW	80 fly	195	highly vocal, cold weather movement
08/03/2023	12:19	GI	1 ENE	50 fly	255	imm plum, soaring in NE buffer
08/03/2023	12:41	KT	1 W	15 fly	495	circuitously west
08/03/2023	13:15	KT	1 localized	20 fly	720	
08/03/2023	13:37	KT	1 WSW	40 fly	315	
08/03/2023	14:17	KT	1 SW	30 fly	210	
23/03/2023	08:47	KT	1 N	50 fly	195	
23/03/2023	09:30	KT	1 E	25 fly	900	
23/03/2023	09:42	PG	33 N	80 fly	165	
23/03/2023	09:57	SE	1 NNW	5 perch	90	
23/03/2023	10:13	KT	1 localized	15 fly	600	hunting core then into N plantation
23/03/2023	10:36	GI	1 ESE	30 fly	150	
23/03/2023	12:00	PG	23 NNE	130 fly	180	prob migratory movement following valley, W buffer
23/03/2023	12:16	T	16 circle	20 fly	255	Loch flock spooked, circling loch area then back down
23/03/2023	12:39	WS	8 N	90 fly	180	
23/03/2023	13:20	KT	3 S	50 fly	300	closely interacting
23/03/2023	13:29	KT	1 ENE	22 fly	645	working ENE, searching central core for 5 minutes then cont ENE
23/03/2023	14:08	KT	1 NNW	25 fly	900	slow patrolling flight
23/03/2023	14:20	PE	1 SSW	75 fly	480	soaring adult
23/03/2023	14:36	KT	3 SW	40 fly	315	wheeling together
28/03/2023	09:30	SE	1 WSW	3 fly	90	
28/03/2023	09:56	WS	7 N	60 fly	180	migration party? 3 imm