

Torfichen Wind Farm: Wintering Bird Survey 2021-22



Clockwise from top left: Pink-footed Goose, Barnacle Geese, Black grouse and Lapwing © Steve Percival

Report to Renewable Energy Systems Ltd

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TORFICHEN PROPOSED WIND FARM: WINTERING BIRD SURVEYS 2021-22

Introduction

1. This report describes the wintering bird survey work carried out for the proposed Torfichen Wind Farm, (hereafter referred to as the 'Proposed Development'). It provides a wintering season's baseline data on the bird populations, activity and flight paths within the vicinity of the potential 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 Stuart Piner and Tom Lowe, both highly experienced bird surveyors.

Study Area

3. The site is located approximately 4 km south of Gorebridge and 9.5 km south-east of Penicuik, within the northern edge of the Moorfoot Hills in the Midlothian Council (MC) area. The wintering bird survey areas were chosen to include all areas within the possible zone of ornithological influence of the Proposed Development. This included the Proposed Development 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 18.5 km² and the wider survey area 49.9 km². It comprised predominantly upland moorland habitat, currently used mainly for grazing sheep and deer, with agriculturally improved grassland on the lower ground in the northern part of the site. It lies mainly within the 'Border Hills' NatureScot Natural Heritage Zone (NHZ20), though the northern edge of the survey area is within the 'Eastern Lowlands' (NHZ16).

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, wider area waterfowl surveys and vantage point surveys of bird flight activity.

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 guidance (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 seven surveys were undertaken at approximately monthly intervals between September 2021 and March 2022.

Waterfowl Feeding Distribution Surveys

7. Additional surveys were undertaken twice-monthly of all possible habitats that could be used by wintering waterfowl 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 Special Protection Areas (SPAs)). The site lies within the potential SPA connectivity distance from the Gladhouse Reservoir and Fala Flow SPAs (for which pink-footed geese are a qualifying feature) and within a known goose feeding area (Mitchell 2012, SNH 2013).
8. The counts were carried out as instantaneous 'look-see' counts, recording a snapshot of the birds present in each field/count sector at the time it was surveyed (Gilbert *et al.* 1998). One such count of each field was made each survey day, recording the numbers of all the key species present. Any additional records made outside this time were noted as supplementary records. These snapshot counts were organised to ensure that the full range of times of day were covered in each part of the survey area.

Vantage point surveys

9. Vantage Point (VP) surveys were carried out to determine bird flight activity within the Proposed Development 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). Target species were the same as those for the walkover surveys.
10. The specific aim of the VP surveys was to collect data on key target species flight activity to enable estimates to be made of:
 - The time spent flying over the survey area;
 - The relative use made of different parts of the survey area; and
 - The proportion of flying time spent at different elevations above the ground.
11. Three VPs were used to cover the Proposed Development site. The computer-generated viewsheds (using Global Mapper v21) are shown in **Figure 1**. For each VP, a basic 36 hours' VP surveys during the autumn/winter from each VP were carried out (as set out in NatureScot guidance), spread evenly across the winter season. As the site lies within the potential SPA connectivity distance from the Gladhouse Reservoir and Fala Flow SPAs (for which pink-footed geese are a qualifying feature) and within a known goose feeding area (Mitchell 2012, SNH 2013), an additional six hours' VP per month for each VP was carried out in September-November and February-March to provide extra survey effort in the main goose migration season, giving a total survey time of 72 hours per VP. Details of survey dates, times and conditions are given in **Appendix 1**.

12. All key target species flights (and any other species of specific nature conservation interest) were recorded, irrespective of their distance from the VP. Observations were carried out throughout daylight hours but not in periods of severely reduced visibility (<3 km).
13. 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 was recorded. To estimate flight height as accurately as possible, available reference structures (e.g. pylon lines) were used. Heights were estimated as accurately as possible and recorded as a raw estimate, rather than being summarised to height classes. Below 10 m estimates were made to 1 m, between 10 m 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 2021-22 results

Autumn/winter walkover survey results

14. 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.

Table 1. Autumn/winter bird populations recorded in the Torfichen survey area during the September 2021 - March 2022 walkover surveys (monthly peak counts).

Species	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Peak 2021-22
Pink-footed Goose	0	152	0	1270	792	888	20	1270
Greylag Goose	18	10	0	5	120	0	3	120
Canada Goose	0	8	0	8	0	0	0	8
<i>Barnacle Goose</i>	<i>0</i>	<i>1773</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>1773</i>
Teal	38	0	0	0	0	0	0	38
Mallard	0	1	0	0	0	0	0	1
Red Grouse	84	33	53	15	43	16	30	84
Black Grouse	1	4	3	9	3	5	2	9
Little Grebe	0	1	0	0	0	0	0	1
Hen Harrier	3	0	2	0	0	0	0	3
Goshawk	3	0	0	0	0	0	1	3
Sparrowhawk	0	1	0	0	0	0	1	1
Buzzard	19	3	8	10	5	8	10	19
Kestrel	4	0	0	1	0	1	1	4
Merlin	0	0	1	0	0	1	0	1
Peregrine	0	0	0	0	2	1	2	2

Species	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Peak 2021-22
Golden Plover	0	2	0	26	45	19	0	45
Lapwing	0	70	262	25	0	170	99	262
Jack Snipe	0	1	0	0	2	0	0	2
Snipe	11	22	12	5	6	2	4	22
Woodcock	0	0	2	3	3	0	0	3
Curlew	0	0	0	0	0	0	223	223
Common Gull	0	40	61	45	15	0	4	61
Lesser Black-backed Gull	1	0	0	0	0	0	0	1
Herring Gull	2	27	10	2	2	4	0	27
Black-headed Gull	0	1	4	0	0	0	0	4
Tawny Owl	0	0	0	0	1	0	0	1

* Barnacle goose records were all of over-flying migrant flocks.

Autumn/winter wider area goose feeding distribution survey results

- 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 survey, and the overall peak counts. Pink-footed geese were the most abundant target species and were seen frequently during the surveys, with higher numbers in the second half of the survey period (peak count 3,279).

Table 2. Autumn/winter bird populations recorded in the wider (2km buffer) Torfichen survey area during the September 2021 - March 2022 waterfowl feeding distribution surveys (monthly peak counts).

[illegible]

Species	Sep 13	Sep 23	Oct 11	Oct 25	Nov 9	Nov 23	Dec 7	Dec 20	Jan 10	Jan 25	Feb 7	Feb 24	Mar 8	Mar 24	Peak 2021-22
Sparrowhawk	0	0	0	0	2	0	1	0	0	0	0	2	0	0	2
Buzzard	4	1	4	3	3	4	0	2	6	1	5	5	5	1	6
Kestrel	0	1	3	0	1	1	1	1	0	2	0	0	0	0	3
Peregrine	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Coot	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Oystercatcher	0	0	0	0	0	0	0	0	0	0	0	0	111	93	111
Golden Plover	0	0	0	0	0	0	0	0	0	0	0	40	0	0	40
Lapwing	63	146	24	276	203	69	0	87	0	230	41	80	127	18	276
Snipe	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Black-tailed Godwit	0	45	0	0	0	0	0	0	0	0	0	0	0	0	45
Curlew	0	0	0	0	0	0	0	0	0	0	0	0	264	62	264
Common Sandpiper	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Green Sandpiper	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Redshank	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4
Common Gull	460	212	135	183	271	310	112	371	248	689	313	66	424	559	689
Lesser Black-backed Gull	50	16	0	1	0	0	0	0	0	0	0	0	4	42	50
Herring Gull	164	297	11	136	25	2	2	21	82	71	51	0	44	8	297
Great Black-backed Gull	1	0	0	0	0	1	0	0	0	0	1	1	4	21	21
Black-headed Gull	11	10	25	126	128	21	0	30	63	30	18	25	353	1121	1121

* Pink-footed goose records were all of over-flying migrant flocks.

Vantage Point Survey Results: Autumn/Winter 2021-22

16. The rates of bird flight movement observed across the survey area during the VP surveys are summarised in **Table 3**. This gives the flight rate per hour recorded in each month and the total number of flights recorded. Pink-footed goose was the most frequently recorded target species, with movements between feeding areas and to/from their night roosts (including on Gladhouse Reservoir). There was also a brief period of barnacle goose migration over the site in October. Flight rates of other species were generally low, though did include records of several key raptors (red kite, hen harrier, goshawk, merlin, peregrine and short-eared owl), and occasional larger flocks of golden plover and lapwing. Further details of key species' flights are given in **Appendix 1**.
17. **Table 3** also gives the percentage of flights of each species that were recorded at rotor height (between 30 m and 180 m above ground level).

Table 3. Bird flight rates recorded over the Torfichen survey area during the September 2021 - March 2022 vantage point surveys. N = 72 hours total observation from each of the three 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	0.08	0	0	0	0	0	3	100%
Whooper Swan	0	0.44	0	0	0	0	0.94	50	100%
Pink-footed Goose	144.2	56.7	36.0	126.1	188.1	214.0	158.1	27809	77%
Greylag Goose	0.61	5.61	23.28	31.38	8.86	1.29	2.17	1828	74%
Canada Goose	0.17	0.14	3.11	2.62	3.24	0.49	0	247	38%
Barnacle Goose	0	15.4	0	0.07	0.05	0	0	558	63%
Teal	1.17	0	0	0	0	0	0	42	100%
Mallard	0	0.06	0	0	0	0.03	0.19	10	40%
Goldeneye	0	0.03	0	0	0	0	0	1	100%
Goosander	0.03	0	0	0	0	0	0	1	0%
Red Grouse	0	0.22	0	0	0	0	0.06	10	0%
Cormorant	0	0	0	0.07	0	0	0	1	100%
Grey Heron	0	0.03	0	0.14	0	0	0.06	5	60%
Red Kite	0.03	0	0.03	0	0	0	0.08	5	40%
Hen Harrier	0.58	0.06	0	0	0.05	0.16	0.17	36	6%
Goshawk	0.47	0.19	0.08	0	0.14	0.11	0.19	41	49%
Sparrowhawk	0.08	0	0.06	0.07	0.05	0.03	0.17	14	14%
Buzzard	1.19	1.22	0.72	0.28	1.43	1.04	1.78	249	35%
Osprey	0.03	0	0	0	0	0	0	1	100%
Kestrel	0.42	0.19	0.19	0	0	0.05	0.39	45	14%
Merlin	0.08	0.03	0.03	0	0	0.08	0	8	25%
Peregrine	0.06	0	0.03	0.14	0	0.03	0.03	7	29%
Golden Plover	0.36	0.33	5.28	0	3.62	1.92	2.22	441	76%
Lapwing	2.11	28.0	0.53	4.55	0	17.5	12.6	2262	30%
Snipe	0.67	0.33	0	0	0	0	0.08	39	37%
Woodcock	0	0	0	0	0.05	0	0.17	7	0%

Species	Flight rate (birds/hour)					Feb	Mar	Total number of birds overflying	% flights at rotor height
	Sep	Oct	Nov	Dec	Jan				
Curlew	0	0	0	0	0	0.03	13.4	482	53%
Common Gull	0.28	1.58	7.78	23.79	1.05	2.00	7.47	1056	37%
Lesser Black-backed Gull	0.97	0.08	0	0	0	0	0.42	53	42%
Herring Gull	7.08	7.47	2.78	2.76	0.19	0.25	0.97	712	29%
Great Black-backed Gull	0	0	0	0	0.24	0.19	0.08	15	60%
Black-headed Gull	0	0.31	0.25	2.14	0	0	24.2	921	80%
Short-eared Owl	0	0	0	0	0	0.05	0	2	0%

Conservation Evaluation of Wintering Bird Populations

18. The conservation value of the wintering bird populations was determined using the criteria specified in **Table 4** (from Percival 2007) and is summarised in **Table 5**. This includes the criteria adopted by NatureScot in Guidelines for Selection of Biological Sites of Special Scientific Interest (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 Proposed 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). Regional (Natural Heritage Zone, NHZ) populations were taken from Wilson *et al.* (2015). The site lies mainly within the 'Border Hills' NatureScot Natural Heritage Zone (NHZ20), though the northern edge of the survey area is within the 'Eastern Lowlands' (NHZ16). In addition, listing on Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside, UK Biodiversity Action Plan (BAP) priority species and Scottish BAP species were all considered in the evaluation process.

Table 4. Definition of terms relating to the sensitivity of the ornithological receptors at the site.

Conservation Value	Definition
VERY HIGH	Cited interest of SPAs, Special Areas of Conservation (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).

19. The conservation value of the wintering bird populations observed in the Torfichen survey area during the wintering bird surveys has been summarised in **Table 5** below. This included one very high sensitivity species (pink-footed goose – the birds seen are ecologically linked to the Gladhouse Reservoir SPA, and also the Fala Flow SPA), 13 high sensitivity species (whooper swan, barnacle goose, goldeneye, osprey, red kite, hen harrier, goshawk, peregrine, merlin, golden plover, black-tailed godwit, green sandpiper and short-eared owl) that are EU Birds Directive Annex 1/Wildlife and Countryside Act Schedule 1 species, 16 medium sensitivity species (UK BAP priority/red listed species of conservation concern and/or species present in regionally important numbers; mute swan, wigeon, teal, mallard, tufted duck, red grouse, black grouse, little grebe, cormorant, oystercatcher, lapwing, curlew, common gull, herring gull, great black-backed gull and black-headed gull), and 11 low sensitivity species.

Table 5. Conservation evaluation of the wintering bird populations in the Torfichen survey area, September 2021 – March 2022.

Species	Peak count (core)	Peak count (wider)	>1% region	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	0	57	✓						Medium
Whooper Swan	0	3	✓	✓	✓	A		✓	High
Pink-footed Goose	1270	3279	✓			A			Very high
Greylag Goose	120	349				A			Low
Canada Goose	8	132							Nil
Barnacle Goose	(1773)*	3	✓	✓		A		✓	High
Shelduck	0	6				A			Low
Wigeon	0	154	✓			A			Medium
Teal	38	190	✓			A			Medium
Mallard	1	239	✓			A			Medium
Pochard	0	1				R		✓	Low
Tufted Duck	0	78	✓						Medium

Species	Peak count (core)	Peak count (wider)	>1% region	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
Goldeneye	0	31			✓	R			High
Goosander	0	4							Nil
Red Grouse	84	0					✓		Medium
Black Grouse	9	0				R	✓	✓	Medium
Little Grebe	1	12	✓						Medium
Cormorant	0	23	✓						Medium
Grey Heron	0	2							Nil
Red Kite	1	0	✓	✓	✓			✓	High
Hen Harrier	3	0	✓	✓	✓	R		✓	High
Goshawk	3	1	✓		✓				High
Sparrowhawk	1	2				A			Low
Buzzard	19	6							Nil
Osprey	1	0	✓	✓	✓	A		✓	High
Kestrel	4	3				A		✓	Low
Merlin	1	0	✓	✓	✓	R		✓	High
Peregrine	2	1	✓	✓	✓			✓	High
Coot	0	2							Nil
Oystercatcher	0	111	✓			A			Medium
Golden Plover	190	40	✓	✓				✓	High
Lapwing	262	276	✓			R	✓	✓	Medium
Jack Snipe	2	0							Nil
Snipe	22	1				A			Low
Woodcock	3	0				R		✓	Low
Black-tailed Godwit	0	45	✓		✓	R	✓	✓	High
Curlew	223	264	✓			R	✓	✓	Medium
Common Sandpiper	0	1				A			Low
Green Sandpiper	0	1			✓	A		✓	High
Redshank	0	4				A			Low
Common Gull	61	689	✓			A			Medium
Lesser Black-backed Gull	1	50				A			Low
Herring Gull	27	297	✓			R	✓	✓	Medium
Great Black-backed Gull	0	21	✓			A			Medium
Black-headed Gull	4	1121	✓			A			Medium
Tawny Owl	1	0				A			Low
Short-eared Owl	1	0	✓	✓		A		✓	High

Note: * = seen predominantly over-flying only.

20. The key autumn/wintering bird populations recorded were as follows:

- **Pink-footed Goose** – the distribution of pink-footed geese observed during the winter surveys and the VP survey flight lines are shown in **Figure 2**. The main pink-footed goose feeding area was to the north-east of the Proposed Development site, though there were feeding flocks seen across most of the wider survey area to the north of the Proposed Development site. There were though very few records within the Proposed Development site itself. There were regular flights

over the site, including birds moving between feeding areas and to/from night roosts. Those roost flights included movements to/from Gladhouse Reservoir, though also to the east (in the direction of Fala Flow).

- **Other high conservation value waterfowl:**
 - **Whooper Swan** – the only record of birds on the ground was a family of two adults and one young during the waterfowl survey on 20/21/21. There were only two flocks observed over-flying during the VP surveys, which were both migrant flocks (one of 16 on 13/10/21 and one of 34 on 8/3/22).
 - **Barnacle Goose** – there were occasional records of single barnacle geese mixed in with the pink-footed goose flocks but the main period of activity for this species was autumn migration. Sixteen migrant flocks were observed during the 12 October walkover survey (on a broad front across the whole survey area), and a further six migrant flocks during the VP surveys between the 11 and 13 October. Flock sizes varied between 10 and 260 birds (with an average of 125).
 - **Goldeneye** – this species was seen in regionally important numbers on Gladhouse Reservoir (peak 31) but there were no records anywhere else.
- **Other wintering wildfowl** – Gladhouse Reservoir supported a range of regionally important wintering waterfowl populations including **mute swan, wigeon, teal, mallard, tufted duck, little grebe** and **cormorant**. These species were, though, largely restricted to the reservoir.
- **Red and Black Grouse** – the distribution of these two species during the winter surveys is shown in **Figure 3**. Red grouse were widely distributed over the higher ground, whilst black grouse were mainly found around the same areas that they had been seen in the previous breeding season (around lek sites on the south-eastern edge of the survey area and in the western part).
- **Hen harrier** – this species was regularly seen hunting over the site through the winter, with 36 flights in total (see **Figure 4**). No evidence was found, though, of any night roosts in the survey area, and most flights seen were below rotor height (so collision risk would be low), and there were not any notable concentrations of flight activity in any particular part of the survey area.
- **Goshawk** – this species was observed regularly during the winter VP surveys, with 41 flights in total (**Figure 5**). As for hen harrier these flights were widely distributed over the survey area without any notable concentrations of activity (though there were fewer flights in the eastern part of the survey area).
- **Other scarce raptors and owls** – red kite, osprey, peregrine, merlin and short-eared owl were all recorded during the winter surveys, but only infrequently in low numbers (**Figure 6**). There was no indication that the survey area was important to any of these species at this time of year.
- **Golden Plover** – small numbers (peak 190 but this was a single flock over-flying with no other counts over 45) of golden plover were seen regularly through the winter, with most birds were seen in the wider area rather than within the site itself and only low numbers observed over-flying (**Figure 7**).
- **Lapwing** – regularly present in the survey area in regionally important numbers, with most records from the wider area to the north-east of the site and to the

west in the fields adjacent to Gladhouse Reservoir (**Figure 8**). Lapwing were also regularly observed over-flying during the VP surveys.

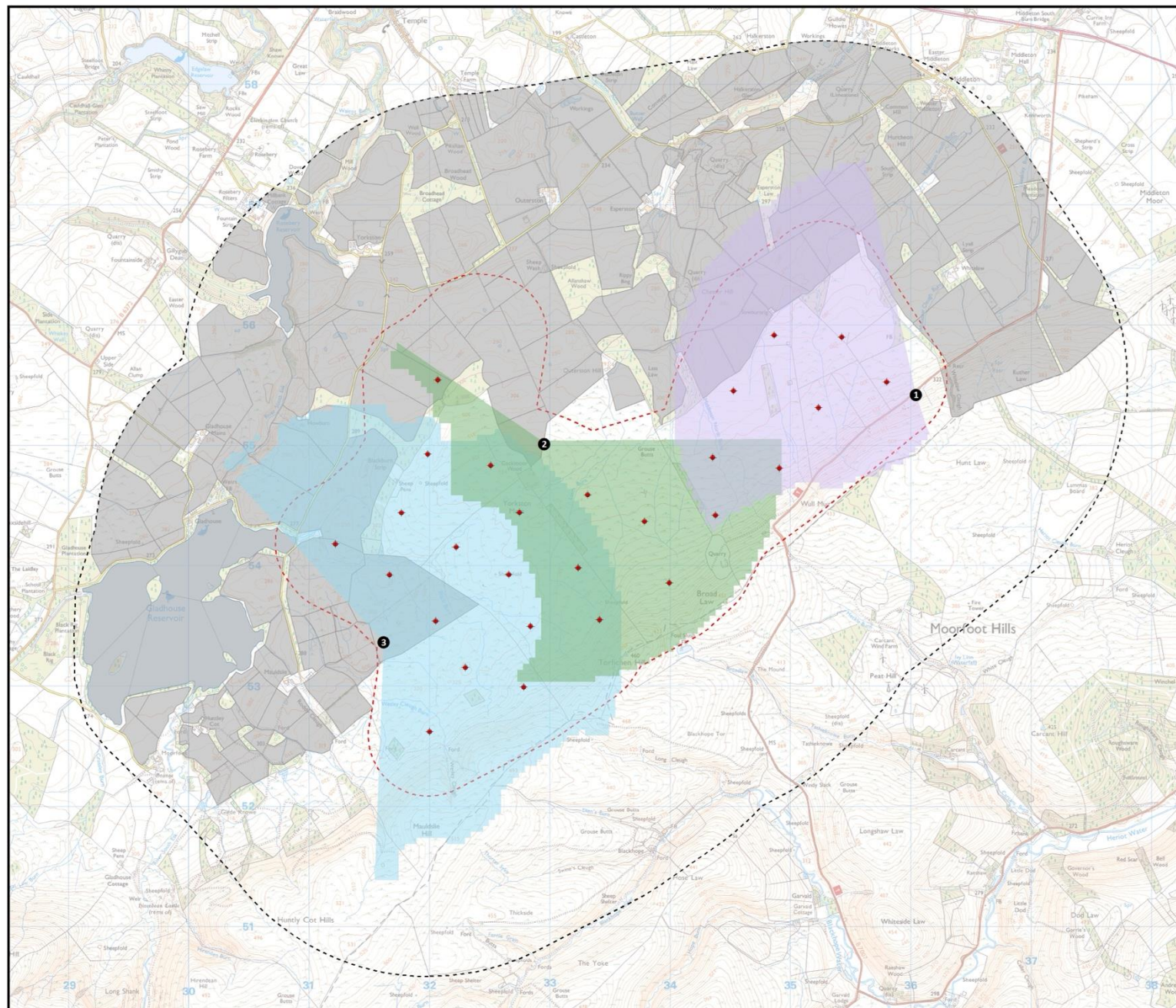
- **Curlew** – this species was recorded in regionally important numbers but only in March, so it is likely that these would have been spring migrants/early returning breeders. They were seen mostly in the fields in the wider area to the north of the site and to the west in the fields adjacent to Gladhouse Reservoir (**Figure 9**).
- **Gulls** – common (**Figure 10**), herring (**Figure 11**), great black-backed (**Figure 12**) and black-headed gulls (**Figure 13**) were all recorded within the survey area in regionally important numbers. All had broadly similar distributions, mainly using the fields to the north of the proposed wind farm site in the wider survey area and Gladhouse Reservoir. All regularly over-flew the site.

Conclusions

21. The 2021-22 wintering bird surveys found a range of wintering bird populations of conservation importance using the survey area. The highest conservation importance was the wintering pink-footed goose population, for which there was a clear ecological link between the site and the Gladhouse Reservoir and Fala Flow SPAs. The wind farm ornithological assessment will require Habitats Regulations Assessment (including Appropriate Assessment).
22. Other wintering waterfowl of importance included migrant whooper swans and barnacle geese, though the overall numbers of these species were low. Gladhouse Reservoir supports a range of regionally important waterfowl populations, but given the separation from the Proposed Development site these would be unlikely to be affected.
23. Red and black grouse were both resident in the higher parts of the survey area, in similar areas to where they had been found during the previous breeding season surveys (Percival *et al.* 2021). Design mitigation was recommended for black grouse (a 500 m buffer around each of the two lek sites) in that report, and that mitigation should reduced effects on this species in winter too.
24. Hen harrier and goshawk were seen regularly hunting over the survey area, though no areas of particular importance were identified for either species. Collision risk modelling will help inform the impacts of the Proposed Development on these species, but no specific spatial constraints for them have been identified.
25. Other raptor species, including red kite, osprey, peregrine, merlin and short-eared owl, were recorded in lower numbers and less frequently, so no design or other mitigation would be likely to be required for them at this stage.
26. Three wader species were recorded in regionally important numbers, golden plover and lapwing (which both occurred regularly through the winter) and curlew (which were seen only in March). The main areas used were outside the Proposed Development site, so the main risk at this time of year would be collision (which will require modelling).
27. Four gull species occurred in regionally important numbers. As for the regionally important populations of waders, most were recorded outside the Proposed Development site to the north in the wider area, so the main potential impact would be collision (requiring modelling to inform the assessment).

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Torfichen Hill Wind Farm

FIGURE 1

Wintering Bird Survey Areas

KEY:

- ◆ Indicative turbine locations
- Core walkover survey area
- Waterfowl survey fields/sectors
- Wider 2km buffer area
- VP locations
- VP1 viewshed
- VP2 viewshed
- VP3 viewshed



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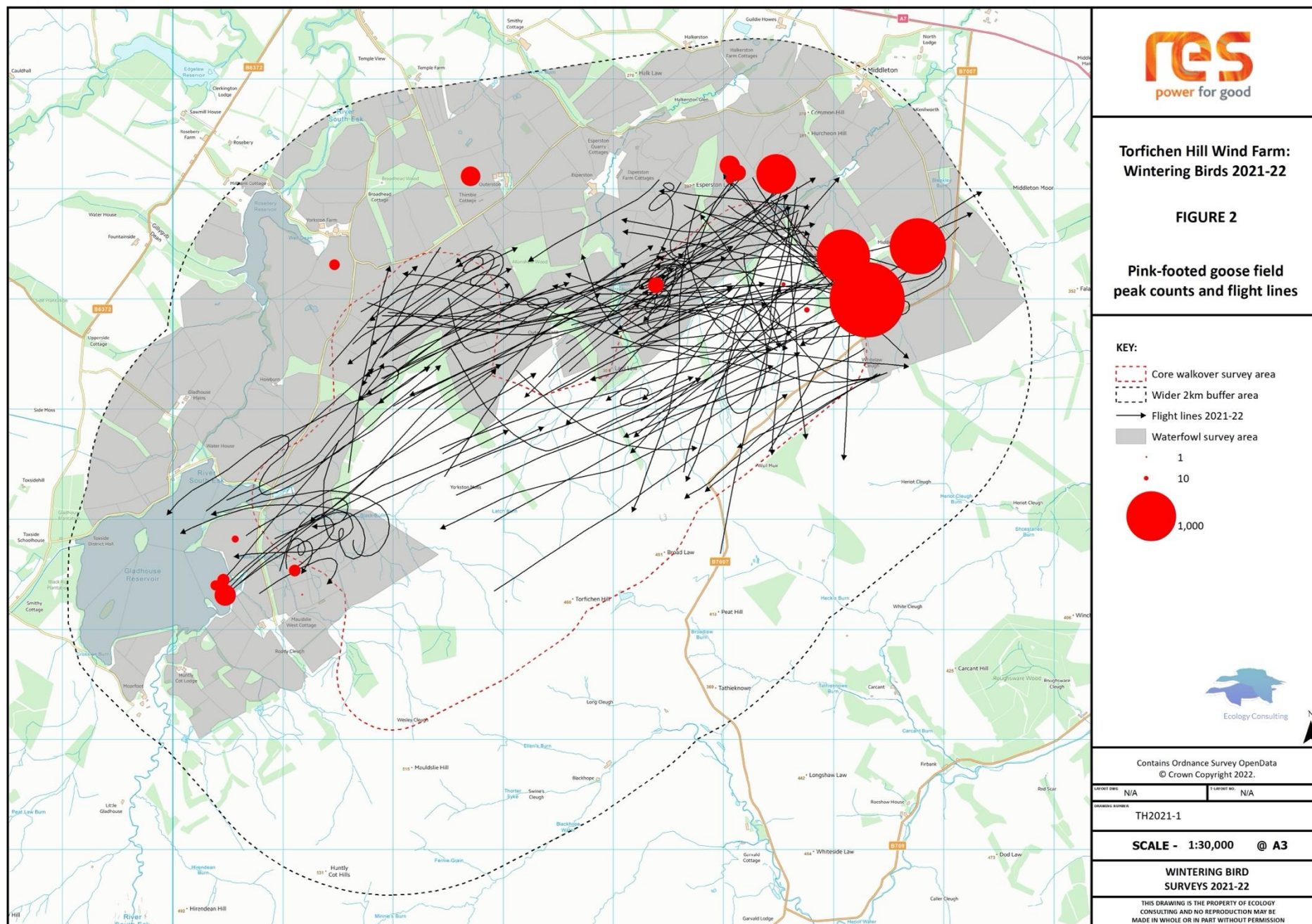
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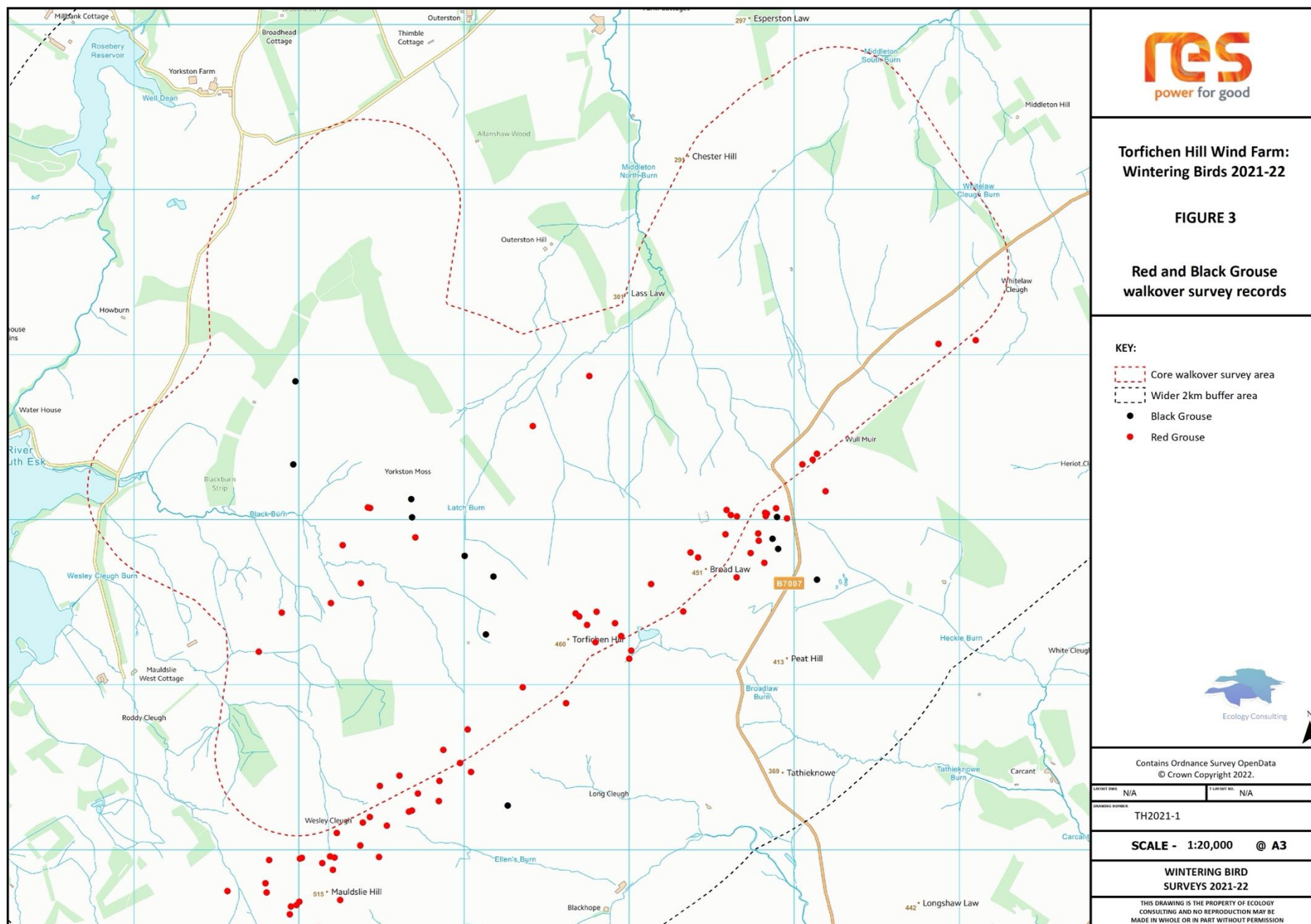
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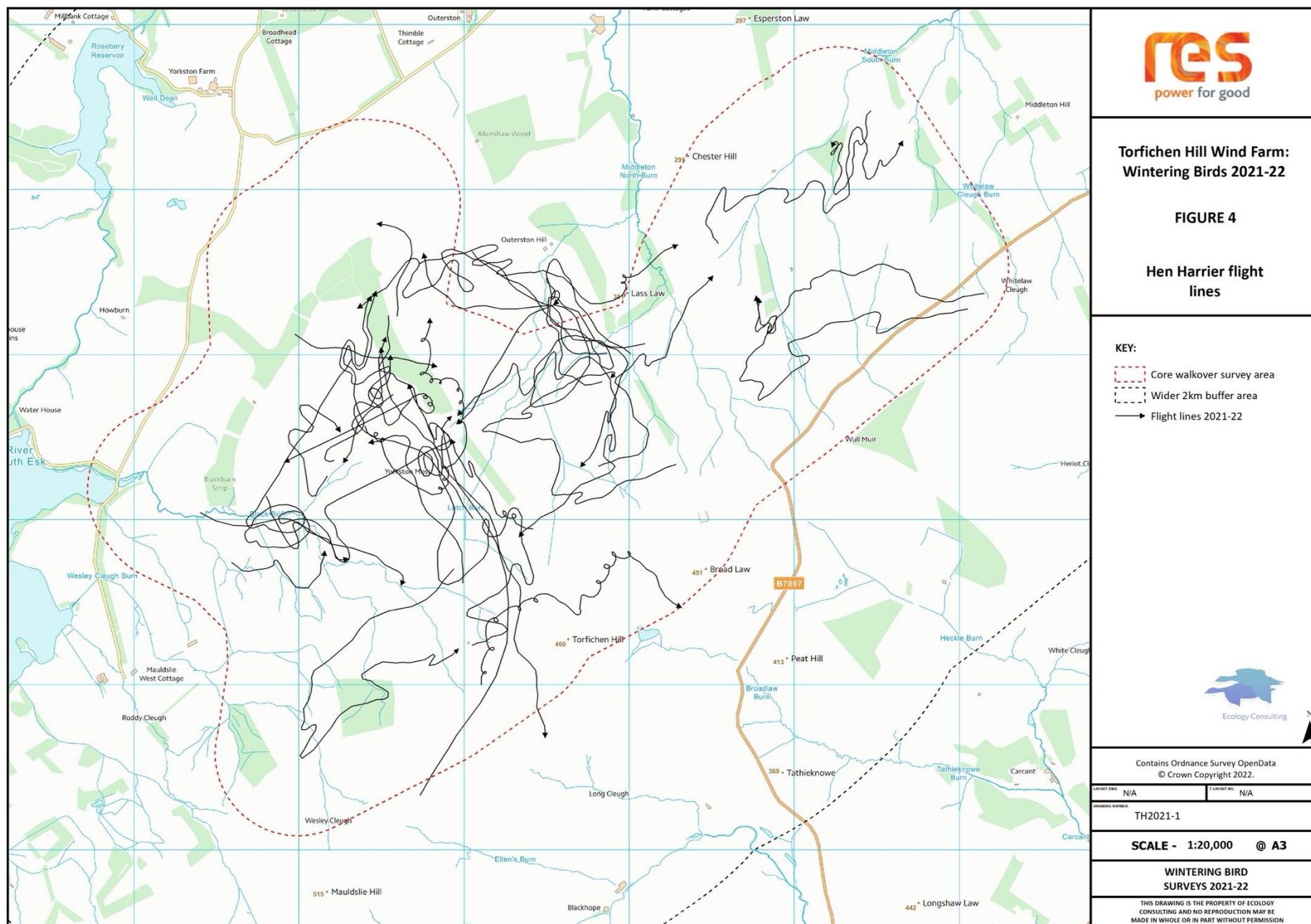
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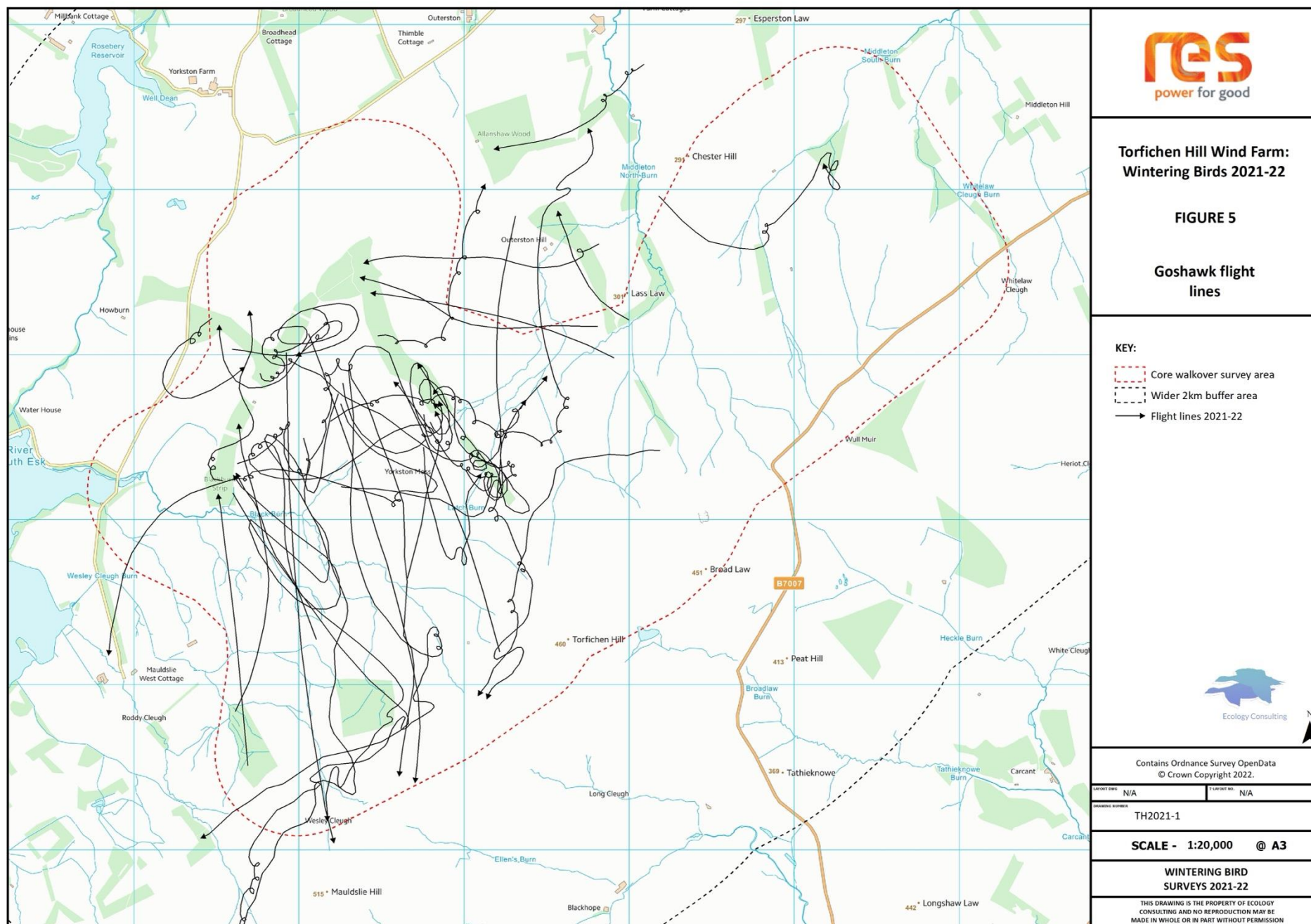
WINTERING BIRD
SURVEYS 2021-22

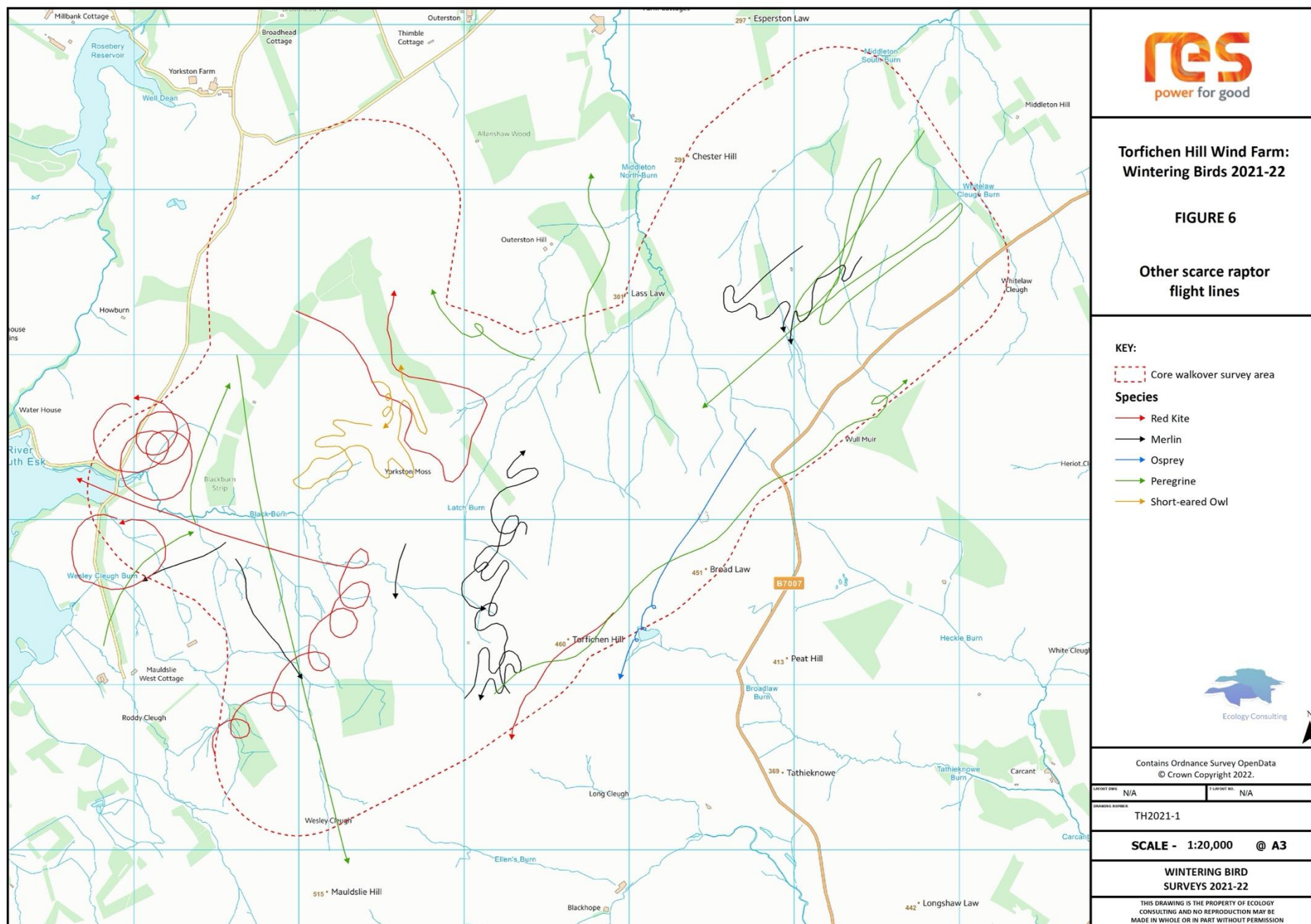
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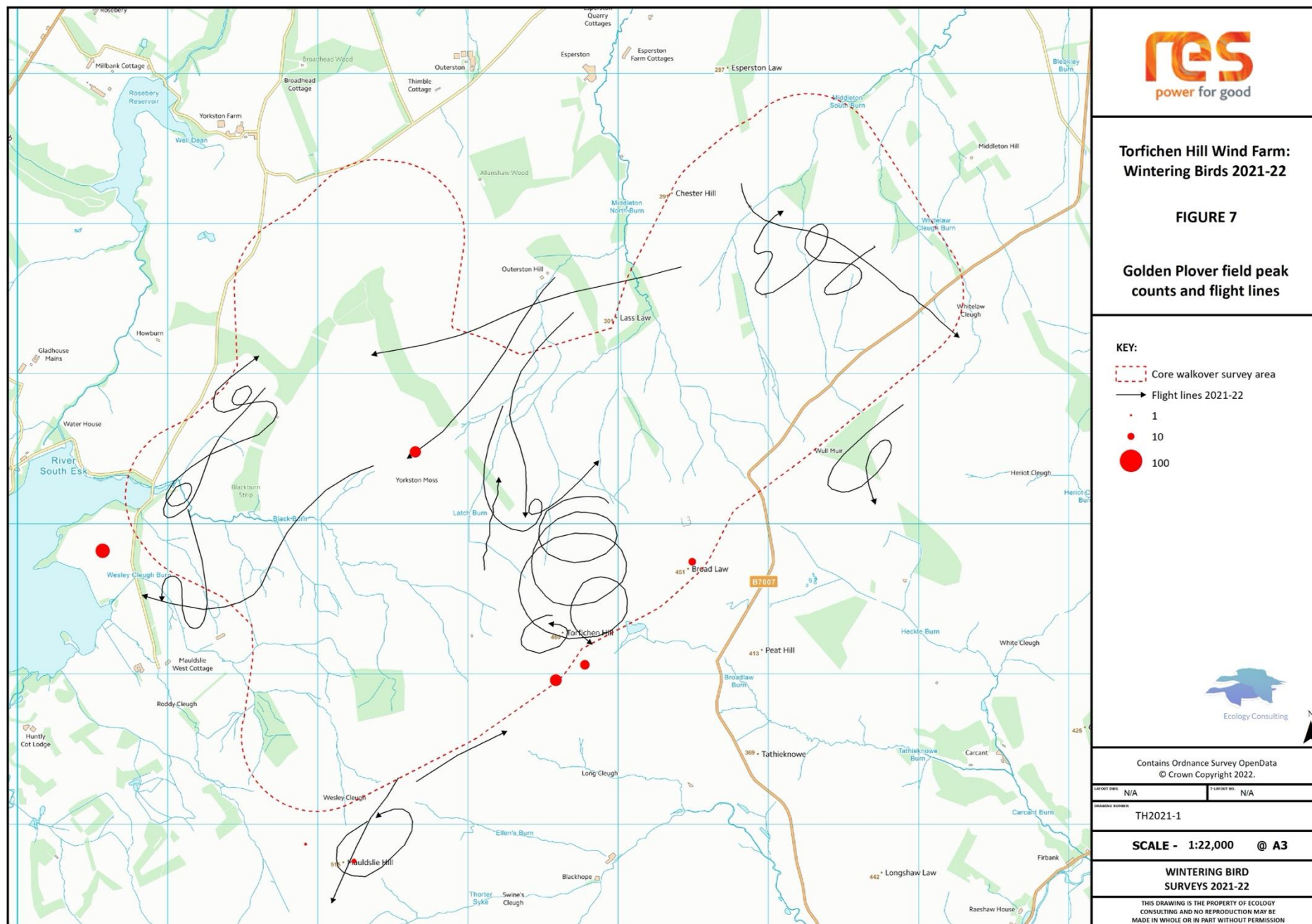


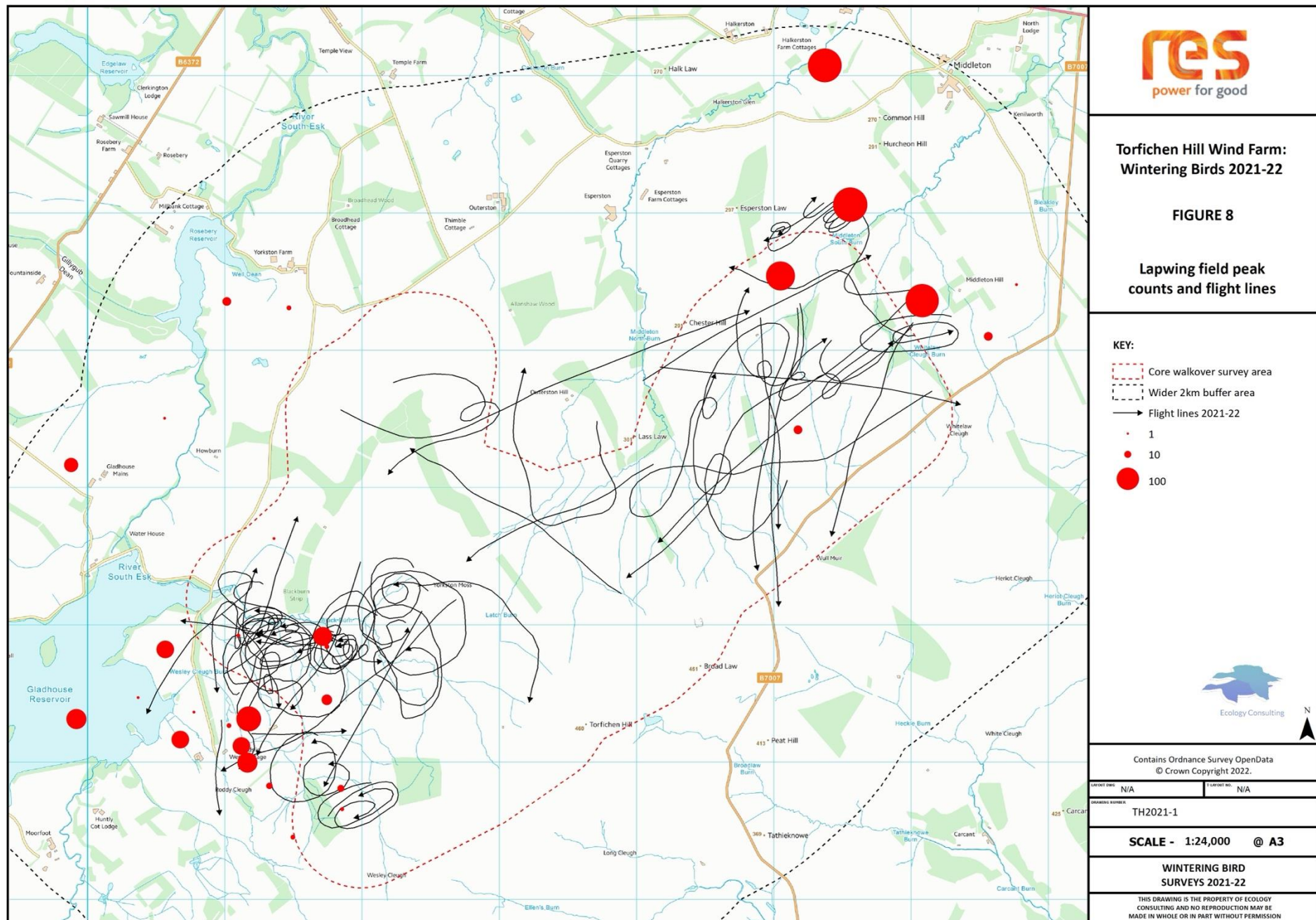


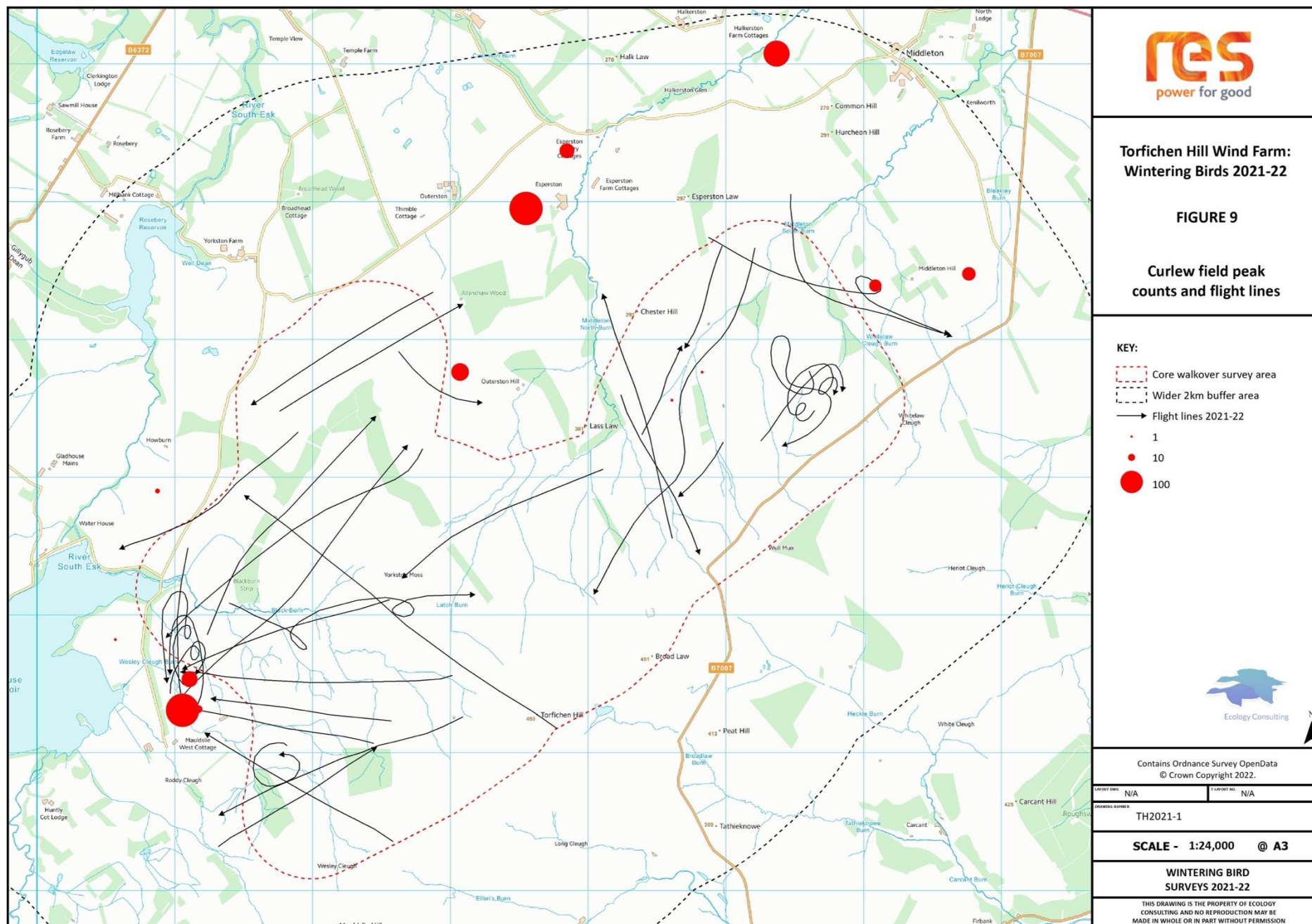


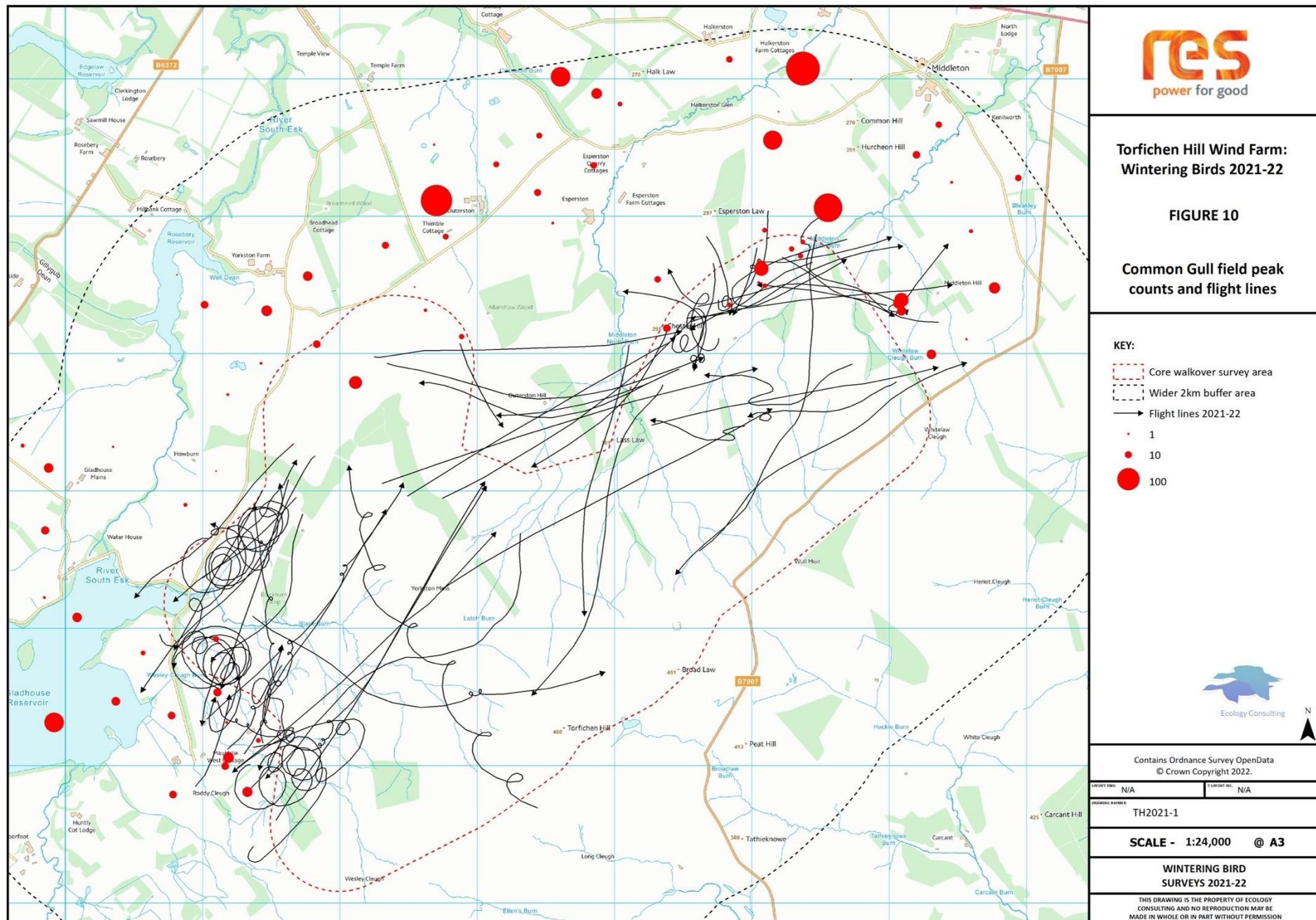


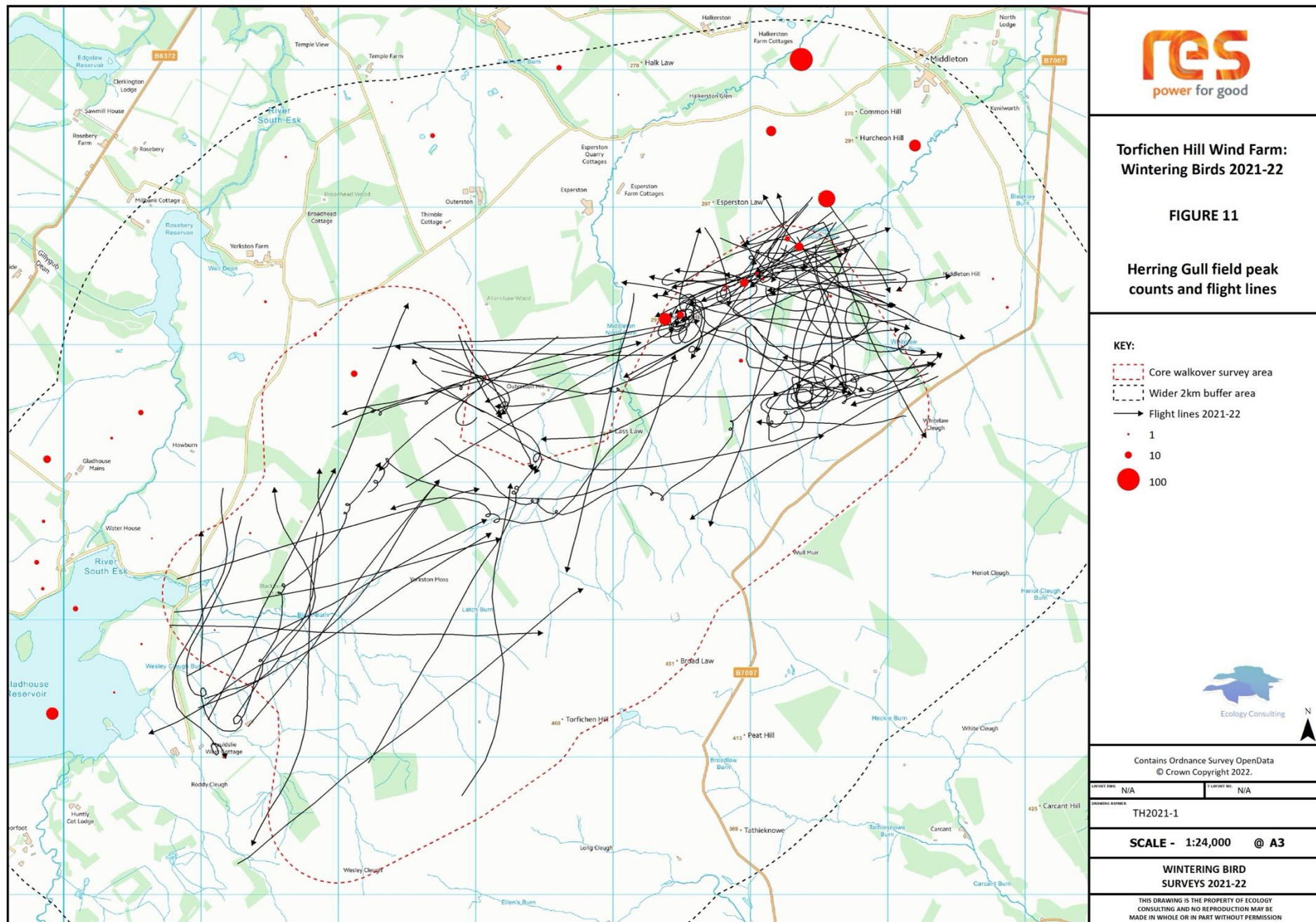


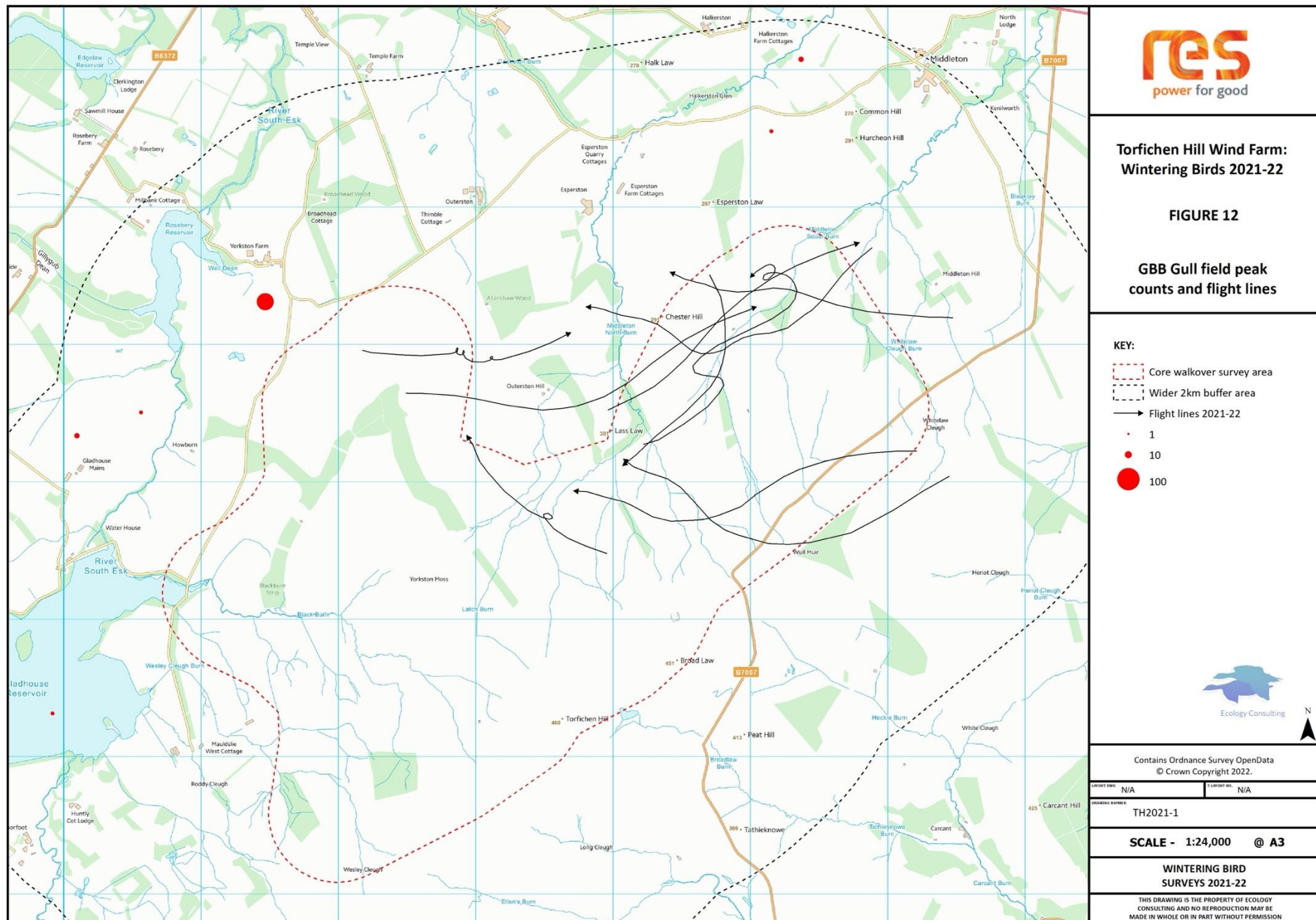


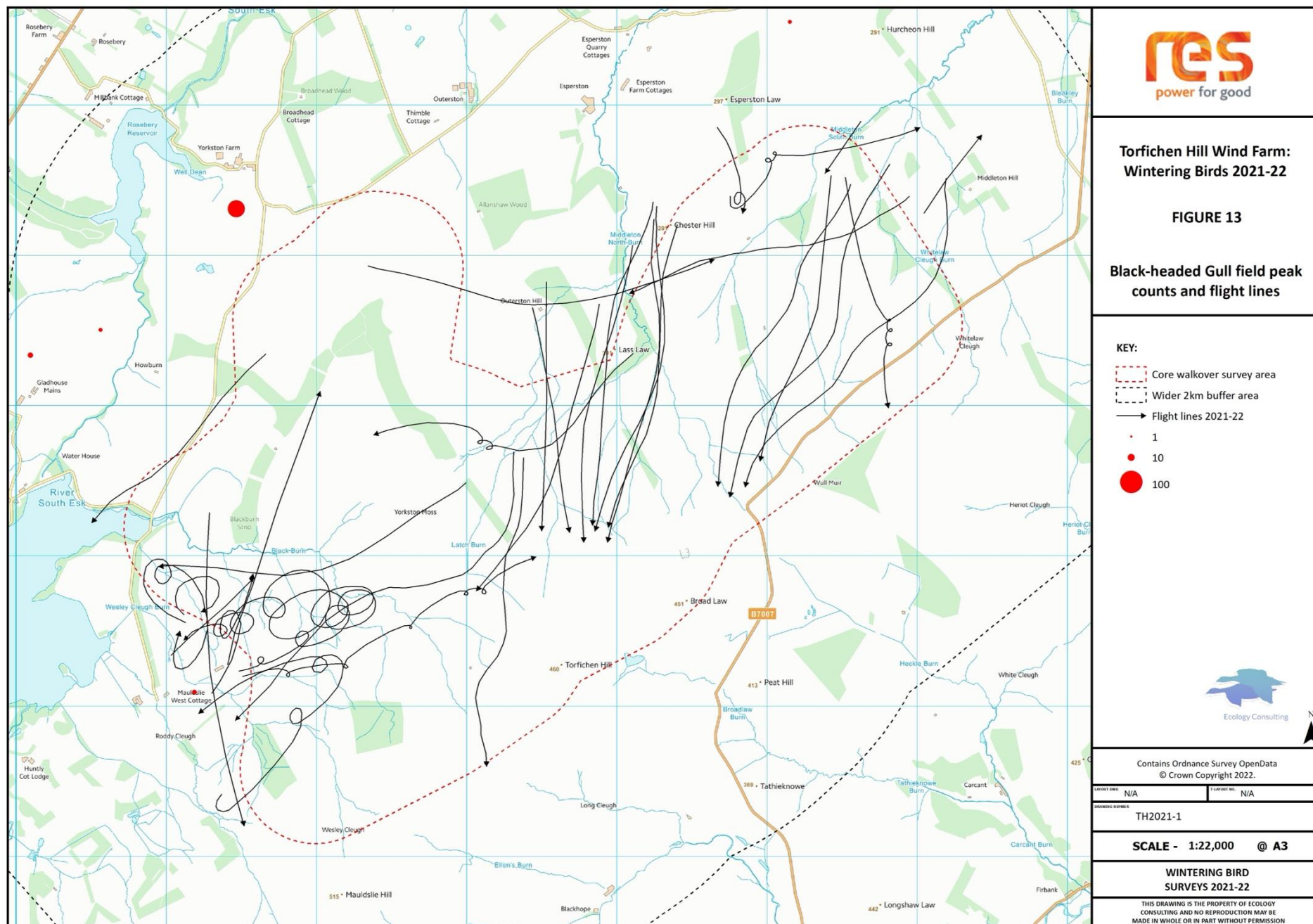












APPENDIX 1. VANTAGE POINT SURVEY DATA

Survey Information

Date	Vantage Point No	Start time	Finish time	Weather
13/09/2021	3	12:00	15:00	cloud 6/8, wind SSE 3, 14C, vis very good
13/09/2021	3	17:05	20:05	cloud 8/8, wind SSE 2, 13C, vis very good
14/09/2021	3	06:10	09:10	cloud 8/8, wind SE 1, 11C, vis very good
14/09/2021	3	09:40	12:40	cloud 8/8, wind SSE 2, 12C, vis very good, occasional shower
15/09/2021	2	06:10	09:10	cloud 7/8, wind 0, 11C, vis good, mist on tops
15/09/2021	2	09:40	12:40	cloud 8/8, wind 0, 12C, vis good, mist on tops
15/09/2021	2	13:10	16:10	cloud 7/8, wind W 1, 16C, vis very good
15/09/2021	2	17:05	20:05	cloud 6/8, wind 0, 16C, vis very good
16/09/2021	1	06:15	09:15	cloud 7/8, wind WSW 2, 11C, vis very good
16/09/2021	1	12:00	15:00	cloud 6/8, wind WSW 2, 14C, vis very good
23/09/2021	1	06:30	09:30	8/8 cloud, 4-5 W wind, good - very good vis 11 to 13C
23/09/2021	1	12:10	15:10	8/8 cloud, 4 W wind, very good vis
11/10/2021	1	10:00	13:00	cloud 7/8, wind W 3, 11C, vis very good
11/10/2021	1	13:30	16:30	cloud 8/8, wind W 3, 11C, vis very good, light showers
11/10/2021	1	17:00	19:00	cloud 8/8, wind W 3, 11C, vis very good
12/10/2021	1	07:05	08:05	cloud 8/8, wind WNW 3, 11C, vis good, light rain showers
12/10/2021	2	13:40	16:40	cloud 8/8, wind E 1, 10C, vis good, cloud base c420m
13/10/2021	2	07:10	10:10	cloud 8/8, wind WSW 2, 11C, vis very good
13/10/2021	2	10:40	13:40	cloud 8/8, wind WNW 3, 11C, vis excellent
03/10/2021	2	15:50	18:50	cloud 7/8, wind W 3, 11C, vis excellent
14/10/2021	3	07:10	10:10	cloud 7/8, wind SW 4, 9C, vis very good
14/10/2021	3	10:40	13:40	cloud 8/8, wind SW 4, 10C, vis very good
14/10/2021	3	14:10	17:10	cloud 8/8, wind WSW 4, 12C, vis very good
25/10/2021	1	07:35	10:35	2-6/8 cloud, 3-4 SSW-SW wind, excellent vis
25/10/2021	3	13:10	16:10	4-6/8 cloud, 5-2 SW wind, excellent vis, light showers
08/11/2021	1	08:20	11:20	cloud 6/8, wind SSW 2, 7C, vis very good
08/11/2021	1	11:50	14:50	cloud 8/8, wind S 2, 10C, vis very good
08/11/2021	1	15:20	16:50	cloud 8/8, wind SSW 3, 10C, vis very good
09/11/2021	1	07:00	08:30	cloud 8/8, wind SW 2, 10C, vis very good, patchy drizzle
09/11/2021	2	10:25	13:25	cloud 8/8, wind WSW 2, 10C, vis good, patchy drizzle
09/11/2021	2	13:55	16:55	cloud 2/8, wind WSW 3, 10C, vis very good
10/11/2021	3	15:20	16:50	cloud 5/8, wind WSW 2, 8C, vis excellent
12/11/2021	3	08:15	10:15	cloud 8/8, wind S 3, 9C, vis very good, showers
11/11/2021	2	07:05	10:05	cloud 7/8, wind SW 2, 7C, vis excellent
11/11/2021	2	10:35	13:35	cloud 5/8, wind SW 3, 9C, vis excellent
12/11/2021	3	10:15	13:15	cloud 8/8, wind SSW 4, 9C, vis very good, few showers
12/11/2021	3	13:45	16:45	cloud 7/8, wind SSW 4, 9C, vis very good
23/11/2021	3	07:25	10:25	8/8 cloud, 3 WSW wind, very good vis
23/11/2021	1	13:30	16:30	8/8 cloud, 3 WSW wind, very good vis
06/12/2021	1	08:20	11:20	cloud 8/8, wind S 2, 0C, snow showers, vis good
08/12/2021	2	07:50	10:50	cloud 8/8, wind 0, 2C, vis excellent
08/12/2021	3	12:30	15:30	cloud 8/8, wind WNW 1, 3C, vis very good
20/12/2021	3	08:00	11:00	4-7/8 cloud, 1 E wind, ok - very good - good vis
20/12/2021	1	13:45	16:15	8/8 cloud, 1 SE wind, very good vis
10/01/2022	2	11:25	13:25	cloud 8/8, wind S 4, 7C, vis excellent
10/01/2022	2	14:00	16:30	cloud 8/8, wind SSW 4, 7C, vis excellent
11/01/2022	2	07:45	09:45	cloud 0, wind SW 1, 1C, vis excellent
11/01/2022	2	10:15	13:15	cloud 0, wind SW 2, 5C, vis excellent
12/01/2022	3	14:15	16:45	cloud 8/8, wind WSW 4, 9C, vis excellent
13/01/2022	1	07:45	10:45	cloud 8/8, wind WSW 4, 6C, vis excellent
25/01/2022	3	08:35	11:35	cloud 8/8, 3-4 WSW wind, very good vis
25/01/2022	1	14:15	17:15	8-3/8 cloud, 3-4 SW wind, good - very good vis
07/02/2022	1	10:30	13:30	cloud 6/8, wind SSW 4, 4C, vis very good
07/02/2022	1	14:00	15:30	cloud 8/8, wind SW 4, 6C, vis very good
07/02/2022	1	16:00	18:00	cloud 8/8, wind SW 4, 7C, vis very good
08/02/2022	1	07:10	10:10	cloud 2/8, wind WSW 4, 5C, vis excellent
09/02/2022	3	07:10	10:10	cloud 8/8, wind WSW 5, 2C, vis very good, sleety shower
09/02/2022	3	10:40	13:40	cloud 4/8, wind WSW 4, 3C, vis very good
09/02/2022	3	15:00	18:00	cloud 4/8, wind WSW 4, 2C, vis very good
10/02/2022	2	07:05	09:05	cloud 4/8, wind WSW 4, 0C, vis very good, snow shower
10/02/2022	2	11:30	14:30	cloud 4/8, wind WSW 4, 2C, vis very good
10/02/2022	2	15:00	18:00	cloud 3/8, wind WSW 4, 2C, vis very good, snow shower
11/02/2022	2	07:00	08:30	cloud 0, wind WSW 1, -3C, vis excellent
11/02/2022	2	09:00	11:30	cloud 0, wind SW 1, -2C, vis excellent
11/02/2022	2	09:30	10:00	cloud 0, wind SW 1, -2C, vis excellent
24/02/2022	1	06:45	09:45	8-4/8 cloud, 3-4 SW wind, ok - very good vis, snow showers
24/02/2022	1	10:30	13:30	4-7/8 cloud, 4 SW wind, very good vis, snow on ground
07/03/2022	2	08:45	11:45	cloud 0, wind S 1, 1C, vis very good
07/03/2022	2	12:15	15:15	cloud 0, wind S 2, 6C, vis very good
07/03/2022	2	15:45	18:45	cloud 0, wind S 2, 6C, vis very good
08/03/2022	2	06:00	09:00	cloud 1/8, wind SSE 3, 1C, vis excellent
08/03/2022	1	17:45	18:15	cloud 7/8, wind SSE 4, 6C, vis very good
08/03/2022	1	18:15	18:45	cloud 7/8, wind SSE 4, 6C, vis very good, light rain
09/03/2022	3	06:00	09:00	cloud 5/8, wind SSE 4, 6C, vis very good
09/03/2022	3	09:30	12:30	cloud 6/8, wind S 5, 6C, vis very good
09/03/2022	3	13:00	16:00	cloud 6/8, wind S 5, 7C, vis very good
10/03/2022	1	06:00	08:00	cloud 7/8, wind SSE 3, 8C, vis very good
10/03/2022	1	08:30	11:30	cloud 7/8, wind SSE 3, 9C, vis very good
10/03/2022	1	12:00	15:00	cloud 8/8, wind S 3, 10C, vis very good
24/03/2022	3	12:45	15:45	4-7/8 cloud, 2 SW wind, excellent vis
24/03/2022	3	16:15	19:15	4-8/8 cloud, 0-1 WSW wind, excellent vis

Key Species Data

VP	Date	Time	Species	Count	Direction of flight	Flight height (m)	Activity	Time bird observed (sec)	Notes
3	13/09/2021	12:33	HH	1	WNW	16	hunt		female
3	13/09/2021	12:39	GI	1	NE	101	soar/hunt	780	juv, dropped to hunt over bracken on steep slope
3	13/09/2021	14:36	HH	1	NNE	111	hunt	260	male
3	13/09/2021	17:33	GI	1	NNE	29	hunt	110	ad male
3	13/09/2021	18:46	HH	1	NNE	21	hunt/chased	150	female
3	14/09/2021	06:54	HH	1	SW	2	hunt	400	female
3	14/09/2021	07:06	HH	1	NE	15	hunt	620	female, same as 1
3	14/09/2021	07:11	ML	1	N	21	hunt	140	female, chased by, then mobbing HH
3	14/09/2021	07:50	HH	1	WSW	2	hunt	40	male, landed on fencepost next to female
3	14/09/2021	07:53	GI	1	NNW	3	hunt	70	juv
3	14/09/2021	08:28	KT	1	SW	10	hunt	80	
3	14/09/2021	08:49	HH	1	SSW	6	hunt	230	male, same as 6, landed
3	14/09/2021	08:56	HH	1	S	16	hunt	660	juv male
3	14/09/2021	09:01	HH	1	NE	16	hunt	340	female, joined 12
3	14/09/2021	09:45	GI	1	ESE	11	hunt	430	juv female, landed in tree
3	14/09/2021	09:45	HH	1	SE	43	mobbing	1020	female, mobbing GI
3	14/09/2021	09:58	GI	1	NNE	31	sparring	170	juv male, dropped out of sight with 5, sparring with GI
3	14/09/2021	09:59	GI	1	SSE	36	sparring	130	juv female, same as 1, soaring and sparring with 4
3	14/09/2021	10:17	GI	3	circle	18	chase	1080	juvs, looks like 2 juv male and juv female, playing
3	14/09/2021	10:37	ML	1	SSW	3	hunt	20	ad male, landed on fencepost
3	14/09/2021	10:57	HH	1	SE	4	hunt	170	juv male, lost in gully
3	14/09/2021	11:36	HH	1	SE	2	hunt	60	juv male, same as 8, landed out of sight
3	14/09/2021	11:57	GI	2	SSE	7	hunt	140	juvs, same as 6
3	14/09/2021	12:13	GI	3	SE	43	soar/spar	740	juvs, same as 6/14
2	15/09/2021	10:54	OP	1	SSW	65	migrating	150	
2	15/09/2021	13:36	GI	1	ENE	93	soar/hunt	490	juv, soaring then stooped on WP but missed
2	15/09/2021	15:35	GI	1	S	46	hunt	350	juv
2	15/09/2021	15:38	ML	1	NNW	21	mobbing	130	female, mobbing GI
2	15/09/2021	17:48	HH	1	SE	4	hunt	260	female
2	15/09/2021	17:56	PE	1	ENE	23	hunt	240	juv
2	15/09/2021	18:17	HH	1	WSW	4	hunt	310	juv male, landed
2	15/09/2021	18:27	HH	1	NNW	3	hunt	450	juv male, same as 4
2	15/09/2021	18:50	HH	1	NW	4	hunt	250	juv, not same as 5, killed a WP and landed to feed
2	15/09/2021	19:18	HH	1	WSW	3	roost	120	juv, same as 6
2	15/09/2021	19:36	GI	1	WNW	11	hunt	90	2cy male
1	16/09/2021	06:35	HH	2	WSW	6	hunt	330	juvs, hunting together, lost behind trees
1	16/09/2021	06:43	HH	1	NNW	4	hunt	290	juv, same as 2
1	16/09/2021	12:43	HH	1	SSW	7	hunt	190	juv, appeared to land in trees
1	23/09/2021	08:14	PG	20	SE	95		120	
1	23/09/2021	09:01	PG	121	SSW	65		330	
1	23/09/2021	09:07	PG	15	WSW	60		240	
1	23/09/2021	09:23	PG	114	WSW	50		420	
1	23/09/2021	09:23	PG	65	WSW	60		360	
1	23/09/2021	09:23	PG	10	WSW	50		360	
1	23/09/2021	12:30	PG	60					flew SW to NW of site at 200m
1	23/09/2021	12:37	PE	1		21	hunt	360	juv
1	23/09/2021	12:44	L	32	SW	21		360	
1	23/09/2021	12:52	PG	30	SSE	175		180	
1	23/09/2021	13:06	GP	13	SSE	50		180	
1	23/09/2021	13:12	PG	230					flew SW to NW of site at 200m
1	23/09/2021	13:18	PG	65	SSW	300		120	
1	23/09/2021	13:21	PG	210					flew SW to NW of site at 300+m
1	23/09/2021	13:26	PG	210	SW	300		420	
1	23/09/2021	13:30	PG	370					flew SW to NW of site at 300+m
1	23/09/2021	13:35	PG	50	SW	300		180	
1	23/09/2021	13:37	PG	220	SW	300		360	
1	23/09/2021	13:40	PG	38	SW	200		360	
1	23/09/2021	13:40	PG	600					flew SW to NW of site at 300+m
1	23/09/2021	13:49	PG	180	W	250		240	
1	23/09/2021	13:52	PG	130	SW	250		420	
1	23/09/2021	13:52	PG	33	WSW	200		420	
1	23/09/2021	13:54	PG	200	SW	250		420	
1	23/09/2021	13:54	PG	45	SSW	200		360	
1	23/09/2021	13:55	PG	41	WSW	200		420	
1	23/09/2021	13:56	PG	55	SW	300		360	
1	23/09/2021	13:58	PG	33	WSW	180		420	
1	23/09/2021	14:01	PG	200					flew SW to NW of site at 300+m
1	23/09/2021	14:09	PG	18	WNW	70		180	
1	23/09/2021	14:09	PG	60	SW	300		300	
1	23/09/2021	14:11	PG	40					flew SW to NW of site at 300+m
1	23/09/2021	14:15	PG	35					flew SW to NW of site at 300+m
1	23/09/2021	14:15	PG	41	WSW	175		300	
1	23/09/2021	14:20	PG	15	WSW	115		360	
1	23/09/2021	14:20	PG	72	SW	80		210	
1	23/09/2021	14:22	PG	40	SSW	300		360	
1	23/09/2021	14:22	PG	190					flew SW to NW of site at 300+m
1	23/09/2021	14:25	PG	85	W	250		300	
1	23/09/2021	14:30	PG	22	SW	300		300	
1	23/09/2021	14:31	PG	45	W	165		300	

VP	Date	Time	Species	Count	Direction of flight	Flight height (m)	Activity	Time bird observed (sec)	Notes
1	23/09/2021	14:40	PG	210	W	225		240	
1	23/09/2021	14:41	PG	26	W	250		240	
1	23/09/2021	14:50	PG	170	WSW	200		300	
1	23/09/2021	14:52	PG	55	SW	70		240	
1	23/09/2021	14:53	PG	150					flew SW to NW of site at 300+m
1	23/09/2021	14:56	L	44	ESE	60		180	
1	23/09/2021	14:57	PG	30	W	300		240	
1	23/09/2021	15:00	PG	150					flew SW to NW of site at 300+m
1	23/09/2021	15:00	PG	80	SW	300		180	
1	23/09/2021	15:05	PG	12	W	300		180	
1	23/09/2021	15:07	PG	300					flew SW to NW of site at 300+m
1	11/10/2021	13:55	PG	20	WNW	150	feed	140	
1	11/10/2021	14:02	L	110	SW	25	flushed	130	landed
1	11/10/2021	14:32	L	50	SSW	75		150	
1	11/10/2021	14:40	PG	130	WSW	65	flushed	90	split off from flock of c1000 flushed from off-site to the north
1	11/10/2021	14:43	PG	110	SSE	120	flushed	110	split off from flock of c1000 flushed from off-site to the north
1	11/10/2021	14:58	PG	34	WNW	40	feed	100	landed
1	11/10/2021	15:21	GI	1	WSW	35	hunt	140	juv
1	11/10/2021	15:29	PG	44	WNW	45	feed	110	landed
1	11/10/2021	16:02	HH	1	WSW	4	hunt	270	male, lost behind plantation
1	11/10/2021	16:05	ML	1	SW	15	mob/hunt	100	male, chased HH
1	11/10/2021	16:20	PG	8	NW	90	feed	110	
1	11/10/2021	17:07	PG	76	SSW	85		160	
1	11/10/2021	17:16	PG	205	circle	115	roost	170	
1	11/10/2021	17:27	PG	28	NNE	165		140	
1	11/10/2021	17:38	L	150	SW	25	flushed	130	landed
1	11/10/2021	17:38	L	170	SW	25	flushed	90	
1	11/10/2021	18:18	L	170	WSW	13	roost	50	same as 6, landed
1	11/10/2021	18:33	BY	160	WSW	135	migrating	160	
2	12/10/2021	13:40	PG	170	WNW	60	flushed	100	
2	12/10/2021	13:44	BY	145	SSW	125	migrating	150	
2	12/10/2021	14:00	PG	16	SSE	65	feed	150	
2	12/10/2021	14:03	PG	45	ENE	70	feed	120	
2	13/10/2021	07:25	BY	57	SSE	165	migrating	120	(off-site to the east, flock split by PE and one bird driven to the ground!)
2	13/10/2021	07:46	GI	1	NW	14	hunt	35	juv
2	13/10/2021	08:06	PG	15	ENE	70	roost	60	
2	13/10/2021	08:34	GI	1	SE	23	hunt	280	juv, dropped into trees
2	13/10/2021	08:50	WS	16	ENE	85	migrating	170	
2	13/10/2021	09:01	PG	12	ENE	55	feed	70	
2	13/10/2021	09:04	PG	36	NNE	250	migrating	120	
2	13/10/2021	09:25	PG	33	ENE	250	migrating	150	
2	13/10/2021	09:28	PG	46	ENE	200	migrating	160	
2	13/10/2021	09:32	PG	81	ENE	180	migrating	150	
2	13/10/2021	09:50	PG	73	WNW	135		300	
2	13/10/2021	10:09	PG	43	WSW	115		320	
2	13/10/2021	11:01	BY	10	WSW	180	migrating	90	
2	13/10/2021	11:09	BY	34	WSW	200	migrating	100	
2	13/10/2021	11:20	BY	150	WSW	180	migrating	100	
2	13/10/2021	11:20	PG	52	WSW	180	migrating	100	
2	13/10/2021	11:37	PG	71	WSW	90	migrating	130	
2	13/10/2021	11:48	PG	170	SSW	70	flushed	120	came off stubble in field 77
2	13/10/2021	13:25	GP	12	WSW	40		130	
2	13/10/2021	18:36	PG	150			roost		
3	14/10/2021	07:52	PG	83	ENE	65	roost	110	
3	14/10/2021	09:16	L	60	circle	15	flushed	50	landed
3	14/10/2021	10:02	PG	48	NE	250	migrating	100	
3	14/10/2021	10:41	L	65	WSW	13	flushed	25	landed
3	14/10/2021	10:52	GI	1	circle	24	hunt	400	ad female
3	14/10/2021	12:11	L	65	W	20	flushed	90	same as 1, landed
3	14/10/2021	12:45	PG	30	ENE	40	feed	70	landed
3	14/10/2021	14:18	L	65	circle	10	flushed	60	landed
3	14/10/2021	14:24	GI	1	SSE	7	hunt	260	ad male
1	25/10/2021	08:08	PG	40	ESE	140		50	
1	25/10/2021	08:23	PG	170	ESE	90		160	
1	25/10/2021	08:40	PG	1	ENE	80		90	
1	25/10/2021	09:09	L	1	SW	13		35	left flock in field briefly
3	25/10/2021	13:10	L	4		8		35	
3	25/10/2021	14:50	L	51		30		270	
3	25/10/2021	14:56	HH	1		16	hunt	660	female
3	25/10/2021	14:58	L	18		10		50	flushed by HH
3	25/10/2021	15:31	L	30	circle ESE	10		70	
3	25/10/2021	15:33	GI	1	SSW	110		780	juv
3	25/10/2021	16:05	GI	1	circle NW	63		90	adult
1	08/11/2021	10:17	ML	1	SW	31	hunt	140	male, unsuccessful chase, possibly landed
1	09/11/2021	07:41	PG	55	E	90	roost	120	
2	09/11/2021	11:34	GP	190	SW	45		160	
2	09/11/2021	16:20	PG	360	NNE	50			flew off to roost from field 124 to Aberlady?
2	09/11/2021	16:34	PG	63	WSW	90	roost	50	
2	09/11/2021	16:53	PG	270	WSW	70	roost	60	
3	10/11/2021	15:24	PG	6	NE	10	flushed	30	landed

VP	Date	Time	Species	Count	Direction of flight	Flight height (m)	Activity	Time bird observed (sec)	Notes
3	10/11/2021	16:01	PG	26	NNE	20	flushed	70	flushed by tractor, landed
3	10/11/2021	16:07	PG	48	SSW	40	roost	320	
3	12/11/2021	08:53	GI	1	SE	28	hunt	400	juv, briefly chased 8 then off hunting
3	12/11/2021	08:53	GI	1	SE	36	hunt	580	juv, lost in gully, low to ground
3	12/11/2021	08:55	L	10	WNW	30	flushed	100	
3	12/11/2021	09:23	PG	1	S	30	flushed	80	by farmer
3	12/11/2021	09:49	KT	1	SE	36	hunt	280	juv
2	11/11/2021	07:12	PG	88	ENE	80	roost	170	
2	11/11/2021	07:33	PG	320	NE	100	roost	60	
2	11/11/2021	09:22	PG	18	NNE	150	migrating	100	came from way off to SW
2	11/11/2021	12:22	PG	4	ENE	90	feed	150	
2	11/11/2021	12:42	PG	38	SSE	80	feed	60	
3	12/11/2021	12:58	L	3	NE	33		140	
3	23/11/2021	09:06	L	6	WNW	20		50	flew from field
3	23/11/2021	09:26	GI	1	NNW	18		80	adult male flew between woods
3	23/11/2021	09:47	PE	1	SSE	50		150	adult
1	06/12/2021	11:11	PG	900	SSW	40	feed	20	landed in wheat (joining 370 present throughout)
2	08/12/2021	07:54	PG	42	ENE	100	roost	160	
3	08/12/2021	12:30	L	33	W	20	flushed	380	landed
3	08/12/2021	13:01	PE	1	NNE	16	hunt	45	ad female, landed on fencepost
3	08/12/2021	13:01	L	33	NW	30	flushed	110	same as 1
3	08/12/2021	13:05	PE	1	NNW	21	hunt	45	ad female, same as 4
3	20/12/2021	08:20	PG	121	NE	40	left roost	150	
3	20/12/2021	08:29	PG	750	NE	55	left roost	150	
3	20/12/2021	08:32	BY	1	ENE	10	left roost	420	with CG flock, landed
3	20/12/2021	08:42	PG	16	NE	65	left roost	150	
2	10/01/2022	15:45	HH	1	W	3	hunt	280	female
2	10/01/2022	15:49	GI	1	W	7	hunt	110	ad female
2	11/01/2022	07:46	PG	870	ENE	100	roost	150	
2	11/01/2022	07:50	PG	116	ENE	90	roost	150	
2	11/01/2022	07:56	PG	240	ENE	100	roost	100	
2	11/01/2022	08:06	PG	103	ENE	110	roost	160	
2	11/01/2022	08:17	PG	62	NE	40	roost	140	
2	11/01/2022	09:30	PG	410	ESE	70	flushed	140	
2	11/01/2022	09:30	PG	50	ESE	45	flushed	240	landed out of sight
2	11/01/2022	11:10	GP	1	SSW	46		80	
2	11/01/2022	11:50	PG	37	E	70	feed	170	
3	12/01/2022	13:47	BY	1	ENE	15	feed	50	landed
3	12/01/2022	15:06	PG	48	WSW	110	roost	280	
1	13/01/2022	07:48	PG	49	ENE	45	roost	130	landed
1	13/01/2022	07:55	PG	35	ENE	60	roost	140	landed
1	13/01/2022	07:57	PG	42	ENE	75	roost	140	landed
1	13/01/2022	08:00	PG	540	ENE	75	roost	220	landed briefly in 124 then continued
1	13/01/2022	08:05	PG	14	ENE	120	roost	150	
1	13/01/2022	08:08	PG	65	ENE	60	roost	130	landed
1	13/01/2022	08:14	PG	63	SSW	50	roost	80	landed (came from coastal roost)
1	13/01/2022	08:18	PG	43	SW	75	flushed	120	same as 7
1	13/01/2022	08:18	PG	20	SW	45	flushed	110	same as 7, landed
1	13/01/2022	08:50	PG	43	WSW	35	feed	80	same as 8, landed
1	13/01/2022	10:14	PG	51	SW	20	flushed	70	landed
1	13/01/2022	10:38	PG	280	SW	30	feed	50	landed
3	25/01/2022	08:39	GP	1	NE	38		100	injured wing
3	25/01/2022	09:04	GI	1	SSE	40		190	juv (2cy)
3	25/01/2022	09:11	GI	1	NNW	77		600	juv, same as 2
3	25/01/2022	09:12	GP	2	NNE	20		35	flushed by GI
3	25/01/2022	09:51	GP	4	SW	30		50	flushed by raven
3	25/01/2022	10:06	GP	22		30		1200	
3	25/01/2022	10:11	GP	19		103		60	
3	25/01/2022	11:09	GP	22		45		480	
3	25/01/2022	11:32	GP	6	NE	45		45	
1	25/01/2022	15:34	PG	17	SW	100		125	
1	25/01/2022	16:23	PG	300	SW	150		270	flew from field
1	25/01/2022	16:23	PG	370	SSW	45		70	flew from field
1	25/01/2022	16:23	PG	50	SSE	75		210	flew from field
1	25/01/2022	16:27	PG	3	SE	150		120	
1	25/01/2022	16:41	PG	29	WSW				flew WSW to NW of site at 200m
1	07/02/2022	12:13	L	80	WSW	45		110	
1	07/02/2022	12:53	GP	6	WSW	33		150	
1	07/02/2022	16:39	L	80	SW	65		50	same as 5, landed
1	07/02/2022	17:35	PG	380	SSW	25	flushed	170	from field 97, landed again (50 flew off E)
1	08/02/2022	07:12	PG	42	ENE	30	roost	130	landed
1	08/02/2022	07:15	PG	120	ENE	45	roost	140	landed
1	08/02/2022	07:20	PG	430	ENE	50	roost	160	landed
1	08/02/2022	07:28	PG	48	ENE	75	roost	120	landed
1	08/02/2022	08:33	L	157	WSW	101		660	
1	08/02/2022	08:42	PG	256	SSW	20	flushed	160	landed
1	08/02/2022	09:55	L	2	SSE	50		90	
3	09/02/2022	07:15	PG	35	ENE	85	roost	100	
3	09/02/2022	07:25	PG	125	ENE	70	roost	130	
3	09/02/2022	07:34	PG	610	ENE	85	roost	130	

VP	Date	Time	Species	Count	Direction of flight	Flight height (m)	Activity	Time bird observed (sec)	Notes
3	09/02/2022	08:16	L	26	WSW	20	flushed	60	landed
3	09/02/2022	08:51	CU	1	WSW	50		80	
3	09/02/2022	09:51	ML	1	WSW	2	hunt	20	female
3	09/02/2022	10:08	L	82	SW	16		140	
3	09/02/2022	10:45	ML	1	NNE	65	hunt	310	female, chasing skylark
3	09/02/2022	12:34	GP	38	SSW	70		540	
3	09/02/2022	15:20	GP	26	WSW	25		150	
3	09/02/2022	15:31	HH	1	NNW	8	hunt	190	female, flushed SE
3	09/02/2022	15:33	SE	1	SE	9	flushed	70	landed on post
3	09/02/2022	15:36	GI	1	W	31	soar/hunt	170	male
3	09/02/2022	15:38	SE	1	W	3	hunt	660	same as 3
3	09/02/2022	15:47	HH	1	ESE	6	hunt	140	female, juv, landed
3	09/02/2022	15:50	HH	1	S	3	hunt	250	female, same as 2
3	09/02/2022	16:01	ML	1	SSE	5	hunt	50	female
3	09/02/2022	16:33	HH	1	NNW	4	hunt	120	juv female, same as 6, landed on post
3	09/02/2022	16:50	HH	1	NNW	3	hunt	50	juv female, same as 11
3	09/02/2022	17:34	L	18	NE	8	feed	30	landed
2	10/02/2022	07:12	PG	51	ENE	60	roost	120	
2	10/02/2022	07:27	PG	330	ENE	85	roost	200	
2	10/02/2022	07:51	HH	1	ENE	8	hunt	220	juv female
2	10/02/2022	08:00	PE	1	NNW	25	hunt	90	male
2	10/02/2022	16:31	GI	1	WSW	21	hunt	250	juv
2	11/02/2022	07:07	PG	400	NE	90	roost	60	off map, NW of survey area
2	11/02/2022	07:21	PG	1280	ENE	100	roost	140	
2	11/02/2022	07:31	GI	1	W	28	roost	130	ad male
2	11/02/2022	07:38	PG	180	ENE	95	roost	150	
2	11/02/2022	08:25	PG	2	SSE	55		130	
2	11/02/2022	09:18	L	23	SSW	70		200	
2	11/02/2022	09:18	L	90	SSE	50		130	
2	11/02/2022	09:58	L	19	ESE	75	feed	200	
2	11/02/2022	10:15	GI	1	WSW	9	hunt	100	ad female
2	11/02/2022	10:55	L	24	ENE	55		260	
1	24/02/2022	06:58	PG	360	NE	115	left roost	270	
1	24/02/2022	07:01	PG		ENE	45	left roost	240	landed
1	24/02/2022	08:46	L	12		15		110	
1	24/02/2022	09:32	PG	2	SE	30		75	landed
1	24/02/2022	11:55	PG	450					flew in from NE and landed in field 97 (did not fly over site)
1	24/02/2022	12:01	PG	24					flew in from NE and joined flock above
1	24/02/2022	12:30	PG	355	NW	35		160	landed in field 97 (left field 116)
1	24/02/2022	13:02	PG	830	SE	25		100	flew from field 97 to 116
1	24/02/2022	13:13	L	16	NE	60		90	
1	24/02/2022	13:20	L	8	WNW	21		170	
1	24/02/2022	13:27	PG	1500					flew in from east and landed in fields 128/116.
2	07/03/2022	08:56	CU	2	WSW	75		70	
2	07/03/2022	09:14	PG	98	ESE	90	feed	160	
2	07/03/2022	09:28	GI	1	ESE	75	soar	500	juv
2	07/03/2022	10:24	PG	65	NNE	140	migrating	150	
2	07/03/2022	10:49	L	1	ENE	55		90	
2	07/03/2022	11:28	L	4	NW	70		150	
2	07/03/2022	11:43	GI	2	SE	28	display	120	pair on flight 1 flew WSW
2	07/03/2022	12:22	L	1	SSE	60		160	
2	07/03/2022	13:31	L	23	SSW	80		290	
2	07/03/2022	13:56	L	21	WSW	8		130	prob same as 5
2	07/03/2022	14:20	HH	1	S	3	hunt	190	female, landed
2	07/03/2022	14:41	HH	1	ENE	1	hunt	170	female, same as 10
2	07/03/2022	15:52	HH	1	N	3	hunt	350	female
2	07/03/2022	16:05	HH	1	NNE	5	hunt	60	female, same as 10
2	07/03/2022	17:10	PG	9	WSW	90		60	
2	07/03/2022	17:15	CU	44	ENE	80		60	
2	07/03/2022	17:31	CU	12	ENE	70		60	
2	07/03/2022	18:25	PG	500	WSW	80	roost	160	
2	07/03/2022	18:35	PG	320	SSW	90	roost	60	
2	07/03/2022	18:43	PG	96	WSW	100	roost	80	
2	08/03/2022	06:17	PG	105	ENE	80	roost	70	
2	08/03/2022	06:21	PG	260	ENE	80	roost	140	
2	08/03/2022	06:21	PG	190	ENE	115	roost	70	
2	08/03/2022	06:35	PG	24	SSE	15	roost	140	landed
2	08/03/2022	06:39	PG	1030	ENE	85	roost	170	
2	08/03/2022	07:12	CU	1	WSW	60		90	
2	08/03/2022	07:56	GP	3	SSW	40		80	
2	08/03/2022	08:04	CU	1	SE	13	feed	40	landed
2	08/03/2022	08:54	CU	2	SW	8	feed	15	landed
2	08/03/2022	08:58	WS	34	NNW	140	migrating	120	
3	09/03/2022	06:11	PG	28	ENE	25	roost	60	landed
3	09/03/2022	06:16	PG	780	ENE	95	roost	170	
3	09/03/2022	06:16	PG	45	ENE	50	roost	80	
3	09/03/2022	06:21	PG	24	ENE	75	roost	150	
3	09/03/2022	06:25	PG	52	NE	105	roost	140	
3	09/03/2022	06:42	PG	380	SE	115	roost	90	
3	09/03/2022	07:09	CU	44	SW	35	roost	140	

VP	Date	Time	Species	Count	Direction of flight	Flight height (m)	Activity	Time bird observed (sec)	Notes
3	09/03/2022	07:16	L	25	SSW	20	feed	120	landed
3	09/03/2022	08:29	CU	6	SSW	15	feed	50	landed
3	09/03/2022	09:40	CU	1	ESE	33	display	220	
3	09/03/2022	10:15	PE	1	WNW	40	hunt	140	
3	09/03/2022	10:19	GP	12	SSW	55		130	
3	09/03/2022	10:33	GP	35	SSE	20	feed	60	landed
3	09/03/2022	11:38	GI	1	SW	23	hunt	110	male
3	09/03/2022	11:51	PG	40	N	10	flushed	50	landed
3	09/03/2022	11:57	GI	1	E	33	display	450	male, same as 16
3	09/03/2022	12:12	L	30	SE	20	feed	70	landed
3	09/03/2022	15:07	CU	60	NNE	10	flushed	40	landed
3	09/03/2022	15:07	CU	7	NE	35	flushed	120	
3	09/03/2022	15:14	CU	4	NNE	33	feed	110	
3	09/03/2022	15:27	L	60	N	25	flushed	110	landed
3	09/03/2022	15:27	CU	68	N	25	flushed	110	landed
3	09/03/2022	15:51	L	60	S	15	flushed	50	same as 11. landed
3	09/03/2022	15:51	CU	110	SSE	20	flushed	60	landed
3	09/03/2022	15:57	HH	1	ESE	10	hunt	120	female, same as VP2 on 7/3
1	10/03/2022	06:39	CU	17	SSW	40	feed	160	
1	10/03/2022	06:42	CU	1	SSE	35	display	150	
1	10/03/2022	06:47	PG	1550	ENE	150	roost	150	
1	10/03/2022	07:06	PG	25	ENE	35	roost	140	landed just off map
1	10/03/2022	07:31	CU	2	SSW	8	feed	40	landed
1	10/03/2022	07:40	CU	1	NE	8	feed	50	landed
1	10/03/2022	07:48	CU	2	SSE	50		100	
1	10/03/2022	07:58	CU	5	S	35	feed	120	
1	10/03/2022	08:42	CU	1	SW	20	display	180	landed
1	10/03/2022	09:52	CU	2	NNE	8	feed	70	landed on post
1	10/03/2022	10:14	CU	70	ESE	35	feed	110	landed
1	10/03/2022	12:12	PG	11	SW	65		260	
1	10/03/2022	12:55	L	21	SW	40		290	
1	10/03/2022	12:58	PG	1	NNE	75		110	
1	10/03/2022	13:08	PG	44	NE	45	feed	170	landed just off map
1	10/03/2022	13:14	CU	1	NNW	45	feed	130	
1	10/03/2022	14:24	PG	7	SSW	35	feed	100	landed
1	10/03/2022	14:41	PG	7	WNW	30		130	
3	24/03/2022	12:45	L	6		30	display	2700	
3	24/03/2022	12:45	L	4		20	display	2400	
3	24/03/2022	13:00	L	2		15	display	1200	
3	24/03/2022	13:03	KT	1	circle NE	58		360	initially mobbed by BZ
3	24/03/2022	13:08	CU	3	NW	105		210	
3	24/03/2022	13:13	KT	1		20		150	same bird as 7
3	24/03/2022	13:28	L	21	E	8		30	landed
3	24/03/2022	13:30	L	10		20	display	1920	
3	24/03/2022	13:37	L	1	SW	13		70	
3	24/03/2022	13:39	CU	3	WNW	6		50	
3	24/03/2022	13:40	L	6		15		160	
3	24/03/2022	13:40	KT	1		10		360	
3	24/03/2022	14:09	L	18		8		90	
3	24/03/2022	14:13	L	2		13	display	240	
3	24/03/2022	14:15	L	1		10		150	
3	24/03/2022	14:23	L	2		10		420	
3	24/03/2022	14:43	L	2		15		2520	
3	24/03/2022	14:47	L	1		10		240	
3	24/03/2022	14:50	GI	1	SE	30		390	adult female, carrying grass/twigs
3	24/03/2022	14:51	L	13		15		150	flushed by GI
3	24/03/2022	15:14	CU	1		15	display	40	
3	24/03/2022	15:15	L	10		15		600	
3	24/03/2022	15:16	L	4		15		270	
3	24/03/2022	15:20	L	4		8		210	
3	24/03/2022	15:26	L	14		15		150	
3	24/03/2022	15:30	CU	2	W	13		110	
3	24/03/2022	16:15	L	3		10		6300	
3	24/03/2022	16:16	L	4		10		1800	
3	24/03/2022	16:28	CU	2	SW	45		110	
3	24/03/2022	16:40	L	5		10		3900	
3	24/03/2022	16:46	L	30		10		150	flushed by RN
3	24/03/2022	17:05	CU	1	SW	15		90	flew from ground
3	24/03/2022	17:10	L	6		10		2880	
3	24/03/2022	17:26	CU	1	NW	55		90	
3	24/03/2022	18:20	L	40		8		120	
3	24/03/2022	18:21	CU	2	NE	15		110	
3	24/03/2022	18:24	GI	1	SSE	45		360	female
3	24/03/2022	18:26	GP	30	circle SE	225		600	
3	24/03/2022	18:35	CU	2	WNW	8		70	flew from ground
3	24/03/2022	18:45	HH	1	SW	3	roost	100	female