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Vale of Leven Wind Farm
Ornithology
Appendix 7.1

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1 INTRODUCTION

MacArthur Green was commissioned by Vale of Leven Wind Farm Limited to complete ornithological surveys at the proposed Vale of Leven Wind Farm, near Bonhill in West Dunbartonshire (hereafter referred to as ‘the Proposed Development’). The surveys were conducted between March 2019 and August 2022 to inform an assessment of the potential ornithological effects of the Proposed Development on the species assemblage present.

This technical report summarises the methods employed and the results of the field surveys and is supported by the following Annexes.

- **Annex A:** Ornithological Legal Protection;
- **Annex B:** Ornithological Survey Methodologies;
- **Annex C:** Ornithological Survey Effort and General Information;
- **Annex D:** Ornithological Survey Results; and
- **Annex E:** Collision Risk Assessments.

Confidential information relating to species listed on Annex 1 of the EU Birds Directive or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) is detailed in **Confidential Appendix 7.2**.

A range of surveys were employed to accurately record baseline conditions within the Proposed Development and appropriate survey areas (detailed in **Annex B**). In this Technical Appendix, associated **Annexes A – E**, **Confidential Technical Appendix 7.2** and **Chapter 7 (Ornithology)** of the Environmental Impact Assessment Report. Terms referred to are as follows:

- ‘the Site’ refers to the area within the Application Boundary, e.g. **Figure 7.1**;
- ‘survey area’ is defined as the area covered by each survey type for the Proposed Development; and
- ‘study area’ is defined as the area of consideration of effects on each species at the time of assessment.

2 LEGAL PROTECTION

With limited exceptions, all wild birds and their eggs are protected by law. Specific levels of protection are determined by a species’ inclusion on certain lists. **Annex A** to this report details the various levels of legal protection afforded to UK bird species.

¹ Breeding bird surveys were undertaken in for the Site plus part of the access track in 2019 and for the whole access track in 2022.

3 FIELD SURVEY METHODS

The following surveys were undertaken at the Site between March 2019 and August 2022:

- Flight activity surveys (one breeding season and one non-breeding season), from three vantage points (VPs) (**Figure 7.3**);
- Breeding bird surveys (two breeding seasons¹), 500 m survey buffer around Site boundary;
- Winter walkover surveys (one non-breeding season), 500 m survey buffer;
- Scarce breeding bird surveys (two breeding seasons), 2 km survey buffer; and
- Black grouse surveys (one breeding season), 1.5 km survey buffer.

Survey methods followed the recommended NatureScot (SNH 2017ⁱ) guidelines and methods are described in detail within **Annex B**. Surveys were carried out within a buffer distance specific to that method (e.g. 2 km buffer for the scarce breeding bird surveys) and these are detailed within **Annex B**.

The relative importance of the data collected was determined by the specific level of protection assigned to those species recorded, coupled with their perceived susceptibility to potential effects resulting from the Proposed Development. The resulting ‘target species’ and ‘secondary species’ lists are a standard assessment tool for wind farm ornithological studies (see **Annex B**).

4 FIELD SURVEY RESULTS

All valid surveys were undertaken during suitable weather conditions (as described within **Annex B**). Where weather conditions deteriorated below acceptable conditions (see definitions in **Annex B**), surveys were either suspended or additional surveys were undertaken. In the case of flight activity surveys, any time where the visibility was <1 km was excluded from total survey effort and subsequent analysis (further detail in **section 4.1**). Schedule 1/Annex 1 surveys were carried out by appropriately licensed surveyors. All survey data were reviewed, inputted, and analysed by MacArthur Green.

A total 106 bird species were recorded during the ornithological surveys conducted. Survey effort and results of the field surveys are detailed within **Annex C** and **Annex D**. The following sections summarise the results from each survey undertaken.

4.1 Flight Activity

The flight activity surveys recorded all target species’ flight activity visible from each of the three VPs (**Figure 7.3**) following NatureScot (SNH 2017) guidelines. Flight activity data collected from the VPs was specifically used for collision risk modelling, flying birds were recorded during other types of survey (e.g. breeding bird surveys) but the data was not used to estimate collision risk. The flights used for collision risk modelling included those

within the ‘Collision Risk Analysis Area’ (CRAA) (i.e. the area to be occupied by operational turbines, together with a 500 m buffer).

Flight activity surveys across the 2019 breeding season and 2019/2020 non-breeding season were undertaken from three VPs (Figure 7.3). Valid survey effort² is detailed in **Table 7-1-1** and full details of flight activity surveys are contained in **Annex C** with methodology in **Annex B**.

Table 7-1-1 Summary of total hours of valid survey per VP in each season

Period	VP1	VP2	VP3
2019 breeding season	36	36	33.7
2019/2020 non-breeding season	36.9	38.7	34.5

A total of nine target species were recorded during the flight activity surveys (further details are provided in **Annex D**). For each species across the whole flight activity survey period, **Table 7-1-2** shows the total number of flights recorded and the total number of birds recorded³. The bird seconds are calculated for each observation as the product of flight duration and number of individuals. This is then summed per species to give the total bird seconds recorded across the entire surveyed period.

Table 7-1-2 Target species recorded and total number of flights recorded during flight activity surveys, 2019-2020

Species	Total number of flightlines recorded	Total number of birds recorded	Total bird seconds recorded
Black grouse	1	1	11
Golden plover	1	12	768
Goshawk	6	6	576
Greylag goose	1	4	560
Hen harrier	7	7	617
Herring gull	12	67	9968
Osprey	7	7	990
Pink-footed goose	6	426	57813
Whooper swan	1	21	1785

4.1.1 Flightlines Used in Collision Risk Modelling

Only flightlines identified to be within the CRAA and recorded within the 2 km viewshed of the associated VP were considered in the collision risk modelling and **Annex E** provides details of the bird seconds from flights identified to be ‘at-risk’.

- ‘At-risk’ is defined as – a flight having at least part of its duration (i) at Potential Collision Height (PCH)⁴; (ii) within the CRAA; and (iii) recorded within the 2 km viewshed of the associated VP.
- PCH is defined as – the altitude between the minimum and maximum blade height⁵ (taken to be from 78 m to 250 m for the Proposed Development).

² Hours where visibility was <1 km are not considered valid for use in collision risk modelling as less than half the 2 km viewshed can be seen.

³ This includes flights that would not technically be ‘at-risk’ of collision (e.g. recorded outwith the CRAA and/or not at rotor height).

⁴ In some cases, only part of a total flight duration was recorded at PCH, and it is assumed that this proportion is applicable for that part of the flight within the CRAA and 2 km viewshed area.

Black grouse, hen harrier and whooper swan were recorded during flight activity surveys, but no flights were considered to be ‘at-risk’⁶. Full survey results detailing the findings from each survey visit (including target species’ flightlines considered not ‘at-risk’ and secondary species information) can be found within **Annex D**. Only bird seconds for observations identified as within the CRAA and associated viewshed are considered in the following discussions. Full target species results are detailed within **Annex D** and the collision risk calculations are detailed in **Annex E**.

4.1.2 Collision Risk Model Outputs

The bird seconds for target species flights within the CRAA at PCH were then input into a Collision Risk Model (CRM) to calculate the predicted collision rates per season. The CRM calculations for each species can be found in **Annex E**. **Table 7-1-3** and **Table 7-1-4** provide the estimated collision rates and number of seasons per collision for each species.

Table 7-1-3 Estimated collision rates.

Species	2019 breeding season	2019/2020 non-breeding season	Annual
Golden plover	0	0.0208	0.0208
Goshawk	0.0151	0	0.0151
Greylag goose	0	0.0019	0.0019
Herring gull	0.3604	0	0.3604
Osprey	0.0255	0	0.0255
Pink-footed goose	0	0.4046	0.4046

Table 7-1-4 Estimated number of seasons per collision

Species	2019 breeding season	2019/2020 non-breeding season	Annual
Golden plover	-	48	48
Goshawk	66	-	66
Greylag goose	-	525	525
Herring gull	2.77	-	2.77
Osprey	39	-	39
Pink-footed goose	-	2.47	2.47

4.2 Breeding Birds

Breeding bird surveys to record waders were undertaken in accordance with NatureScot (SNH 2017) guidelines. One complete breeding bird season (comprising of four visits between April to July) was undertaken across the Site including part of the proposed access route in 2019. The whole proposed access route was surveyed in 2022 (comprising four visits between April to July). Wader observations recorded during all survey types were used to estimate territory numbers. Surveys recorded seven wader species, of which five were considered to be breeding (**Table 7-1-5**). Golden plover and woodcock were also recorded but were not considered to be breeding.

⁵ Where the actual rotor blade altitude differs from the pre-defined survey height bands, the collision risk model accounts for this difference on the assumption of an even flight distribution within each particular survey height band, and an adjustment can be made to estimate total flight duration at actual rotor blade altitude.

⁶ i.e. the flights were either not within the CRAA and associated viewshed or were only recorded flying above 250m.

Full details of the breeding bird surveys are provided within **Annex C** and **Annex D** and survey methodology is provided within **Annex B**.

Table 7-1-5 Breeding wader territories, 2019 and 2022.

Species	Number of territories 2019	Number of territories 2022
Common sandpiper	1	-
Curlew	2-4	3-5
Lapwing	4	2
Oystercatcher	1	2
Snipe	-	4-6

4.3 Winter Walkover

Winter walkover bird surveys were undertaken in accordance with NatureScot (SNH 2017) guidelines. Winter walkover surveys were conducted during the 2019/2020 non-breeding season. Surveys recorded 47 species of which seven are considered to be target species (**Table 7-1-6**). Full details of the winter walkover surveys are provided within **Annex C** and **Annex D** and survey methodology is provided within **Annex B**.

Table 7-1-6 Winter walkover: target species recorded, 2019/2020

Species	2019/2020 non-breeding season Number of records	Total number of birds
Black grouse	1	2
Golden plover	1	9
Goshawk	1	1
Greylag goose	1	1000
Hen harrier	1	1
Herring gull	3	42
Woodcock	10	11

ⁱ Scottish Natural Heritage (2017) Recommended Bird Survey Methods to inform impact assessment of Onshore Windfarms.

4.4 Scarce Breeding Birds

Scarce breeding bird surveys were undertaken in accordance with NatureScot (SNH 2017) guidelines. Scarce breeding bird surveys were conducted across the Site and proposed access route during the 2019 (March to August) and 2022 (April to August) breeding seasons.

Goshawk and osprey were confirmed to be breeding within the survey area and breeding activity is summarised in **Table 7-1-7**. **Confidential Technical Appendix 7.2** contains the full details of all breeding activity. Peregrine falcon were also recorded during surveys but were not considered to be breeding.

Table 7-1-7 Scarce breeding bird summary

Species	2019	2022
Goshawk	No breeding observed	Breeding confirmed at one location, two chicks known to have fledged
Osprey	No breeding observed	Breeding confirmed at two locations, one chick known to have fledged from one nest and fledging success unknown for other nest

Buzzard, kestrel, sparrowhawk and tawny owl (secondary raptor species) were also recorded across the survey area and are likely to have bred within the wider area.

Full details of the scarce breeding bird surveys are provided within **Annex C** and **Annex D** and **Confidential Technical Appendix 7.2** and survey methodology is provided within **Annex B**.

4.5 Black Grouse

Black grouse surveys were undertaken in accordance with NatureScot (SNH 2017) guidelines. Surveys to identify areas of black grouse activity, locate lek locations and establish lek size were conducted in the 2019 breeding season during April and May. Surveys did not record any lekking birds. Full details of the black grouse surveys are provided within **Annex C** and **Annex D** and survey methodology is provided within **Annex B**.

ANNEX A. ORNITHOLOGICAL LEGAL PROTECTION

In Scotland, all wild birds are protected under the Wildlife and Countryside Act 1981 (the 'Act'), as amended by the Nature Conservation (Scotland) Act 2004. This protection also extends to their eggs and nests, with it being an offence to intentionally or recklessly¹:

- Kill, injure or take any wild bird²;
- Take, damage, destroy or otherwise interfere with the nest of any wild bird while it is being built or is in use³;
- At any other time take, damage, destroy or otherwise interfere with any nest habitually used by any wild bird included in Schedule A1 (Protected Nests and Nest Sites for Birds: white-tailed eagle and golden eagle)⁴;
- Obstruct or prevent any wild bird from using its nest⁵; or
- Take or destroy an egg of any wild bird⁶.

It is also an offence to have in possession or control any live or dead wild bird or any part thereof; or any egg or part of an egg of any wild bird⁷.

Further special protection under this legislation is afforded to those species listed on Schedule 1 of the Act. For these species, it is an offence to:

- Intentionally or recklessly disturb any wild bird listed on Schedule 1 while it is nest building, or is in, on or near a nest containing eggs or young, or disturb the dependent young of such a bird⁸;
- Intentionally or recklessly disturb any wild birds included on Schedule 1 which leks, while it is doing so⁹ (capercaillie is the only bird this offence applies to in Scotland);
- Intentionally or recklessly harass any wild bird included in Schedule 1A¹⁰. Section 1, subsection 5B states, 'Subject to the provisions of this Part, any person who intentionally or recklessly harasses any wild bird included in Schedule 1A shall be guilty of an offence'. At this time, Schedule 1A includes golden eagle, hen harrier, red kite and white-tailed eagle. This updated legislation was introduced on 16 March 2013; or
- Intentionally or recklessly take, damage, destroy or otherwise interfere with any nest and/or nest site habitually used by any bird on Schedule A1 at any time. At this time, Schedule 1A includes golden eagle and white-tailed eagle¹¹;

It is also an offence to knowingly cause or permit to be done an act which is made unlawful by any of the above provisions.

Further protection is described under the EU Birds Directive which requires member states to maintain wild bird species in favourable conservation status¹² and promote the conservation of bird species listed within Annex 1 of the Birds Directive through the protection of their habitat. This is achieved via the designation of Special Protection Areas (SPAs).

Red List bird species are those deemed to be globally threatened and to be suffering population declines within the UK. Although not legally enforceable, the conservation of Red List bird species represents a material consideration, in planning terms.

¹ Exceptions to these offences exist under various circumstances (e.g. controlling pest species; taking birds during specific season; and killing sick or injured birds etc.).

² Wildlife and Countryside Act 1981, Section 1(1)(a)

³ Wildlife and Countryside Act 1981, Section 1(1)(b)

⁴ Wildlife and Countryside Act 1981, Section 1(1)(ba)

⁵ Wildlife and Countryside Act 1981, Section 1(1)(bb)

⁶ Wildlife and Countryside Act 1981, Section 1(1)(c)

⁷ Wildlife and Countryside Act 1981, Section 1(2)

⁸ Wildlife and Countryside Act 1981, Section 1(5)

⁹ Wildlife and Countryside Act 1981, Section 1(5A)

¹⁰ Wildlife and Countryside Act 1981, Section 1(5B)

¹¹ This reflects the changes introduced by the Wildlife and Countryside Act 1981 (as amended by: Variation of Schedules A1 and 1A (Scotland) Order 2013.

¹² While the term 'favourable conservation status' is not used in the Birds Directive, EU court cases over recent years have progressively interpreted the concept as meaningful in a Birds Directive context (SNH, 2006).

ANNEX B. ORNITHOLOGICAL SURVEY METHODOLOGY

A range of ornithological surveys have been conducted for the Proposed Development. The methodologies used in these surveys are summarised in the sections below; more detailed descriptions are provided in the NatureScot guidance (SNH, 2017ⁱ) on which these surveys are based.

B.1 Flight Activity Surveys

The aims of the flight activity (vantage point) surveys are: (1) to record flight activity within the vicinity of the Site in order to identify areas of importance to birds; and (2) to quantify flight activity within 500 m of the proposed turbine locations in order to estimate the likelihood of collision (SNH 2017ⁱ, P.14-19).

Timing

- A survey period of 36 hours is recommended as the minimum level of sampling intensity at each VP for each season (breeding, non-breeding, migratory) (SNH 2017ⁱ, P.17);
- Watches were spread as evenly throughout the year as possible to ensure that temporally representative data are collected (see **Annex C**). Specific consideration was given to the period around dawn and twilight for breeding waders and to changing raptor behaviour across seasons (SNH 2017ⁱ, P.17);
- Watches were suspended and resumed to take account of changes in visibility (e.g. fluctuations in cloud base). Watches were undertaken in conditions of good ground visibility when the cloud base was higher than the most elevated ground being observed; and
- Watches were conducted in a range of weather conditions and were spread throughout the day (see **Annex C** and **Annex D**).

Field Methods

- Viewshed analysis was conducted using Arc GIS to confirm suitable Vantage Point (VP) locations and their associated visible areas at 20m above ground level¹;
- Reconnaissance surveys were undertaken to refine VP locations;
- The VP locations and associated viewsheds are shown in **Figure 7.3**;
- Care was taken to maximize the area visible whilst minimising disturbance to birds;
- The final three VP locations were selected with the aim of achieving coverage of all the proposed turbine locations such that no turbine was more than 2 km from a VP.
- A maximum 180° view arc was scanned by surveyors. This rule did not however apply when tracking migratory waterfowl or raptors across the Site;
- Each watch lasted a maximum of three hours but was suspended and then resumed to take account of changes in visibility (e.g. fluctuations in the cloud base).

For each target and secondary species, the following data were recorded (SNH 2017ⁱ, P.17-18):

- The flightlines by individuals or flocks of birds;

- The time the target bird was detected and the duration (seconds) spent flying over a defined survey area (the viewshed);
- The birds' flight heights, defined into five prescribed height bands (0-20 m, 21-40 m, 41-100 m, 101-150 m and >151 m) were recorded at the point of detection and at 15 second intervals thereafter. From this the proportion of time spent flying below, within (referred to as Potential Collision Height (PCH)) and above approximate rotor height could be estimated. The actual planned rotor height is 78 – 250 m above ground level. This difference is accounted for within the collision risk models on the assumption of even flight distribution within each height band;
- The route followed was plotted in the field onto 1:25,000 scale maps;
- Observations of target species took priority over recording secondary species if both species were present simultaneously;
- The number of birds recorded were the minimum number of individuals that could account for the activity observed; and
- Observers only recorded perched birds and birds on waterbodies once only on arrival at the VP. Thereafter only flying birds and newly noticed perched/swimming birds were included in the activity summaries.

B.2 Upland Breeding Bird Survey

Upland breeding bird survey methodology was employed as detailed within NatureScot guidance (SNH 2017ⁱ, P.11). In summary, surveys involved the following:

- Open upland (including hedgerows, scrub, isolated trees and copses) was surveyed using an intensive version of the Brown and Shepherd (1993ⁱⁱ) method for upland bird survey;
- The objectives were to map the distribution of breeding bird territories within 500 m of the Site and estimate the approximate size of breeding bird populations;
- After each survey visit one overview map was then produced showing all target species. The maps from all four survey visits from that year were then compared, enabling the estimation of numbers of breeding territories. This was done by grouping the observations into territories using the methodology described by Bibby *et al.* (2000ⁱⁱⁱ). Due to the cryptic nature of many breeding birds and the necessary assumptions made when plotting territories, a minimum and maximum number of territories was identified for each target species; and
- All upland wader species were recorded during the breeding bird survey.

Timing

- As recommended in Calladine *et al.* (2009^{iv}), four survey visits were undertaken between April and July;
- Fieldwork was undertaken between sunrise and 1800hrs; and

¹ The viewsheds are based on a 5 m DTM to provide a representation of visibility from the observer locations; this is confirmed and refined through field site visits.

- Fieldwork was not undertaken in conditions considered likely to affect bird detection rates, for example in winds greater than Beaufort Scale Force 4, persistent precipitation, poor visibility (less than 300 m), or in unusually hot weather.

Field Methods

- Walk-routes which optimised ground visibility were used;
- Surveyors paused at appropriate vantage and listening points;
- Isolated trees, copses and patches of scrub were approached and examined;
- Streams, ditches and hedgerows were walked;
- All other areas were approached to within 100 m; and
- Registrations were mapped at the first location that behaviour indicative of breeding was observed; and
- Standard British Trust for Ornithology (BTO) activity codes were used.

B.3 Winter Walkover

Winter walkovers were performed in the non-breeding seasons to map wintering populations of birds within 500 m of the Site.

- The area was surveyed three times during each non-breeding season;
- These surveys involved following a route that optimised ground coverage, such that observers walked within 250 m of every point; and
- Observers periodically stopped at appropriate viewing and listening points along the route and longer vantage point watches were included within the walkover to allow potentially important areas to be monitored in greater detail.

B.4 Scarce Breeding Bird Survey

The aim of the scarce breeding bird surveys was to determine the distribution of occupied nests/territories for target raptor and owl species within 2 km of the Site and record breeding success. Secondary species such as buzzard, sparrowhawk and kestrel were also noted but location of their nests was not the key focus of the surveys. Surveys were undertaken by experienced and licensed² field ornithologists. Extreme care was taken to avoid unnecessary disturbance to breeding birds.

Guidance from NatureScot (SNH 2017ⁱ, P.11-14), 'Bird Monitoring Methods' (Gilbert *et al.* 1998^v) and 'Raptors: a field guide to survey and monitoring' (Hardey *et al.* 2013^{vi}) were all consulted to inform survey methodology and are referenced where appropriate in the species methodologies below.

Barn Owl

- The surveys followed methodology outlined in Gilbert *et al.* (1998^v), as mentioned in NatureScot guidance (SNH 2017ⁱ, P12-13);

² All surveyors hold SNH Schedule 1 Licences.

- Surveys were undertaken within 1 km of the Site; and
- Surveyors checked for signs of occupation (moulted feathers, pellets) in all suitable buildings within this 1 km buffer.

Goshawk

Methodology outlined in Hardey *et al.* (2013^{vi}) was used as guidance for the surveying of areas for potential goshawk breeding. Extreme care was taken not to disturb potential nests especially around the time of year when females were likely to be laying or incubating.

- Areas of suitable woodland were observed for the presence of nests. Searches for goshawk nests were focused on mature forestry blocks, although their presence was not ruled out of other wooded areas;
- Searches carried out between March and April focussed on observing territorial and nest building behaviours;
- Where nests were known to be present, scans were carried out between mid-March and May to confirm breeding. Scans were kept brief – carried out for between 5-10 minutes and from a distance; and
- When breeding was confirmed, searches for further nests were deferred until such a time as the young had hatched. Searches were then undertaken between late May and late June for evidence of provisioning young and then between late July and early August to watch for fledgling activity, this included listening for the begging calls of newly fledged young.

Hen Harrier

Methodology outlined in Hardey *et al.* (2013^{vi}) was used as guidance for the surveying of areas for potential hen harrier breeding. Extreme care was taken not to disturb potential nests especially around the time of year when females were likely to be laying or in cold/wet weather when females were likely to be incubating or brooding. Areas of suitable habitat³ were visited during four time periods across the breeding season to:

- Check for territory occupancy (between March and mid-April) – this consisted of watching over suitable habitat from a good vantage point for displaying males (and females) and checking all areas of suitable habitat to within 250 m (watching out for signs of kills);
- Locate incubating females (between mid-April and late May) by listening for female begging calls and watching for food passes between the male and female – surveyors watched for at least four hours as Hardey *et al.* (2013^{vi}) notes that when the female is incubating it can be up to six hours between feeding visits from the male, but on average it is less than every four hours. Surveys were undertaken between 06:00 to 12:00 or 16:00 to 20:00;
- Check for young or breeding evidence (between late May and late June) again by listening for female begging calls and watching for food passes between male and female when the female is brooding and watching for the male and female provisioning the nest with food once brooding has ended– surveyors should watch for at least two hours as Hardey *et al.* (2013^{vi}) notes that an adult bird will visit the nest every 1-2 hours. Surveyors should also watch for display behaviour which could indicate a failed breeding attempt; and

³ Unsuitable habitat areas include: land above 600 m; improved pasture and arable land; extensive areas of degraded land with no heather cover and low vegetation; the vicinity of cliffs, rocky outcrops, boulder fields and scree; areas within 100 m of hill farms and occupied dwellings.

- Check for fledged young (between late June and late August).

Merlin

Methodology outlined in Hardey *et al.* (2013^{vi}) was used as guidance for the surveying of areas for potential merlin breeding.

- Areas of suitable nesting habitat (including forest edge where trees are >5 m high) were closely observed between 20th March and 30th April;
- Boulders, fence lines, isolated posts, stone dykes, grouse butts, hummocks, stream banks, crags, trees and recently burnt areas of heather were checked for signs of occupation (e.g. plucked prey, moulted feathers, pellets and faeces);
- If merlin were observed, or signs found, areas were visited at least twice to verify occupation of the territory; and
- Potential nest areas were watched for 4-6 hours if necessary.

Osprey

Methodology outlined in Hardey *et al.* (2013^{vi}) and Gilbert *et al.* (1998^v) was used as guidance for the surveying of areas for potential osprey breeding. Care was taken when carrying out the searches so as not to disturb any displaying or nesting birds, with nests checked from a distance.

- All wooded areas within the study area were searched for the possible presence of nests, especially those located close to freshwater lochs and rivers that could provide feeding sites. Artificial platforms were also checked;
- If breeding was suspected within the study area, the location was visited between April and May until nesting was confirmed;
- In line with the methods suggested by Gilbert *et al.* (1998^v) and Hardey *et al.* (2013^{vi}), proof of occupancy was determined by: two osprey seen on the same eyrie on more than one occasion (with a week separating observations), incubation, or feeding of chicks.
- Further scans were undertaken between late May and early July to try and observe any young in the nests.

Peregrine Falcon

- Potential nest sites were visited and checked for evidence of occupation between March and April;
- Sites checked included crags and steep banks identified from OS maps and searches of the survey area;
- Surveyors checked for signs of occupation (e.g. faecal splash, fresh plucked prey);
- If occupied sites were found they were re-visited to verify incubation; and

- Searches were made for eyries. Where this was not possible sites were watched from a suitable vantage point for 3-4 hours or until a nest was located.

Red Kite

Care was taken not to disturb any birds, especially between mid-March and mid-April when disturbance to displaying red kites can cause them to move to another area (Hardey *et al.* 2013^{vi}).

- Wooded areas were scanned from outside for the presence of nests, with signs occupation searched for between February and March;
- Potential territories were watched for 1-2 hours between March and April to observe any breeding or nest-building behaviour; and
- Where breeding was confirmed, nests were scanned to determine the breeding success between late April and late June/early July.

Short-Eared Owl

- At least two visits between early April and the end of May were carried out;
- Suitable habitat was visited and checked for evidence of hunting males, territorial activity and other signs of presence; and
- If breeding was confirmed, a further visit was made in June to watch birds, locate nest-sites and confirm breeding behaviour wherever possible.

B.5 Black Grouse Survey

The survey methodology used is detailed in NatureScot guidance (SNH 2017ⁱ, P.12). A summary is provided below.

- Breeding black grouse were surveyed within 1.5 km of the Site by counting total numbers of males and females at leks, most lekking activity taking place at or soon after dawn in spring.
- Known lek sites and other areas of suitable habitat which can host leks were identified and visited during April and May within 2 hours of dawn on calm dry days with good visibility;
- Visits involved listening and scanning for lekking black grouse from strategic locations (avoiding disturbance of leks) and during walks between these locations ensuring that all potential habitat was covered;
- The maximum count of males in the 2 hours around dawn gives the standard count estimate but the maximum number of females seen was also presented; and
- Leks that were at least 200 m apart within the same year were treated as separate leks.

ⁱ Scottish Natural Heritage (2017) Recommended bird survey methods to inform impact assessment of onshore windfarms.

ⁱⁱ Brown, A. F. and Shepherd, K. B. (1993) A method for censusing upland breeding waders. *Bird Study*, 40: 189-195.

ⁱⁱⁱ Bibby, C. J., Neil D. Burgess, David A. Hill and Simon H. Mustoe (2000) *Bird Census Techniques*, 2nd Edition, London, Academic Press.

^{iv} Calladine, J., Garner, G., Wernham, C., & Thiel, A. (2009) The influence of survey frequency on population estimates of moorland breeding birds. *Bird Study*, 56: 3, 381-388.

^v Gilbert, G., Gibbons, D. W. and Evans, J. (1998) *Bird Monitoring Methods*. RSPB, Sandy.

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ANNEX C. ORNITHOLOGICAL SURVEY EFFORT & GENERAL INFORMATION

Table C-1 shows the system used for recording weather conditions on all the surveys (sections C.1 to C.5 below).

Table C-1 Key to meteorological conditions recorded during all surveys

Wind speed		Rain		Cloud cover		Cloud height	
Calm	0	Moderate gale	7	None	0	In eighths	<150m
Light air	1	Fresh gale	8	Drizzle/Mist	1	e.g. 3/8	150-500m
Light breeze	2	Strong gale	9	Light showers	2		>500m
Gentle breeze	3	Whole gale	10	Heavy showers	3		
Moderate breeze	4	Storm	11	Heavy rain	4		
Fresh breeze	5	Hurricane	12	Snow		Frost	
Strong breeze	6			None	0	None	0
				On site	1	Ground	1
				High ground	2	All day	2
				Visibility			
						Poor (<1km)	0
						Moderate (1-2km)	1
						Good (>2km)	2

C.1 Flight Activity Surveys

Flight activity surveys were undertaken during the 2019 breeding season and 2019/2020 non-breeding season. Details of the flight activity surveys undertaken across each Vantage Point (VP) location are supplied in **Table C-2** (survey hours per VP per season are summarised in **Technical Appendix 7.1 Table 7-1-1**) and the associated weather data recorded is detailed in **Table C-3**. Refer to **Annex B** for survey methodology and **Annex D** for survey results.

Table C-2 Summary of flight activity surveys undertaken at Vale of Leven (sorted chronologically)

Date	Season	Observer	VP	Survey start time	Survey finish time	No. hours ¹ surveyed
22/03/2019	2019 BR	PN	1	0820	1120	3
22/03/2019	2019 BR	PN	1	1150	1420	0.5
28/03/2019	2019 BR	PN	1	0725	1025	3
28/03/2019	2019 BR	PN	1	1055	1355	3
28/03/2019	2019 BR	JR	3	0735	1035	3
28/03/2019	2019 BR	JR	3	1105	1405	3
05/04/2019	2019 BR	RTW	2	1400	1700	3
05/04/2019	2019 BR	RTW	2	1730	2030	3
11/04/2019	2019 BR	AH	1	0845	1145	3
11/04/2019	2019 BR	AH	1	1215	1515	3
12/04/2019	2019 BR	AH	3	0816	1116	3
12/04/2019	2019 BR	AH	3	1146	1446	3
01/05/2019	2019 BR	PN	3	0815	1115	2.5
01/05/2019	2019 BR	PN	3	1145	1445	3
15/05/2019	2019 BR	PN	2	0610	0910	3
15/05/2019	2019 BR	PN	2	0940	1240	3
16/05/2019	2019 BR	PN	1	1240	1540	3
16/05/2019	2019 BR	PN	2	0900	1200	3
16/05/2019	2019 BR	NG	2	1215	1515	3
20/05/2019	2019 BR	JR	3	0550	0850	1.5
18/06/2019	2019 BR	RTW	2	1020	1320	3
18/06/2019	2019 BR	RTW	2	1350	1650	3
19/06/2019	2019 BR	RTW	1	0820	1120	3
19/06/2019	2019 BR	RTW	1	1150	1450	3

¹ Note: only valid hours (i.e. where visibility was at least 1 km) are presented in this column.

Date	Season	Observer	VP	Survey start time	Survey finish time	No. hours ¹ surveyed
20/06/2019	2019 BR	RTW	3	0650	0950	3
20/06/2019	2019 BR	RTW	3	1020	1320	3
16/07/2019	2019 BR	RTW	1	1015	1315	3
16/07/2019	2019 BR	RTW	1	1345	1645	3
17/07/2019	2019 BR	RTW	2	1200	1500	3
17/07/2019	2019 BR	RTW	2	1530	1830	3
19/07/2019	2019 BR	RTW	3	0710	1010	3
19/07/2019	2019 BR	RTW	3	1040	1340	3
12/08/2019	2019 BR	JR	1	0830	1130	3
12/08/2019	2019 BR	JR	1	1200	1500	2.5
14/08/2019	2019 BR	JR	3	0740	1040	1.136
14/08/2019	2019 BR	JR	3	1110	1440	1.561
15/08/2019	2019 BR	JR	2	0830	1130	3
15/08/2019	2019 BR	JR	2	1200	1500	3
19/09/2019	2019/2020 NBR	AM	2	1040	1340	3
19/09/2019	2019/2020 NBR	AM	2	1410	1710	3
20/09/2019	2019/2020 NBR	AM	1	1000	1300	3
20/09/2019	2019/2020 NBR	AM	1	1330	1630	3
21/09/2019	2019/2020 NBR	AM	3	1140	1440	3
21/09/2019	2019/2020 NBR	AM	3	1510	1810	3
29/09/2019	2019/2020 NBR	AM	2	0815	1115	3
29/09/2019	2019/2020 NBR	AM	3	1200	1500	3
16/10/2019	2019/2020 NBR	JR	1	1145	1445	3
16/10/2019	2019/2020 NBR	JR	1	1515	1815	3
16/10/2019	2019/2020 NBR	PN & JRM	2	1555	1755	2
16/10/2019	2019/2020 NBR	PN & JRM	3	1225	1525	3
30/10/2019	2019/2020 NBR	JR	1	0805	1105	2.5
30/10/2019	2019/2020 NBR	JR	1	1135	1405	3
30/10/2019	2019/2020 NBR	JRM	3	0840	1140	3
30/10/2019	2019/2020 NBR	JRM	3	1140	1340	2
04/11/2019	2019/2020 NBR	PN	2	0930	1000	0
05/11/2019	2019/2020 NBR	JR	2	0930	1230	3
06/11/2019	2019/2020 NBR	JRM	1	0830	1130	3
06/11/2019	2019/2020 NBR	JR	3	0915	1215	3
08/11/2019	2019/2020 NBR	PN	2	1110	1410	3
08/11/2019	2019/2020 NBR	PN	2	1440	1610	1.5
14/11/2019	2019/2020 NBR	PN	2	0820	1120	3
14/11/2019	2019/2020 NBR	PN	2	1150	1350	3
16/12/2019	2019/2020 NBR	PN	1	1015	1215	2
16/12/2019	2019/2020 NBR	PN	1	1245	1540	2.92
16/12/2019	2019/2020 NBR	JRM	3	0940	1240	3
16/12/2019	2019/2020 NBR	JRM	3	1310	1510	2
18/12/2019	2019/2020 NBR	PN	2	1000	1300	3
18/12/2019	2019/2020 NBR	PN	2	1330	1445	1.25
21/01/2020	2019/2020 NBR	JRM	2	0905	1205	3
21/01/2020	2019/2020 NBR	JRM	2	1235	1345	0.92
31/01/2020	2019/2020 NBR	JRM	1	0900	1020	0
31/01/2020	2019/2020 NBR	PN	3	0915	1015	0
04/02/2020	2019/2020 NBR	JRM	1	0850	1150	3
04/02/2020	2019/2020 NBR	JRM	1	1220	1520	3
04/02/2020	2019/2020 NBR	PN	3	0900	1200	3

Date	Season	Observer	VP	Survey start time	Survey finish time	No. hours ¹ surveyed
04/02/2020	2019/2020 NBR	PN	3	1230	1530	3
18/02/2020	2019/2020 NBR	JRM	1	1345	1445	1
18/02/2020	2019/2020 NBR	PN	2	0945	1245	3
18/02/2020	2019/2020 NBR	PN	2	1315	1415	1
25/02/2020	2019/2020 NBR	PN	2	0940	1210	2.08
02/03/2020	2019/2020 NBR	PN	1	0930	1230	2
02/03/2020	2019/2020 NBR	PN	1	1300	1530	2.5
02/03/2020	2019/2020 NBR	JRM	3	0815	1115	3
02/03/2020	2019/2020 NBR	JRM	3	1145	1215	0.5

Table C-3 Meteorological conditions during flight activity surveys at Vale of Leven (sorted chronologically)

Date	Observer	VP	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
22/03/2019	PN	1	0820	1120	1	6	S	0	8	2	2	0	0
22/03/2019	PN	1	0820	1120	2	6	S	0	8	2	2	0	0
22/03/2019	PN	1	0820	1120	3	7	SSW	4	8	1	1	0	0
22/03/2019	PN	1	1150	1420	4	7	SSW	4	8	0	0	0	0
22/03/2019	PN	1	1150	1420	5	5	SSW	2	8	1	1	0	0
22/03/2019	PN	1	1150	1420	6	5	SSW	2	8	1	0	0	0
28/03/2019	PN	1	0725	1025	1	2	SW	0	8	2	2	0	0
28/03/2019	PN	1	0725	1025	2	2	SW	0	8	2	2	0	0
28/03/2019	PN	1	0725	1025	3	3	SW	0	8	2	2	0	0
28/03/2019	PN	1	1055	1355	4	3	SW	0	7	2	2	0	0
28/03/2019	PN	1	1055	1355	5	3	SW	0	7	2	2	0	0
28/03/2019	PN	1	1055	1355	6	4	SW	0	7	2	2	0	0
28/03/2019	JR	3	0735	1035	1	3	SW	0	8	2	2	0	0
28/03/2019	JR	3	0735	1035	2	3	SW	0	8	2	2	0	0
28/03/2019	JR	3	0735	1035	3	3	SW	0	7	2	2	0	0
28/03/2019	JR	3	1105	1405	4	3	SW	0	7	2	2	0	0
28/03/2019	JR	3	1105	1405	5	3	SW	0	8	2	2	0	0
28/03/2019	JR	3	1105	1405	6	3	SW	0	8	2	2	0	0
05/04/2019	RTW	2	1400	1700	1	3	ENE	0	5	2	2	0	0
05/04/2019	RTW	2	1400	1700	2	3	ENE	0	6	2	2	0	0
05/04/2019	RTW	2	1400	1700	3	3	E	0	6	2	2	0	0
05/04/2019	RTW	2	1730	2030	4	3	E	0	5	2	2	0	0
05/04/2019	RTW	2	1730	2030	5	2	E	0	6	2	2	0	0
05/04/2019	RTW	2	1730	2030	6	2	E	0	6	2	2	0	0
11/04/2019	AH	1	0845	1145	1	2	S	0	1	2	2	1	0
11/04/2019	AH	1	0845	1145	2	2	S	0	1	2	2	0	0
11/04/2019	AH	1	0845	1145	3	2	S	0	3	2	2	0	0
11/04/2019	AH	1	1215	1515	4	3	S	0	5	2	2	0	0
11/04/2019	AH	1	1215	1515	5	2	SW	0	7	2	2	0	0
11/04/2019	AH	1	1215	1515	6	2	SW	0	7	2	2	0	0
12/04/2019	AH	3	0816	1116	1	1	ESE	0	0	0	2	1	0
12/04/2019	AH	3	0816	1116	2	2	ESE	0	1	2	2	0	0
12/04/2019	AH	3	0816	1116	3	2	ESE	0	2	2	2	0	0
12/04/2019	AH	3	1146	1446	4	3	ESE	0	6	2	2	0	0
12/04/2019	AH	3	1146	1446	5	3	ESE	0	8	2	2	0	0
12/04/2019	AH	3	1146	1446	6	4	ESE	0	8	2	2	0	0
01/05/2019	PN	3	0815	1115	1	2	SSW	1	8	1	1	0	0
01/05/2019	PN	3	0815	1115	2	2	SSW	2	8	1	1	0	0
01/05/2019	PN	3	0815	1115	3	2	SSW	0	8	1	2	0	0
01/05/2019	PN	3	1145	1445	4	2	SSW	0	8	1	2	0	0
01/05/2019	PN	3	1145	1445	5	2	SSW	0	8	2	2	0	0
01/05/2019	PN	3	1145	1445	6	2	SSW	2	8	2	2	0	0
15/05/2019	PN	2	0610	0910	1	1	NE	0	1	2	2	0	0
15/05/2019	PN	2	0610	0910	2	1	ENE	0	1	2	2	0	0
15/05/2019	PN	2	0610	0910	3	1	NE	0	1	2	2	0	0
15/05/2019	PN	2	0940	1240	4	1	WSW	0	1	2	2	0	0
15/05/2019	PN	2	0940	1240	5	1	SW	0	1	2	2	0	0
15/05/2019	PN	2	0940	1240	6	1	SW	0	1	2	2	0	0
16/05/2019	PN	1	1240	1540	4	3	NE	0	7	2	2	0	0
16/05/2019	PN	1	1240	1540	5	4	E	0	3	2	2	0	0
16/05/2019	PN	1	1240	1540	6	4	E	0	2	2	2	0	0
16/05/2019	PN	2	0900	1200	1	3	E	0	7	2	2	0	0

Date	Observer	VP	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
16/05/2019	PN	2	0900	1200	2	3	ENE	0	7	2	2	0	0
16/05/2019	PN	2	0900	1200	3	3	NE	0	6	2	2	0	0
16/05/2019	NG	2	1215	1515	1	3	E	0	6	2	2	0	0
16/05/2019	NG	2	1215	1515	2	2	E	0	7	2	2	0	0
16/05/2019	NG	2	1215	1515	3	2	E	0	5	2	2	0	0
20/05/2019	JR	3	0550	0850	1	2	WSW	1	8	1	1	0	0
20/05/2019	JR	3	0550	0850	2	2	WSW	0	8	1	1	0	0
20/05/2019	JR	3	0550	0850	3	1	WSW	0	8	1	1	0	0
18/06/2019	RTW	2	1020	1320	1	3	S	0	7	2	2	0	0
18/06/2019	RTW	2	1020	1320	2	3	S	0	7	2	2	0	0
18/06/2019	RTW	2	1020	1320	3	3	S	0	7	2	2	0	0
18/06/2019	RTW	2	1350	1650	4	3	S	0	7	2	2	0	0
18/06/2019	RTW	2	1350	1650	5	3	S	0	6	2	2	0	0
18/06/2019	RTW	2	1350	1650	6	3	S	0	7	2	2	0	0
19/06/2019	RTW	1	0820	1120	1	2	SSSW	0	4	2	2	0	0
19/06/2019	RTW	1	0820	1120	2	2	SSW	0	4	2	2	0	0
19/06/2019	RTW	1	0820	1120	3	2	S	0	4	2	2	0	0
19/06/2019	RTW	1	1150	1450	4	2	S	0	5	2	2	0	0
19/06/2019	RTW	1	1150	1450	5	2	SSW	0	5	2	2	0	0
19/06/2019	RTW	1	1150	1450	6	2	S	0	5	2	2	0	0
20/06/2019	RTW	3	0650	0950	1	3	SW	0	8	2	2	0	0
20/06/2019	RTW	3	0650	0950	2	3	SW	0	8	2	2	0	0
20/06/2019	RTW	3	0650	0950	3	3	WSW	0	8	1	2	0	0
20/06/2019	RTW	3	1020	1320	4	3	WSW	0	8	2	2	0	0
20/06/2019	RTW	3	1020	1320	5	3	SW	1	8	1	1	0	0
20/06/2019	RTW	3	1020	1320	6	3	SW	0	8	2	2	0	0
16/07/2019	RTW	1	1015	1315	1	3	S	0	2	2	2	0	0
16/07/2019	RTW	1	1015	1315	2	3	S	0	3	2	2	0	0
16/07/2019	RTW	1	1015	1315	3	3	S	0	3	2	2	0	0
16/07/2019	RTW	1	1345	1645	4	3	S	0	2	2	2	0	0
16/07/2019	RTW	1	1345	1645	5	3	S	0	3	2	2	0	0
16/07/2019	RTW	1	1345	1645	6	3	S	0	3	2	2	0	0
17/07/2019	RTW	2	1200	1500	1	3	SE	0	6	2	2	0	0
17/07/2019	RTW	2	1200	1500	2	3	SE	0	6	2	2	0	0
17/07/2019	RTW	2	1200	1500	3	2	SE	0	6	2	2	0	0
17/07/2019	RTW	2	1530	1830	4	2	SE	0	6	2	2	0	0
17/07/2019	RTW	2	1530	1830	5	2	SE	0	6	2	2	0	0
17/07/2019	RTW	2	1530	1830	6	2	S	0	6	2	2	0	0
19/07/2019	RTW	3	0710	1010	1	2	SW	0	3	2	2	0	0
19/07/2019	RTW	3	0710	1010	2	2	S	0	4	2	2	0	0
19/07/2019	RTW	3	0710	1010	3	2	S	0	3	2	2	0	0
19/07/2019	RTW	3	1040	1340	4	2	SE	0	3	2	2	0	0
19/07/2019	RTW	3	1040	1340	5	2	SE	0	4	2	2	0	0
19/07/2019	RTW	3	1040	1340	6	2	S	0	4	2	2	0	0
12/08/2019	JR	1	0830	1130	1	2	NW	0	3	2	2	0	0
12/08/2019	JR	1	0830	1130	2	3	WNW	0	3	2	2	0	0
12/08/2019	JR	1	0830	1130	3	3	W	0	5	2	2	0	0
12/08/2019	JR	1	1200	1500	4	4	W	0	7	2	2	0	0
12/08/2019	JR	1	1200	1500	5	3	W	0	8	2	2	0	0
12/08/2019	JR	1	1200	1500	6	3	W	4	7	2	2	0	0
14/08/2019	JR	3	0740	1040	1	2	NE	2	8	1	1	0	0
14/08/2019	JR	3	0740	1040	2	2	NE	2	8	1	0	0	0
14/08/2019	JR	3	0740	1040	3	2	NE	2	8	1	0	0	0

Date	Observer	VP	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
14/08/2019	JR	3	1110	1440	4	3	E	2	8	1	0	0	0
14/08/2019	JR	3	1110	1440	5	4	ESE	2	8	1	1	0	0
14/08/2019	JR	3	1110	1440	6	3	ESE	2	8	1	1	0	0
15/08/2019	JR	2	0830	1130	1	5	NW	2	6	2	2	0	0
15/08/2019	JR	2	0830	1130	2	5	NW	0	5	2	2	0	0
15/08/2019	JR	2	0830	1130	3	6	WNW	0	4	2	2	0	0
15/08/2019	JR	2	1200	1500	4	6	WNW	0	4	2	2	0	0
15/08/2019	JR	2	1200	1500	5	5	WNW	0	5	2	2	0	0
15/08/2019	JR	2	1200	1500	6	4	WNW	0	7	2	2	0	0
05/11/2019	JR	2	0930	1230	1	3	E	0	3	2	2	0	0
05/11/2019	JR	2	0930	1230	2	3	ENE	0	5	2	2	0	0
05/11/2019	JR	2	0930	1230	3	3	E	0	4	2	2	0	0
06/11/2019	JRM	1	0830	1130	1	3	NE	0	2	2	2	0	0
06/11/2019	JRM	1	0830	1130	2	3	NNE	0	3	2	2	0	0
06/11/2019	JRM	1	0830	1130	3	3	NE	0	3	2	2	0	0
14/11/2019	PN	2	0820	1120	1	3	NNE	0	1	2	2	1	0
14/11/2019	PN	2	0820	1120	2	3	NNE	0	1	2	2	1	0
14/11/2019	PN	2	0820	1120	3	3	NNE	0	1	2	2	0	0
14/11/2019	PN	2	0820	1120	1	3	NNE	0	1	2	2	0	0
14/11/2019	PN	2	0820	1120	2	3	NNE	0	1	2	2	0	0
14/11/2019	PN	2	0820	1120	3	3	NNE	0	1	2	2	0	0
08/11/2019	PN	2	1110	1410	1	2	NE	0	1	2	2	1	0
08/11/2019	PN	2	1110	1410	2	2	WNW	0	1	2	2	1	0
08/11/2019	PN	2	1110	1410	3	2	NNW	0	1	2	2	0	0
08/11/2019	PN	2	1440	1610	1	2	WNW	0	3	2	2	0	0
08/11/2019	PN	2	1440	1610	2	2	NE	0	2	2	2	0	0
06/11/2019	JR	3	0915	1215	1	3	E	0	7	2	2	0	0
06/11/2019	JR	3	0915	1215	2	3	E	0	6	2	2	0	0
06/11/2019	JR	3	0915	1215	3	3	E	0	5	2	2	0	0
04/11/2019	PN	2	0930	1000	1	3	NE	4	8	0	0	0	0
30/10/2019	JRM	3	0840	1140	1	2	E	0	1	2	1	0	0
30/10/2019	JRM	3	0840	1140	2	2	E	0	3	1	1	0	0
30/10/2019	JRM	3	0840	1140	3	3	ESE	0	2	2	2	0	0
30/10/2019	JRM	3	1140	1340	1	4	SE	0	3	2	2	0	0
30/10/2019	JRM	3	1140	1340	2	5	E	0	4	2	2	0	0
30/10/2019	JR	1	0805	1105	1	3	E	0	3	1	0	1	0
30/10/2019	JR	1	0805	1105	2	4	E	0	2	1	2	0	0
30/10/2019	JR	1	0805	1105	3	4	E	0	3	1	2	0	0
30/10/2019	JR	1	1135	1405	1	4	E	0	2	2	2	0	0
30/10/2019	JR	1	1135	1405	2	4	E	0	3	2	2	0	0
18/12/2019	PN	2	1000	1300	1	2	SE	0	7	2	2	0	0
18/12/2019	PN	2	1000	1300	2	2	SE	0	7	2	2	0	0
18/12/2019	PN	2	1000	1300	3	3	ESE	0	8	2	2	0	0
18/12/2019	PN	2	1330	1445	1	3	ENE	0	8	2	2	0	0
18/12/2019	PN	2	1330	1445	2	3	SE	4	8	1	1	0	0
16/12/2019	JRM	3	0940	1240	1	5	WSW	0	8	1	2	0	2
16/12/2019	JRM	3	0940	1240	2	4	WSW	2	8	1	2	0	2
16/12/2019	JRM	3	0940	1240	3	6	WSW	2	8	1	2	0	2
16/12/2019	JRM	3	0940	1240	1	5	W	2	6	1	2	0	2
16/12/2019	JRM	3	0940	1240	2	5	W	2	5	1	2	0	2
16/12/2019	PN	1	1015	1215	1	4	WSW	2	8	1	2	2	2
16/12/2019	PN	1	1015	1215	2	5	WSW	2	8	1	2	2	2
16/12/2019	PN	1	1245	1540	1	5	WSW	2	8	1	2	2	2

Date	Observer	VP	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
16/12/2019	PN	1	1245	1540	2	5	WSW	0	8	2	2	2	2
16/12/2019	PN	1	1245	1540	3	4	WSW	0	8	1	2	2	2
16/10/2019	JR	1	1145	1445	1	3	WSW	1	5	2	2	0	0
16/10/2019	JR	1	1145	1445	2	3	SW	0	4	2	2	0	0
16/10/2019	JR	1	1145	1445	3	4	SW	2	4	2	2	0	0
16/10/2019	JR	1	1145	1445	1	4	SW	0	5	2	2	0	0
16/10/2019	JR	1	1145	1445	2	4	SW	0	2	2	2	0	0
16/10/2019	JR	1	1145	1445	3	4	SW	0	3	2	2	0	0
16/10/2019	PN & JRM	3	1225	1525	1	3	SW	0	4	2	2	0	0
16/10/2019	PN & JRM	3	1225	1525	2	3	SW	2	6	2	2	0	0
16/10/2019	PN & JRM	3	1225	1525	3	3	SW	2	6	2	2	0	0
16/10/2019	PN & JRM	3	1555	1755	1	3	SW	0	2	2	2	0	0
16/10/2019	PN & JRM	3	1555	1755	2	4	SSW	0	6	2	2	0	0
19/09/2019	AM	2	1040	1340	1	3	WSW	0	7	2	2	0	0
19/09/2019	AM	2	1040	1340	2	3	WSW	0	5	2	2	0	0
19/09/2019	AM	2	1040	1340	3	3	WSW	0	5	2	2	0	0
19/09/2019	AM	2	1410	1710	1	3	WSW	0	4	2	2	0	0
19/09/2019	AM	2	1410	1710	2	3	WSW	0	5	2	2	0	0
19/09/2019	AM	2	1410	1710	3	2	WSW	0	5	2	2	0	0
20/09/2019	AM	1	1000	1300	1	1	ESE	1	2	2	1	0	0
20/09/2019	AM	1	1000	1300	2	1	ESE	0	2	2	2	0	0
20/09/2019	AM	1	1000	1300	3	1	ESE	0	1	2	2	0	0
20/09/2019	AM	1	1330	1630	1	2	ESE	0	1	2	2	0	0
20/09/2019	AM	1	1330	1630	2	3	SE	0	1	2	2	0	0
20/09/2019	AM	1	1330	1630	3	3	SE	0	1	2	2	0	0
21/09/2019	AM	3	1140	1440	1	3	E	0	0	-	2	0	0
21/09/2019	AM	3	1140	1440	2	3	E	0	0	-	2	0	0
21/09/2019	AM	3	1140	1440	3	3	ENE	0	1	2	2	0	0
21/09/2019	AM	3	1510	1810	1	3	E	0	2	2	2	0	0
21/09/2019	AM	3	1510	1810	2	3	ENE	0	3	2	2	0	0
21/09/2019	AM	3	1510	1810	3	3	NE	0	4	2	2	0	0
29/09/2019	AM	2	0815	1115	1	2	NNE	0	7	2	2	0	0
29/09/2019	AM	2	0815	1115	2	3	NNE	0	7	2	2	0	0
29/09/2019	AM	2	0815	1115	3	3	NNE	0	7	2	2	0	0
29/09/2019	AM	3	1200	1500	1	1	WNW	0	7	2	2	0	0
29/09/2019	AM	3	1200	1500	2	1	WNW	0	7	2	2	0	0
29/09/2019	AM	3	1200	1500	3	2	NW	2	7	2	2	0	0
21/01/2020	JRM	2	0905	1205	1	3	SW	0	8	1	2	0	0
21/01/2020	JRM	2	0905	1205	2	3	SSW	0	8	1	2	0	0
21/01/2020	JRM	2	0905	1205	3	3	SW	1	8	1	2	0	0
21/01/2020	JRM	2	1235	1345	1	5	SSW	1	8	0	1	0	0
31/01/2020	PN	3	0915	1015	1	4	WSW	3	8	1	0	0	0
04/02/2020	JRM	1	0850	1150	1	4	NW	0	3	2	2	0	0
04/02/2020	JRM	1	0850	1150	2	4	NW	0	1	2	2	0	0
04/02/2020	JRM	1	0850	1150	3	5	NW	0	1	2	2	0	0
04/02/2020	JRM	1	1220	1520	1	5	NW	0	1	2	2	0	0
04/02/2020	JRM	1	1220	1520	2	5	NW	0	3	2	2	0	0
04/02/2020	JRM	1	1220	1520	3	5	NW	0	3	2	2	0	0
04/02/2020	PN	3	0900	1200	1	3	NW	0	4	2	2	0	0
04/02/2020	PN	3	0900	1200	2	3	WNW	0	2	2	2	0	0
04/02/2020	PN	3	0900	1200	3	2	WNW	0	3	2	2	0	0
04/02/2020	PN	3	1230	1530	1	3	NW	0	2	2	2	0	0
04/02/2020	PN	3	1230	1530	2	3	WNW	0	4	2	2	0	0

Date	Observer	VP	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
04/02/2020	PN	3	1230	1530	3	3	WNW	0	6	2	2	0	0
31/01/2020	JRM	1	0900	1020	1	4	SW	2	8	0	0	0	0
31/01/2020	JRM	1	0900	1020	2	4	SW	2	8	0	0	0	0
18/02/2020	JRM	1	1345	1445	1	5	SW	2	6	2	2	0	1
18/02/2020	PN	2	0945	1245	1	5	SW	0	7	2	2	0	0
18/02/2020	PN	2	0945	1245	2	5	SW	2	7	2	2	0	0
18/02/2020	PN	2	0945	1245	3	5	SW	2	7	2	2	0	0
18/02/2020	PN	2	1315	1415	1	4	WSW	2	7	2	2	0	0
25/02/2020	PN	2	0940	1210	1	4	SW	2	7	2	1	2	1
25/02/2020	PN	2	0940	1210	2	4	SW	3	7	2	2	2	1
25/02/2020	PN	2	0940	1210	3	4	SW	0	7	2	2	2	2
02/03/2020	PN	1	0930	1230	1	4	SSW	4	8	0	0	0	2
02/03/2020	PN	1	0930	1230	2	4	SSW	0	7	2	2	0	2
02/03/2020	PN	1	0930	1230	3	4	SSW	0	7	2	2	0	2
02/03/2020	PN	1	1300	1530	1	5	SSW	0	7	2	2	0	2
02/03/2020	PN	1	1300	1530	2	5	WSW	0	7	2	2	0	2
02/03/2020	PN	1	1300	1530	3	5	WSW	0	6	2	2	0	2
02/03/2020	JRM	3	0815	1115	1	4	SSW	0	6	2	2	0	2
02/03/2020	JRM	3	0815	1115	2	3	S	3	8	1	2	0	2
02/03/2020	JRM	3	0815	1115	3	3	S	3	4	2	2	0	2
02/03/2020	JRM	3	1145	1215	1	5	S	0	5	2	2	0	2

C.2 Moorland Breeding Bird Surveys

Moorland breeding bird surveys were undertaken during the 2019 and 2022 breeding seasons. **Table C-4** details survey dates and weather data recorded. Refer to **Annex B** for survey methodology and **Annex D** for survey results.

Table C-4 Meteorological conditions during breeding bird surveys at Vale of Leven (sorted chronologically)

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
08/04/2019	1	RTW	0830	1430	1	4	NE	0	7	2	2	0	0
08/04/2019	1	RTW	0830	1430	2	4	NE	0	6	2	2	0	0
08/04/2019	1	RTW	0830	1430	3	4	NE	0	5	2	2	0	0
08/04/2019	1	RTW	0830	1430	4	4	NE	0	4	2	2	0	0
08/04/2019	1	RTW	0830	1430	5	4	NE	0	4	2	2	0	0
08/04/2019	1	RTW	0830	1430	6	4	NE	0	4	2	2	0	0
08/04/2019	1	AH	0830	1430	1	4	NE	0	7	2	2	0	0
08/04/2019	1	AH	0830	1430	2	4	NE	0	6	2	2	0	0
08/04/2019	1	AH	0830	1430	3	4	NE	0	5	2	2	0	0
08/04/2019	1	AH	0830	1430	4	4	NE	0	4	2	2	0	0
08/04/2019	1	AH	0830	1430	5	4	NE	0	4	2	2	0	0
08/04/2019	1	AH	0830	1430	6	4	NE	0	4	2	2	0	0
09/04/2019	1	RTW	0815	1415	1	3	ENE	0	2	2	2	0	0
09/04/2019	1	RTW	0815	1415	2	3	ENE	0	2	2	2	0	0
09/04/2019	1	RTW	0815	1415	3	3	ENE	0	2	2	2	0	0
09/04/2019	1	RTW	0815	1415	4	3	ENE	0	2	2	2	0	0
09/04/2019	1	RTW	0815	1415	5	3	ENE	0	2	2	2	0	0
09/04/2019	1	RTW	0815	1415	6	3	ENE	0	2	2	2	0	0
09/04/2019	1	AH	0815	1415	1	3	ENE	0	2	2	2	0	0
09/04/2019	1	AH	0815	1415	2	3	ENE	0	2	2	2	0	0
09/04/2019	1	AH	0815	1415	3	3	ENE	0	2	2	2	0	0
09/04/2019	1	AH	0815	1415	4	3	ENE	0	2	2	2	0	0
09/04/2019	1	AH	0815	1415	5	3	ENE	0	2	2	2	0	0
09/04/2019	1	AH	0815	1415	6	3	ENE	0	2	2	2	0	0
09/05/2019	2	AA	0830	1530	1	2	SW	0	5	2	2	0	0

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
09/05/2019	2	AA	0830	1530	2	3	ENE	0	5	2	2	0	0
09/05/2019	2	AA	0830	1530	3	2	ENE	0	4	2	2	0	0
09/05/2019	2	AA	0830	1530	4	2	ENE	0	6	2	2	0	0
09/05/2019	2	AA	0830	1530	5	2	ENE	0	7	2	2	0	0
09/05/2019	2	AA	0830	1530	6	2	ENE	0	7	2	2	0	0
09/05/2019	2	AA	0830	1530	7	2	ENE	0	7	2	2	0	0
10/05/2019	2	AA	0730	1330	1	0	-	0	3	2	2	0	0
10/05/2019	2	AA	0730	1330	2	0	-	0	4	2	2	0	0
10/05/2019	2	AA	0730	1330	3	2	ENE	0	5	2	2	0	0
10/05/2019	2	AA	0730	1330	4	0	-	1	6	2	2	0	0
10/05/2019	2	AA	0730	1330	5	2	ENE	0	7	2	2	0	0
10/05/2019	2	AA	0730	1330	6	2	ENE	0	7	2	2	0	0
17/05/2019	2	JR	0740	1240	1	3	E	0	7	2	2	0	0
17/05/2019	2	JR	0740	1240	2	4	E	0	7	2	2	0	0
17/05/2019	2	JR	0740	1240	3	4	ENE	0	6	2	2	0	0
17/05/2019	2	JR	0740	1240	4	4	ENE	0	5	2	2	0	0
17/05/2019	2	JR	0740	1240	5	4	ENE	0	5	2	2	0	0
17/05/2019	2	AA	0730	1330	1	3	NE	0	8	2	2	0	0
17/05/2019	2	AA	0730	1330	2	4	NE	0	7	2	2	0	0
17/05/2019	2	AA	0730	1330	3	3	NE	0	6	2	2	0	0
17/05/2019	2	AA	0730	1330	4	3	NE	0	4	2	2	0	0
17/05/2019	2	AA	0730	1330	5	3	NE	0	2	2	2	0	0
17/05/2019	2	AA	0730	1330	6	3	NE	0	2	2	2	0	0
10/06/2019	3	RTW	0815	1415	1	2	SE	0	2	2	2	0	0
10/06/2019	3	RTW	0815	1415	2	2	SE	0	1	2	2	0	0
10/06/2019	3	RTW	0815	1415	3	1	SE	0	1	2	2	0	0
10/06/2019	3	RTW	0815	1415	4	1	ESE	0	1	2	2	0	0
10/06/2019	3	RTW	0815	1415	5	1	ESE	0	1	2	2	0	0
10/06/2019	3	RTW	0815	1415	6	1	ESE	0	2	2	2	0	0
11/06/2019	3	RTW	0800	1400	1	2	E	0	4	2	2	0	0
11/06/2019	3	RTW	0800	1400	2	2	E	0	5	2	2	0	0
11/06/2019	3	RTW	0800	1400	3	2	E	0	5	2	2	0	0
11/06/2019	3	RTW	0800	1400	4	2	E	0	5	2	2	0	0
11/06/2019	3	RTW	0800	1400	5	2	E	0	5	2	2	0	0
11/06/2019	3	RTW	0800	1400	6	2	E	0	5	2	2	0	0
12/06/2019	3	RTW	0800	1400	1	3	E	0	6	2	2	0	0
12/06/2019	3	RTW	0800	1400	2	3	E	0	6	2	2	0	0
12/06/2019	3	RTW	0800	1400	3	3	SE	0	6	2	2	0	0
12/06/2019	3	RTW	0800	1400	4	3	SE	0	6	2	2	0	0
12/06/2019	3	RTW	0800	1400	5	3	SE	0	7	2	2	0	0
12/06/2019	3	RTW	0800	1400	6	3	SSE	1	8	2	2	0	0
13/06/2019	3	RTW	0800	1400	1	3	S	0	6	2	2	0	0
13/06/2019	3	RTW	0800	1400	2	3	S	0	5	2	2	0	0
13/06/2019	3	RTW	0800	1400	3	3	S	0	6	2	2	0	0
13/06/2019	3	RTW	0800	1400	4	3	S	0	6	2	2	0	0
13/06/2019	3	RTW	0800	1400	5	3	SE	0	7	2	2	0	0
13/06/2019	3	RTW	0800	1400	6	3	SE	0	6	2	2	0	0
01/07/2019	4	RTW	0800	1400	1	3	NW	0	4	2	2	0	0
01/07/2019	4	RTW	0800	1400	2	2	NW	0	5	2	2	0	0
01/07/2019	4	RTW	0800	1400	3	2	NW	0	5	2	2	0	0
01/07/2019	4	RTW	0800	1400	4	2	NW	0	3	2	2	0	0
01/07/2019	4	RTW	0800	1400	5	2	WNW	0	5	2	2	0	0
01/07/2019	4	RTW	0800	1400	6	3	WNW	0	3	2	2	0	0

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
02/07/2019	4	RTW	0930	1430	1	3	NW	0	8	2	2	0	0
02/07/2019	4	RTW	0930	1430	2	3	NW	0	8	2	2	0	0
02/07/2019	4	RTW	0930	1430	3	2	NW	0	8	2	2	0	0
02/07/2019	4	RTW	0930	1430	4	2	W	0	8	2	2	0	0
02/07/2019	4	RTW	0930	1430	5	3	W	0	8	2	2	0	0
04/07/2019	4	RTW	0940	1440	1	3	SW	0	8	2	2	0	0
04/07/2019	4	RTW	0940	1440	2	3	W	0	8	2	2	0	0
04/07/2019	4	RTW	0940	1440	3	3	W	0	8	2	2	0	0
04/07/2019	4	RTW	0940	1440	4	3	W	0	7	2	2	0	0
04/07/2019	4	RTW	0940	1440	5	3	W	0	7	2	2	0	0
05/07/2019	4	RTW	0800	1400	1	2	WSW	0	8	2	2	0	0
05/07/2019	4	RTW	0800	1400	2	2	WSW	2	8	2	2	0	0
05/07/2019	4	RTW	0800	1400	3	2	SW	0	8	2	2	0	0
05/07/2019	4	RTW	0800	1400	4	2	SW	0	8	2	2	0	0
05/07/2019	4	RTW	0800	1400	5	2	SW	0	8	2	2	0	0
05/07/2019	4	RTW	0800	1400	6	2	SW	0	8	2	2	0	0
05/04/2022	1	JRM	0800	0930	1	3	WSW	3	8	2	2	0	0
05/04/2022	1	JRM	0800	0930	2	3	WSW	3	8	2	2	0	0
05/05/2022	2	JR	0800	1100	1	2	SW	2	8	1	1	0	0
05/05/2022	2	JR	0800	1100	2	2	SW	2	8	1	2	0	0
05/05/2022	2	JR	0800	1100	3	3	SSW	0	8	1	2	0	0
03/06/2022	3	JR	0800	1130	1	1	NE	1	8	1	1	0	0
03/06/2022	3	JR	0800	1130	2	2	NE	0	6	2	2	0	0
03/06/2022	3	JR	0800	1130	3	2	ENE	0	4	2	2	0	0
03/06/2022	3	JR	0800	1130	4	2	ENE	0	8	2	2	0	0
29/07/2022	4	EB	0900	1215	1	2	SW	0	1	2	2	0	0
29/07/2022	4	EB	0900	1215	2	3	SW	0	2	2	2	0	0
29/07/2022	4	EB	0900	1215	3	2	SW	0	0	2	2	0	0
29/07/2022	4	EB	0900	1215	4	2	SW	0	1	2	2	0	0

C.3 Winter Walkover Surveys

Winter walkover surveys were undertaken during the 2019/2020 non-breeding seasons. **Table C-5** details survey dates and weather data recorded. Refer to **Annex B** for survey methodology and **Annex D** for survey results.

Table C-5 Meteorological conditions during winter walkover surveys at Vale of Leven (sorted chronologically)

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
04/11/2019	1	PN	0730	0930	1	3	NE	2	8	0	1	0	0
04/11/2019	1	PN	0730	0930	2	3	NE	4	8	0	0	0	0
04/11/2019	1	PN	1000	1100	1	3	NE	3	8	0	0	0	0
05/11/2019	1	JRM	0730	0930	1	2	ENE	0	4	2	2	0	0
05/11/2019	1	JRM	0730	0930	2	3	E	0	3	2	2	0	0
05/11/2019	1	JRM	1230	1330	1	3	E	0	4	2	2	0	0
05/11/2019	1	JR	0800	1400	1	3	NE	0	2	2	2	0	0
05/11/2019	1	JR	0800	1400	2	2	NE	0	4	2	2	0	0
05/11/2019	1	JR	0800	1400	3	3	NNE	0	3	2	2	0	0
05/11/2019	1	JR	0800	1400	4	3	NNE	0	6	2	2	0	0
05/11/2019	1	JR	0800	1400	5	2	NNE	2	6	2	2	0	0
05/11/2019	1	JR	0800	1400	6	2	Variable	0	4	2	2	0	0
06/11/2019	1	JR	0740	0910	1	1	NNE	0	5	2	2	1	0
06/11/2019	1	JR	0740	0910	2	3	E	0	7	2	2	0	0
06/11/2019	1	JR	1215	1345	1	3	E	0	6	2	2	0	0
06/11/2019	1	JR	1215	1345	2	3	E	0	7	2	2	0	0
14/01/2020	2	JRM	0810	1310	1	5	WSW	0	6	2	2	0	0

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
14/01/2020	2	JRM	0810	1310	2	5	WSW	0	7	2	2	0	0
14/01/2020	2	JRM	0810	1310	3	5	WSW	0	8	2	2	0	0
14/01/2020	2	JRM	0810	1310	4	6	SW	0	7	2	2	0	0
14/01/2020	2	JRM	0810	1310	5	6	WSW	1	7	2	2	0	0
15/01/2020	2	PN	0810	1310	1	6	SSW	0	8	2	2	0	0
15/01/2020	2	PN	0810	1310	2	6	SSW	0	7	2	2	0	0
15/01/2020	2	PN	0810	1310	3	6	SW	0	7	2	2	0	0
15/01/2020	2	PN	0810	1310	4	6	SW	0	7	2	2	0	0
15/01/2020	2	PN	0810	1310	5	6	SW	0	8	2	2	0	0
15/01/2020	2	JRM	0830	1330	1	6	SSW	0	7	2	2	0	0
15/01/2020	2	JRM	0830	1330	2	6	WSW	0	7	2	2	0	0
15/01/2020	2	JRM	0830	1330	3	6	SW	0	7	2	2	0	0
15/01/2020	2	JRM	0830	1330	4	6	SW	0	6	2	2	0	0
15/01/2020	2	JRM	0830	1330	5	6	SW	1	8	2	2	0	0
31/01/2020	2	PN	0830	0915	1	4	WSW	3	8	1	0	0	0
31/01/2020	2	PN	1015	1115	1	4	WSW	3	8	1	0	0	0
06/11/2019	1	JRM	0730	0830	1	3	NE	0	3	2	2	0	0
06/11/2019	1	JRM	1130	1330	1	3	NE	0	4	2	2	0	0
06/11/2019	1	JRM	1130	1330	2	3	NE	0	4	2	2	0	0
18/02/2020	3	JRM	0830	1330	1	5	SW	3	8	1	2	0	1
18/02/2020	3	JRM	0830	1330	2	5	SW	2	7	1	2	0	1
18/02/2020	3	JRM	0830	1330	3	4	SW	1	5	2	2	0	1
18/02/2020	3	JRM	0830	1330	4	4	SW	0	7	2	2	0	1
18/02/2020	3	JRM	0830	1330	5	5	SW	2	4	2	2	0	1
18/02/2020	3	PN	0815	0945	1	5	SSW	3	8	2	2	0	0
18/02/2020	3	PN	0815	0945	2	5	SSW	3	8	2	2	0	0
18/02/2020	3	PN	1415	1545	1	6	WSW	0	7	2	2	0	0
18/02/2020	3	PN	1415	1545	2	6	WSW	4	8	2	0	0	0
25/02/2020	3	JRM	0710	1210	1	3	SW	2	7	1	2	0	0
25/02/2020	3	JRM	0710	1210	2	3	SW	2	8	1	2	0	0
25/02/2020	3	JRM	0710	1210	3	4	SW	2	8	1	2	0	1
25/02/2020	3	JRM	0710	1210	4	4	SW	2	6	1	2	0	1
25/02/2020	3	JRM	0710	1210	5	5	SW	0	4	2	2	0	1
25/02/2020	3	PN	0730	0930	1	3	SW	3	8	1	0	2	1
25/02/2020	3	PN	0730	0930	2	3	SW	0	8	1	0	2	1
25/02/2020	3	PN	1210	1310	3	4	SW	0	7	2	2	2	2

C.4 Scarce Breeding Bird Surveys

Scarce breeding bird surveys were undertaken during the 2019 and 2022 breeding seasons. **Table C-6** details survey dates and weather data recorded. Refer to **Annex B** for survey methodology and **Annex D** for survey results.

Table C-6 Meteorological conditions during scarce breeding bird surveys at Vale of Leven (sorted chronologically)

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
22/03/2019	1	JR	0730	1330	1	5	SSW	0	8	2	2	0	0
22/03/2019	1	JR	0730	1330	2	6	SSW	0	8	2	2	0	0
22/03/2019	1	JR	0730	1330	3	6	SSW	2	8	2	1	0	0
22/03/2019	1	JR	0730	1330	4	6	SSW	3	8	1	1	0	0
22/03/2019	1	JR	0730	1330	5	6	SSW	4	8	1	0	0	0
22/03/2019	1	JR	0730	1330	6	5	SW	4	8	1	0	0	0
06/04/2019	2	RCW	0930	1230	1	2	WNW	0	8	2	2	0	0
06/04/2019	2	RCW	0930	1230	2	2	NW	0	7	2	2	0	0
06/04/2019	2	RCW	0930	1230	3	2	NW	2	7	2	2	0	0
07/04/2019	2	RCW	0930	1230	1	3	ENE	0	7	2	2	0	0
07/04/2019	2	RCW	0930	1230	2	3	ENE	2	7	2	2	0	0
07/04/2019	2	RCW	0930	1230	3	3	ENE	0	8	2	2	0	0
10/04/2019	2	AH	0815	1415	1	2	SE	0	2	2	2	1	0
10/04/2019	2	AH	0815	1415	2	2	SE	0	1	2	2	1	0
10/04/2019	2	AH	0815	1415	3	2	SE	0	1	2	2	0	0
10/04/2019	2	AH	0815	1415	4	2	SE	0	1	2	2	0	0
10/04/2019	2	AH	0815	1415	5	2	SE	0	1	2	2	0	0
10/04/2019	2	AH	0815	1415	6	2	SE	0	0	2	2	0	0
10/04/2019	2	RTW	0815	1415	1	2	SE	0	2	2	2	0	0
10/04/2019	2	RTW	0815	1415	2	2	SE	0	2	2	2	0	0
10/04/2019	2	RTW	0815	1415	3	2	SE	0	2	2	2	0	0
10/04/2019	2	RTW	0815	1415	4	2	SE	0	1	2	2	0	0
10/04/2019	2	RTW	0815	1415	5	2	SE	0	1	2	2	0	0
10/04/2019	2	RTW	0815	1415	6	2	SE	0	0	2	2	0	0
01/05/2019	3	JR	0740	1345	1	1	Variable	0	8	1	1	0	0
01/05/2019	3	JR	0740	1345	2	1	Variable/S	1	8	0	1	0	0
01/05/2019	3	JR	0740	1345	3	2	SSW	1	8	0	0	0	0
01/05/2019	3	JR	0740	1345	4	1	SW	2	8	0	1	0	0
01/05/2019	3	JR	0740	1345	5	2	SSW	1	8	0	1	0	0
01/05/2019	3	JR	0740	1345	6	2	SW	1	8	1	1	0	0
15/05/2019	3	JR	0520	1300	1	0	-	0	0	2	2	0	0
15/05/2019	3	JR	0520	1300	2	1	Variable	0	0	2	2	0	0
15/05/2019	3	JR	0520	1300	3	1	Variable	0	0	2	2	0	0
15/05/2019	3	JR	0520	1300	4	1	Variable/NW	0	1	2	2	0	0
15/05/2019	3	JR	0520	1300	5	1	Variable/N	0	1	2	2	0	0
15/05/2019	3	JR	0520	1300	6	1	Variable/N	0	1	2	2	0	0
16/05/2019	3	JR	0740	1440	1	3	NE	0	4	2	2	0	0
16/05/2019	3	JR	0740	1440	2	3	NE	0	7	2	2	0	0
16/05/2019	3	JR	0740	1440	3	3	NE	0	7	2	2	0	0
16/05/2019	3	JR	0740	1440	4	3	NE	0	7	2	2	0	0
16/05/2019	3	JR	0740	1440	5	3	NE	0	7	2	2	0	0
16/05/2019	3	JR	0740	1440	6	2	NE	0	6	2	2	0	0
16/05/2019	3	JR	0740	1440	7	2	NE	0	4	2	2	0	0
07/06/2019	4	RCW	0630	1230	1	3	SW	0	6	2	2	0	0
07/06/2019	4	RCW	0630	1230	2	3	SW	0	6	2	2	0	0
07/06/2019	4	RCW	0630	1230	3	3	SW	0	6	2	2	0	0
07/06/2019	4	RCW	0630	1230	4	3	SW	0	6	2	2	0	0
07/06/2019	4	RCW	0630	1230	5	3	SW	0	7	2	2	0	0

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
07/06/2019	4	RCW	0630	1230	6	3	SW	0	8	2	2	0	0
07/06/2019	4	RTW	0710	1310	1	3	SW	0	6	2	2	0	0
07/06/2019	4	RTW	0710	1310	2	3	SW	0	6	2	2	0	0
07/06/2019	4	RTW	0710	1310	3	3	SW	0	6	2	2	0	0
07/06/2019	4	RTW	0710	1310	4	3	SW	0	6	2	2	0	0
07/06/2019	4	RTW	0710	1310	5	3	SW	0	7	2	2	0	0
07/06/2019	4	RTW	0710	1310	6	3	SW	0	8	2	2	0	0
14/06/2019	4	RTW	0950	1550	1	3	SSW	0	5	2	2	0	0
14/06/2019	4	RTW	0950	1550	2	3	SSW	0	5	2	2	0	0
14/06/2019	4	RTW	0950	1550	3	3	SW	0	5	2	2	0	0
14/06/2019	4	RTW	0950	1550	4	3	SW	0	5	2	2	0	0
14/06/2019	4	RTW	0950	1550	5	3	SW	0	5	2	2	0	0
14/06/2019	4	RTW	0950	1550	6	3	SW	0	5	2	2	0	0
23/07/2019	5	RTW	0915	1515	1	3	SW	0	6	2	2	0	0
23/07/2019	5	RTW	0915	1515	2	3	SW	0	6	2	2	0	0
23/07/2019	5	RTW	0915	1515	3	3	SW	0	6	2	2	0	0
23/07/2019	5	RTW	0915	1515	4	3	SW	0	7	2	2	0	0
23/07/2019	5	RTW	0915	1515	5	3	SW	0	6	2	2	0	0
23/07/2019	5	RTW	0915	1515	6	3	SW	0	6	2	2	0	0
13/08/2019	6	JR	0740	1340	1	2	W	0	3	2	2	0	0
13/08/2019	6	JR	0740	1340	2	3	W	0	2	2	2	0	0
13/08/2019	6	JR	0740	1340	3	3	W	0	2	2	2	0	0
13/08/2019	6	JR	0740	1340	4	3	W	2	5	2	2	0	0
13/08/2019	6	JR	0740	1340	5	3	W	3	6	2	2	0	0
13/08/2019	6	JR	0740	1340	6	2	W	3	7	2	2	0	0
04/04/2022	7	JR	0945	1645	1	3	NW	2	7	1	2	0	0
04/04/2022	7	JR	0945	1645	2	3	NW	2	8	1	2	0	0
04/04/2022	7	JR	0945	1645	3	3	NW	4	8	1	2	0	0
04/04/2022	7	JR	0945	1645	4	3	WNW	2	8	1	2	0	0
04/04/2022	7	JR	0945	1645	5	3	WNW	2	8	1	2	0	0
04/04/2022	7	JR	0945	1645	6	3	WNW	2	8	1	2	0	0
04/04/2022	7	JR	0945	1645	7	3	WNW	2	8	1	2	0	0
05/04/2022	7	JR	0830	1230	1	2	W	4	8	0	0	0	0
05/04/2022	7	JR	0830	1230	2	2	W	4	8	0	0	0	0
05/04/2022	7	JR	0830	1230	3	2	W	4	8	0	0	0	0
05/04/2022	7	JR	0830	1230	4	2	W	3	8	0	0	0	0
06/04/2022	7	JR	0815	1615	1	2	WSW	3	7	1	1	0	0
06/04/2022	7	JR	0815	1615	2	2	WSW	3	7	1	1	0	0
06/04/2022	7	JR	0815	1615	3	3	W	2	7	1	1	0	0
06/04/2022	7	JR	0815	1615	4	4	W	0	6	2	2	0	0
06/04/2022	7	JR	0815	1615	5	4	WSW	3	7	2	2	0	0
06/04/2022	7	JR	0815	1615	6	4	SW	3	6	2	2	0	0
06/04/2022	7	JR	0815	1615	7	4	SW	2	6	2	2	0	0
06/04/2022	7	JR	0815	1615	8	4	SW	4	7	2	0	0	0
07/04/2022	7	JR	0815	1615	1	4	NW	2	8	2	2	0	0
07/04/2022	7	JR	0815	1615	2	4	NW	0	7	2	2	0	0
07/04/2022	7	JR	0815	1615	3	5	NW	2	8	2	2	0	0
07/04/2022	7	JR	0815	1615	4	5	NW	0	8	2	2	0	0
07/04/2022	7	JR	0815	1615	5	2	NW	0	7	2	2	0	0
07/04/2022	7	JR	0815	1615	6	2	NW	0	7	2	2	0	0
07/04/2022	7	JR	0815	1615	7	2	NW	0	7	2	2	0	0
07/04/2022	7	JR	0815	1615	8	2	NW	0	6	2	2	0	0
02/05/2022	8	JR	0800	1530	1	1	VAR	0	8	1	1	0	0

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
02/05/2022	8	JR	0800	1530	2	2	SW	0	8	1	2	0	0
02/05/2022	8	JR	0800	1530	3	1	SW	0	8	1	2	0	0
02/05/2022	8	JR	0800	1530	4	1	SW	0	8	1	2	0	0
02/05/2022	8	JR	0800	1530	5	1	SW	0	8	2	2	0	0
02/05/2022	8	JR	0800	1530	6	1	S	0	8	2	2	0	0
02/05/2022	8	JR	0800	1530	7	2	S	2	8	2	2	0	0
02/05/2022	8	JR	0800	1530	8	1	SSE	2	8	2	2	0	0
03/05/2022	8	JR	0800	1400	1	1	SW	1	8	0	0	0	0
03/05/2022	8	JR	0800	1400	2	1	SW	2	8	1	1	0	0
03/05/2022	8	JR	0800	1400	3	1	VAR	1	8	1	1	0	0
03/05/2022	8	JR	0800	1400	4	0	-	1	8	1	1	0	0
03/05/2022	8	JR	0800	1400	5	0	-	0	8	1	1	0	0
03/05/2022	8	JR	0800	1400	6	1	SE	0	8	1	2	0	0
04/05/2022	8	JR	0750	1450	1	1	WNW	2	8	0	0	0	0
04/05/2022	8	JR	0750	1450	2	2	NW	1	8	1	1	0	0
04/05/2022	8	JR	0750	1450	3	2	NW	2	8	1	1	0	0
04/05/2022	8	JR	0750	1450	4	2	NW	1	7	1	1	0	0
04/05/2022	8	JR	0750	1450	5	3	NW	1	8	1	2	0	0
04/05/2022	8	JR	0750	1450	6	2	NW	0	7	2	2	0	0
04/05/2022	8	JR	0750	1450	7	2	NW	0	6	2	2	0	0
05/05/2022	8	JR	1100	1300	1	1	SW	0	8	1	2	0	0
05/05/2022	8	JR	1100	1300	2	2	SW	0	8	1	2	0	0
31/05/2022	8	JR	0715	1415	1	1	NE	0	6	2	2	0	0
31/05/2022	8	JR	0715	1415	2	1	ENE	0	7	2	2	0	0
31/05/2022	8	JR	0715	1415	3	1	ENE	0	6	2	2	0	0
31/05/2022	8	JR	0715	1415	4	1	ENE	0	4	2	2	0	0
31/05/2022	8	JR	0715	1415	5	2	ENE	2	5	2	2	0	0
31/05/2022	8	JR	0715	1415	6	2	ENE	2	6	2	2	0	0
31/05/2022	8	JR	0715	1415	7	1	ENE	2	6	2	2	0	0
01/06/2022	9	JR	0800	1500	1	2	NE	0	5	2	2	0	0
01/06/2022	9	JR	0800	1500	2	2	NE	0	7	2	2	0	0
01/06/2022	9	JR	0800	1500	3	0	NE	0	7	2	2	0	0
01/06/2022	9	JR	0800	1500	4	1	SE	0	7	2	2	0	0
01/06/2022	9	JR	0800	1500	5	1	S	0	6	2	2	0	0
01/06/2022	9	JR	0800	1500	6	1	SW	0	5	2	2	0	0
01/06/2022	9	JR	0800	1500	7	1	VAR	0	4	2	2	0	0
02/06/2022	9	JR	0730	1430	1	1	SE	0	6	2	2	0	0
02/06/2022	9	JR	0730	1430	2	1	E	0	4	2	2	0	0
02/06/2022	9	JR	0730	1430	3	1	S	0	4	2	2	0	0
02/06/2022	9	JR	0730	1430	4	2	S	0	3	2	2	0	0
02/06/2022	9	JR	0730	1430	5	2	SSW	0	4	2	2	0	0
02/06/2022	9	JR	0730	1430	6	2	SSW	0	6	2	2	0	0
02/06/2022	9	JR	0730	1430	7	2	SW	0	5	2	2	0	0
25/07/2022	10	JR	0800	1400	1	2	WSW	2	8	1	2	0	0
25/07/2022	10	JR	0800	1400	2	2	WSW	0	7	1	2	0	0
25/07/2022	10	JR	0800	1400	3	2	W	0	7	2	2	0	0
25/07/2022	10	JR	0800	1400	4	3	WNW	0	8	1	1	0	0
25/07/2022	10	JR	0800	1400	5	3	NE	2	7	2	2	0	0
25/07/2022	10	JR	0800	1400	6	3	NE	0	7	2	2	0	0
01/08/2022	11	JR	0800	1400	1	2	WSW	0	4	2	2	0	0
01/08/2022	11	JR	0800	1400	2	2	SW	0	6	2	2	0	0
01/08/2022	11	JR	0800	1400	3	2	SW	0	7	2	2	0	0
01/08/2022	11	JR	0800	1400	4	2	SW	0	7	2	2	0	0

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
01/08/2022	11	JR	0800	1400	5	2	SW	0	8	2	2	0	0
01/08/2022	11	JR	0800	1400	6	2	SW	0	6	2	2	0	0

C.5 Black Grouse Surveys

Black grouse surveys were undertaken during the 2019 breeding season. **Table C-7** details survey dates and weather data recorded. Refer to **Annex B** for survey methodology and **Annex D** for survey results.

Table C-7 Meteorological conditions during black grouse surveys at Vale of Leven (sorted chronologically)

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
06/04/2019	1	RCW	1	0600	0900	2	W	0	8	2	2	0	0
06/04/2019	1	RCW	2	0600	0900	2	W	0	8	2	2	0	0
06/04/2019	1	RCW	3	0600	0900	2	W	0	8	2	2	0	0
07/04/2019	1	RCW	1	0600	0900	3	NE	0	8	2	2	0	0
07/04/2019	1	RCW	2	0600	0900	3	NE	2	8	2	2	0	0
07/04/2019	1	RCW	3	0600	0900	3	NE	0	8	2	2	0	0
20/05/2019	2	JR	1	0340	0550	2	WSW	0	8	1	2	0	0
20/05/2019	2	JR	2	0340	0550	2	WSW	0	8	1	2	0	0
20/05/2019	2	JR	3	0340	0550	2	WSW	1	8	1	2	0	0

ANNEX D. ORNITHOLOGICAL SURVEY RESULTS

D.1 Flight Activity Records: Target Species

In accordance with NatureScot guidance (2017), target species are those which may be considered to be at risk from the potential effects of wind farms. All flights of target species within the turbine area and the surrounding area were mapped and are detailed in **Table D-1**.

Table D-1 Details of target species recorded during flight activity surveys (sorted by species)

Date	Observer	VP	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)					Outside CRAA (seconds)					
							0-20m	21-40m	41-100m	101-150m	>150m	0-20m	21-40m	41-100m	101-150m	>150m	
16/05/2019	PN	2	0901	Black grouse	1	11	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19/09/2019	AM	2	1504	Golden plover	12	64	0.00	19.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28/03/2019	PN	1	1154	Goshawk	1	80	0.00	0.00	0.00	0.00	0.00	0.00	80.00	0.00	0.00	0.00	0.00
28/03/2019	PN	1	1308	Goshawk	1	45	0.00	0.00	0.00	0.00	0.00	0.00	45.00	0.00	0.00	0.00	0.00
28/03/2019	JR	3	1106	Goshawk	1	152	13.99	57.82	55.95	13.99	0.00	1.01	4.18	4.05	1.01	0.00	0.00
12/04/2019	AH	3	1146	Goshawk	1	200	6.68	6.68	55.67	20.04	0.00	8.32	8.32	69.33	24.96	0.00	0.00
06/11/2019	JR	3	0926	Goshawk	1	61	31.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/02/2020	JRM	1	1108	Goshawk	1	38	0.00	0.00	0.00	0.00	0.00	0.00	38.00	0.00	0.00	0.00	0.00
18/12/2019	PN	2	1335	Greylag goose	4	140	0.00	0.00	0.00	0.00	46.83	0.00	0.00	0.00	0.00	0.00	93.17
06/11/2019	JR	3	0934	Hen harrier	1	450	450.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18/12/2019	PN	2	1221	Hen harrier	1	11	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18/12/2019	PN	2	1221	Hen harrier	1	3	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18/12/2019	PN	2	1227	Hen harrier	1	75	30.45	20.30	0.00	0.00	0.00	14.55	9.70	0.00	0.00	0.00	0.00
18/02/2020	PN	2	1059	Hen harrier	1	16	4.53	0.00	0.00	0.00	0.00	11.47	0.00	0.00	0.00	0.00	0.00
02/03/2020	PN	1	1122	Hen harrier	1	60	0.00	0.00	0.00	0.00	0.00	30.00	30.00	0.00	0.00	0.00	0.00
02/03/2020	JRM	3	1046	Hen harrier	1	2	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20/05/2019	JR	3	0728	Herring gull	1	40	12.97	21.62	0.00	0.00	0.00	2.03	3.38	0.00	0.00	0.00	0.00
18/06/2019	RTW	2	1421	Herring gull	3	143	0.00	7.81	29.41	0.00	0.00	0.00	22.19	83.59	0.00	0.00	0.00
18/06/2019	RTW	2	1443	Herring gull	2	129	0.00	59.45	0.00	0.00	0.00	0.00	69.55	0.00	0.00	0.00	0.00
19/06/2019	RTW	1	1319	Herring gull	7	266	0.00	0.00	109.83	0.00	0.00	0.00	0.00	156.17	0.00	0.00	0.00
20/06/2019	RTW	3	0703	Herring gull	11	138	0.00	0.00	117.08	0.00	0.00	0.00	0.00	20.92	0.00	0.00	0.00
20/06/2019	RTW	3	1107	Herring gull	3	164	0.00	0.00	164.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20/06/2019	RTW	3	1158	Herring gull	6	110	0.00	0.00	85.49	0.00	0.00	0.00	0.00	24.51	0.00	0.00	0.00
16/07/2019	RTW	1	1134	Herring gull	3	132	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	132.00	0.00	0.00
16/07/2019	RTW	1	1354	Herring gull	4	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.00	45.00	0.00	0.00
17/07/2019	RTW	2	1347	Herring gull	17	145	0.00	0.00	81.69	0.00	0.00	0.00	0.00	63.31	0.00	0.00	0.00
17/07/2019	RTW	2	1532	Herring gull	3	162	0.00	0.00	56.61	0.00	0.00	0.00	0.00	105.39	0.00	0.00	0.00
19/07/2019	RTW	3	1058	Herring gull	7	126	0.00	0.00	56.13	0.00	0.00	0.00	0.00	69.87	0.00	0.00	0.00
20/05/2019	JR	3	0723	Osprey	1	105	0.25	1.49	0.00	0.00	0.00	14.75	88.51	0.00	0.00	0.00	0.00
18/06/2019	RTW	2	1136	Osprey	1	324	0.00	0.00	179.87	48.67	0.00	0.00	0.00	75.13	20.33	0.00	0.00
19/06/2019	RTW	1	1114	Osprey	1	72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.00	0.00	0.00	0.00
12/08/2019	JR	1	0929	Osprey	1	110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	110.00	0.00	0.00	0.00
12/08/2019	JR	1	1307	Osprey	1	127	0.00	0.00	0.00	0.00	0.00	15.00	112.00	0.00	0.00	0.00	0.00
15/08/2019	JR	2	1128	Osprey	1	155	14.38	21.57	21.57	16.78	0.00	15.62	23.43	23.43	18.22	0.00	0.00
15/08/2019	JR	2	1337	Osprey	1	97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.00	37.00	0.00	0.00
28/03/2019	JR	3	0736	Pink-footed goose	63	43	0.00	0.00	0.00	34.39	0.00	0.00	0.00	0.00	8.61	0.00	0.00
29/09/2019	AM	3	1246	Pink-footed goose	75	96	0.00	0.00	0.00	0.00	43.58	0.00	0.00	0.00	0.00	0.00	52.42
29/09/2019	AM	3	1344	Pink-footed goose	60	115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	115.00
29/09/2019	AM	3	1400	Pink-footed goose	130	220	0.00	0.00	0.00	0.00	86.17	0.00	0.00	0.00	0.00	0.00	133.83
29/09/2019	AM	3	1457	Pink-footed goose	86	130	0.00	0.00	0.00	0.00	49.19	0.00	0.00	0.00	0.00	0.00	80.81
30/10/2019	JR	1	0848	Pink-footed goose	12	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.00	57.00	0.00	0.00
22/03/2019	PN	1	1039	Whooper swan	21	85	0.00	7.50	7.50	22.49	5.00	0.00	7.50	7.50	22.51	5.00	0.00

D.2 Moorland Breeding Bird Records

Moorland breeding bird surveys were undertaken during the 2019 and 2022 breeding seasons and focussed on recording activity of upland wader species within the survey area (**Table D-2**). Survey methodology is detailed in **Annex B** and survey timing/weather conditions in **Annex C**.

Table D-2 Wader activity recorded during moorland breeding bird surveys

Date	Observer	Species	Number recorded	Notes	Territory ID
22/03/2019	JR	Snipe	1	Calling	SN_6
07/04/2019	RCW	Curlew	2	Pair displaying. South of Merkins farm- NS 43839 82349	CU_1
07/04/2019	RCW	Snipe	1	Calling from ground, north slope of Blairquhomrie Muir - NS 43700 82279	SN_1
08/04/2019	AH	Snipe	1		SN_7
08/04/2019	AH	Snipe	1		SN_7
08/04/2019	AH	Snipe	1		SN_8
08/04/2019	RTW	Golden plover	4	Calling	N/A
08/04/2019	RTW	Snipe	1	Alarm calling	SN_5
09/04/2019	AH	Curlew	1		CU_1
09/04/2019	RTW	Oystercatcher	2	Pair, calling	OC_1
09/04/2019	RTW	Snipe	1		SN_3
09/04/2019	RTW	Snipe	1		SN_4
09/04/2019	RTW	Snipe	1		SN_2
09/04/2019	RTW	Woodcock	1		N/A
01/05/2019	JR	Common sandpiper	2	Calling	CM_1
01/05/2019	JR	Snipe	1	Calling and displaying	SN_9
01/05/2019	JR	Snipe	1	Calling	SN_9
09/05/2019	AA	Curlew	1		CU_2
09/05/2019	AA	Curlew	1		CU_1
09/05/2019	AA	Curlew	1		CU_1
15/05/2019	JR	Curlew	2	Pair alarm calling	CU_2
15/05/2019	JR	Curlew	1	Alarm calling and in song	CU_2
15/05/2019	JR	Curlew	1	Calling/singing	CU_3
15/05/2019	JR	Lapwing	2	Pair in song and alarm calling; Flight activity recorded on survey sheets	L_1
15/05/2019	JR	Lapwing	1	Calls far off	L_2
15/05/2019	JR	Lapwing	2	Pair alarm calling	L_3
15/05/2019	JR	Oystercatcher	1	Alarm calling	OC_1
16/05/2019	JR	Redshank	1	On River Leven - over 1.5km from the site	N/A
17/05/2019	JR	Common sandpiper	1	Repeatedly alarm calling, indicating territorial significance	CM_1
17/05/2019	JR	Snipe	1	Calling	SN_10
17/05/2019	JR	Snipe	1	Calling	SN_10
17/05/2019	JR	Snipe	1	Calling	SN_10
20/05/2019	JR	Curlew	1	Calling to south west of Auchenreoch	CU_4
20/05/2019	JR	Lapwing	1	Calling from Murroch Glen	L_4
10/06/2019	RTW	Common sandpiper	1	Repeatedly alarm calling indicating territorial significance	CM_1
13/06/2019	RTW	Curlew	1	Repeatedly alarm calling, indicating territorial significance	CU_1
13/06/2019	RTW	Snipe	1	Singing	SN_4
01/07/2019	RTW	Oystercatcher	1	Calling	OC_1

Date	Observer	Species	Number recorded	Notes	Territory ID
01/07/2019	RTW	Snipe	1	Repeatedly alarm calling, indicating territorial significance	SN_5
13/08/2019	JR	Snipe	1	Calling	N/A
05/04/2022	JRM	Oystercatcher	1	Flyover.	N/A
05/04/2022	JR	Oystercatcher	1		N/A
07/04/2022	JR	Curlew	1	Singing.	CU_1
03/05/2022	JR	Curlew	2	Singing.	CU_1
03/05/2022	JR	Curlew	2	Singing.	CU_2
03/05/2022	JR	Curlew	2	Singing.	CU_3
03/05/2022	JR	Curlew	1	Alarm calling.	CU_5
03/05/2022	JR	Lapwing	1		L_1
03/05/2022	JR	Lapwing	1	Singing.	L_1
03/05/2022	JR	Lapwing	1	Alarm calling.	L_2
05/05/2022	JR	Oystercatcher	2	Pair.	OC_1
05/05/2022	JR	Curlew	-		-
31/05/2022	JR	Curlew	2	Alarm calling.	CU_4
31/05/2022	JR	Curlew	2	Alarm calling.	CU_5
01/06/2022	JR	Lapwing	8		N/A
01/06/2022	JR	Oystercatcher	2	Pair.	OC_2
01/06/2022	JR	Snipe	1	Alarm calling.	SN_2
01/06/2022	JR	Snipe	1	Alarm calling.	SN_3
01/06/2022	JR	Snipe	2	Displaying.	SN_4
01/06/2022	JR	Snipe	2	Displaying.	SN_4
02/06/2022	JR	Snipe	1	Displaying.	SN_1
02/06/2022	JR	Snipe	1	Displaying.	SN_1

D.3 Winter Walkover Records

Table D-3 details all the species recorded. Refer to **Annex B** for survey methodology and **Annex C** for weather data.

Table D-3 Winter walkover survey records: 2019/2020 non-breeding seasons

Date	Observer	Species	Number recorded	Notes
04/11/2019	PN	Blue tit	1	
04/11/2019	PN	Buzzard	1	Flew out from trees, circling. Gallangad Glen
04/11/2019	PN	Carrion crow	4	
04/11/2019	PN	Chaffinch	32	
04/11/2019	PN	Fieldfare	14	
04/11/2019	PN	Great spotted woodpecker	1	
04/11/2019	PN	Jay	2	
04/11/2019	PN	Kestrel	1	Repeatedly alarm calling from trees in Gallangad Glen, east of the Merkins
04/11/2019	PN	Meadow pipit	6	
04/11/2019	PN	Pheasant	1	
04/11/2019	PN	Red grouse	2	Two, calling, flushed from heather near disused quarry south of Common Ford
04/11/2019	PN	Redwing	8	
04/11/2019	PN	Reed bunting	5	
04/11/2019	PN	Robin	5	
04/11/2019	PN	Rook	3	

Date	Observer	Species	Number recorded	Notes
04/11/2019	PN	Siskin	12	
04/11/2019	PN	Snipe	2	
04/11/2019	PN	Wren	6	
05/11/2019	JR	Black grouse	2	Pair
05/11/2019	JR	Blackbird	-	Species present during WWO survey
05/11/2019	JR	Buzzard	1	In flight. Calling. Hazel Glen
05/11/2019	JR	Buzzard	1	In flight. Murroch Glen
05/11/2019	JR	Carrion crow	-	Species present during WWO survey
05/11/2019	JR	Chaffinch	-	Species present during WWO survey
05/11/2019	JR	Coal tit	-	Species present during WWO survey
05/11/2019	JR	Collared dove	-	Species present during WWO survey
05/11/2019	JR	Common crossbill	1	Calling. Murroch Glen
05/11/2019	JR	Feral pigeon	-	Species present during WWO survey
05/11/2019	JR	Fieldfare	-	Species present during WWO survey
05/11/2019	JR	Goldfinch	-	Species present during WWO survey
05/11/2019	JR	Herring gull	1	
05/11/2019	JR	Herring gull	12	
05/11/2019	JR	Kestrel	1	In flight. Hill of Standing Stones
05/11/2019	JR	Linnet	-	Species present during WWO survey
05/11/2019	JR	Magpie	-	Species present during WWO survey
05/11/2019	JR	Meadow pipit	-	Species present during WWO survey
05/11/2019	JR	Raven	-	Species present during WWO survey
05/11/2019	JR	Snipe	1	
05/11/2019	JR	Snipe	2	
05/11/2019	JR	Snipe	1	
05/11/2019	JR	Stock dove	-	Species present during WWO survey
05/11/2019	JR	Stonechat	-	Species present during WWO survey
05/11/2019	JR	Twite	-	Species present during WWO survey
05/11/2019	JR	Woodpigeon	-	Species present during WWO survey
05/11/2019	JR	Wren	-	Species present during WWO survey
05/11/2019	JRM	Red grouse	1	Moorland between Spouts Burn and Black Burn
05/11/2019	JRM	Red grouse	1	Moorland between Spouts Burn and Black Burn
05/11/2019	JRM	Red grouse	1	Moorland between Spouts Burn and Black Burn
06/11/2019	JR	Canada goose	4	In flight. West by south west from Sheepfold at Merkins Farm to Blairquhomrie Muir
06/11/2019	JR	Carrion crow	10	Total count from WWO survey
06/11/2019	JR	Fieldfare	30	Total count from WWO survey
06/11/2019	JR	Jackdaw	30	Total count from WWO survey
06/11/2019	JR	Meadow pipit	1	Total count from WWO survey
06/11/2019	JR	Pheasant	2	Total count from WWO survey
06/11/2019	JR	Raven	5	Total count from WWO survey
06/11/2019	JR	Red grouse	1	Calling. Merkins Muir
06/11/2019	JR	Red grouse	1	Singing. Blairquhomrie Muir
06/11/2019	JR	Red grouse	1	Singing. Merkins Muir
06/11/2019	JR	Redwing	-	Species present during WWO survey
06/11/2019	JR	Reed bunting	1	Total count from WWO survey
06/11/2019	JR	Snipe	1	
06/11/2019	JR	Snipe	1	
06/11/2019	JR	Snipe	1	
06/11/2019	JR	Snipe	1	
06/11/2019	JR	Snipe	1	
06/11/2019	JR	Starling	10	Total count from WWO survey

Date	Observer	Species	Number recorded	Notes
06/11/2019	JR	Woodpigeon	1	Total count from WWO survey
14/01/2020	JRM	Buzzard	-	Species present during WWO survey
14/01/2020	JRM	Carrion crow	-	Species present during WWO survey
14/01/2020	JRM	Coal tit	-	Species present during WWO survey
14/01/2020	JRM	Common crossbill	-	Species present during WWO survey
14/01/2020	JRM	Fieldfare	-	Species present during WWO survey
14/01/2020	JRM	Goldcrest	-	Species present during WWO survey
14/01/2020	JRM	Jay	-	Species present during WWO survey
14/01/2020	JRM	Lesser redpoll	-	Species present during WWO survey
14/01/2020	JRM	Raven	-	Species present during WWO survey
14/01/2020	JRM	Reed bunting	-	Species present during WWO survey
14/01/2020	JRM	Woodcock	1	Flushed along quad trail
14/01/2020	JRM	Wren	-	Species present during WWO survey
15/01/2020	JRM	Carrion crow	24	Total count from WWO
15/01/2020	JRM	Jack snipe	1	
15/01/2020	JRM	Raven	2	Total count from WWO
15/01/2020	JRM	Red grouse	2	Roughting Burn
15/01/2020	JRM	Red grouse	1	Little White Hill
15/01/2020	JRM	Red grouse	2	Doughnot Hill
15/01/2020	JRM	Snipe	1	
15/01/2020	PN	Blue tit	2	Total count from WWO
15/01/2020	PN	Buzzard	2	Total count from WWO
15/01/2020	PN	Carrion crow	14	Total count from WWO
15/01/2020	PN	Chaffinch	4	Total count from WWO
15/01/2020	PN	Coal tit	2	Total count from WWO
15/01/2020	PN	Common crossbill	1	Total count from WWO
15/01/2020	PN	Fieldfare	20	Total count from WWO
15/01/2020	PN	Great tit	10	Total count from WWO
15/01/2020	PN	Lesser redpoll	2	Total count from WWO
15/01/2020	PN	Pheasant	5	Total count from WWO
15/01/2020	PN	Raven	2	Total count from WWO
15/01/2020	PN	Reed bunting	5	Total count from WWO
15/01/2020	PN	Snipe	2	Flushed. Calling
15/01/2020	PN	Snipe	1	Flushed. Calling
15/01/2020	PN	Song thrush	1	Total count from WWO
15/01/2020	PN	Treecreeper	1	Total count from WWO
15/01/2020	PN	Woodcock	2	Minimum count two. Third bird flushed assumed to be one of the two originally flushed, but possibly three in total.
15/01/2020	PN	Woodcock	1	
15/01/2020	PN	Wren	3	Total count from WWO
31/01/2020	PN	Blue tit	2	Total count from WWO
31/01/2020	PN	Buzzard	1	In flight. Glendonachy
31/01/2020	PN	Carrion crow	7	Total count from WWO
31/01/2020	PN	Chaffinch	3	Total count from WWO
31/01/2020	PN	Common crossbill	2	Total count from WWO
31/01/2020	PN	Goldcrest	3	Total count from WWO
31/01/2020	PN	Jack snipe	1	
31/01/2020	PN	Meadow pipit	2	Total count from WWO
31/01/2020	PN	Siskin	4	Total count from WWO
31/01/2020	PN	Starling	103	Total count from WWO
31/01/2020	PN	Stonechat	1	Total count from WWO

Date	Observer	Species	Number recorded	Notes
31/01/2020	PN	Woodcock	1	
31/01/2020	PN	Woodcock	1	
31/01/2020	PN	Woodcock	1	
31/01/2020	PN	Woodcock	1	
31/01/2020	PN	Wren	8	Total count from WWO
18/02/2020	JRM	Hen harrier	1	Hunting along the edge of forestry heading north. Flight height under 20m
18/02/2020	JRM	Jack snipe	1	
18/02/2020	JRM	Kestrel	1	In flight. Roughing Burn
18/02/2020	JRM	Lesser redpoll	-	Species present during WWO survey
18/02/2020	JRM	Raven	-	Species present during WWO survey
18/02/2020	JRM	Red grouse	1	In flight. Doughnot Hill
18/02/2020	JRM	Red grouse	2	In flight. Doughnot Hill
18/02/2020	JRM	Skylark	-	Species present during WWO survey
18/02/2020	JRM	Snipe	1	
18/02/2020	JRM	Snipe	1	
18/02/2020	JRM	Stonechat	-	Species present during WWO survey
18/02/2020	PN	Carrion crow	5	
18/02/2020	PN	Common crossbill	5	
18/02/2020	PN	Goldcrest	1	
18/02/2020	PN	Great spotted woodpecker	3	
18/02/2020	PN	Great tit	1	
18/02/2020	PN	Herring gull	29	Mostly adult flock including eight juveniles
18/02/2020	PN	Meadow pipit	1	
18/02/2020	PN	Raven	2	
18/02/2020	PN	Droppings	0	Two piles of red grouse droppings at Red Brae
18/02/2020	PN	Red grouse	1	Flushed at Gallangad Burn south of Lang Dyke

D.4 Scarce Breeding Bird Records

Table D-4 details all records of raptors and owls recorded during surveys, however only Annex 1¹ or Schedule 1² species are considered to be scarce breeding birds (i.e. target species). Refer to **Annex B** for survey methodology, **Annex C** for weather data and **Confidential Technical Appendix 7.2** for confidential data relating to goshawk and osprey.

Table D-4 Raptor and owl records: 2019 and 2022 breeding seasons

Date	Observer	Species	Number recorded	Sex	Age	Nest ID	Notes
22/03/2019	JR	Buzzard	1	-	-	-	
06/04/2019	RCW	Buzzard	1	-	-	-	Adult hunting; Flight activity recorded on survey sheet- not digitized
06/04/2019	RCW	Kestrel	1	-	-	-	Adult male hunting
08/04/2019	RTW	Buzzard	2	-	-	-	Pair, calling
08/04/2019	RTW	Buzzard	1	-	-	-	
08/04/2019	RTW	Kestrel	1	-	-	-	Female, immature
08/04/2019	RTW	Sparrowhawk	1	-	-	-	Calling
09/04/2019	RTW	Buzzard	1	-	-	-	
09/04/2019	RTW	Buzzard	1	-	-	-	

Date	Observer	Species	Number recorded	Sex	Age	Nest ID	Notes
09/04/2019	RTW	Buzzard	1	-	-	-	
09/04/2019	RTW	Buzzard	1	-	-	-	
09/04/2019	RTW	Buzzard	1	-	-	-	
09/04/2019	RTW	Buzzard	1	-	-	-	
09/04/2019	RTW	Kestrel	1	-	-	-	Hill of Standing Stones
09/04/2019	RTW	Kestrel	1	-	-	-	Hill of Standing Stones
09/04/2019	RTW	Sparrowhawk	1	-	-	-	In flight. Female. The Merkins
01/05/2019	JR	Buzzard	1	-	-	-	Calling; Flight activity recorded on survey sheets
01/05/2019	JR	Kestrel	1	-	-	-	
01/05/2019	JR	Osprey	1	-	Adult	-	Calling
09/05/2019	AA	Buzzard	1	-	-	-	Sheepfold
10/05/2019	AA	Buzzard	1	-	-	-	In flight. Merkins Muir
10/05/2019	AA	Buzzard	1	-	-	-	In flight. Gallangad Muir. Aggression with ravens
10/05/2019	AA	Osprey	1	-	-	-	
10/05/2019	AA	Osprey	1	-	-	-	
15/05/2019	JR	Buzzard	1	-	-	-	Flight activity recorded on survey sheets
15/05/2019	JR	Buzzard	1	-	-	-	Flight activity recorded on survey sheets
15/05/2019	JR	Kestrel	1	-	-	-	
15/05/2019	JR	Sparrowhawk	1	-	-	-	Flight activity recorded on survey sheets
16/05/2019	JR	Buzzard	1	-	-	-	
16/05/2019	JR	Osprey	1	-	Adult	-	2 different ospreys seen at different times carrying food over Dumbarton Muir, presumed nest outside of buffer - NS 463 793
16/05/2019	JR	Osprey	1	-	Adult	-	2 different ospreys seen at different times carrying food over Dumbarton Muir, presumed nest outside of buffer - NS 463 793
17/05/2019	AA	Buzzard	1	-	-	-	In flight. Murroch Glen. Repeatedly alarm calling, indicating territorial significance
17/05/2019	AA	Buzzard	1	-	-	-	In flight. Hazel Glen. Aggression with raven
20/05/2019	JR	Tawny owl	-	-	-	-	
07/06/2019	RTW	Osprey	1	-	Adult	-	Adult fishing, catching food and gaining height before making straight line for presumed nest (nest location not known, may be outside buffer) - NS 458 760
10/06/2019	RTW	Buzzard	1	-	-	-	In flight. Doughnot Hill
11/06/2019	RTW	Buzzard	1	-	-	-	In flight. Murroch Glen
11/06/2019	RTW	Buzzard	1	-	-	-	In flight. Murroch Glen
12/06/2019	RTW	Buzzard	1	-	-	-	In flight. South of Ishneich Waterfall
02/07/2019	RTW	Buzzard	1	-	-	-	Gallangad Glen. Calling
02/07/2019	RTW	Kestrel	1	Male	Adult	-	In flight. Gallangad Burn. Male
05/07/2019	RTW	Buzzard	1	-	-	-	
05/07/2019	RTW	Buzzard	1	-	-	-	
05/07/2019	RTW	Buzzard	1	-	-	-	

¹ Annex 1 of the EU Bird Directive

² Schedule 1 of the Wildlife and Countryside Act 1981, as amended by the Nature Conservation Act (Scotland) 2004

Date	Observer	Species	Number recorded	Sex	Age	Nest ID	Notes
23/07/2019	RTW	Osprey	1	-	Adult	-	No nesting but osprey carrying fish off (presumed adult) - NS 459 760
13/08/2019	JR	Buzzard	1	-	-	-	Juvenile, lots of food demand calls
13/08/2019	JR	Buzzard	1	-	-	-	Calling
13/08/2019	JR	Buzzard	1	-	-	-	Calling, family
13/08/2019	JR	Buzzard	2	-	-	-	Pair/family, calling
13/08/2019	JR	Buzzard	1	-	-	-	Calling; Flight activity recorded on survey sheets
13/08/2019	JR	Kestrel	4	-	-	-	Family
13/08/2019	JR	Osprey	1	-	Adult	-	Soaring, Greystonelea - NS 43 84
13/08/2019	JR	Osprey	1	-	Adult	-	Flying towards Loch Humphrey reservoir
13/08/2019	JR	Osprey	1	-	Adult	-	
04/04/2022	JR	Buzzard	2	-	-	-	Pair.
04/04/2022	JR	Kestrel	2	-	-	-	Pair.
06/04/2022	JR	Buzzard	2	-	-	-	Pair.
06/04/2022	JR	Kestrel	1	-	-	-	Calling from trees at NS450832; possible nest site.
06/04/2022	JR	Osprey	1	Male	Adult	OP_2	Carrying nesting material.
06/04/2022	JR	Osprey	1	Male	Adult	OP_2	Carrying nesting material. Same bird as Ref_ID 182.
06/04/2022	JR	Osprey	1	Male	Adult	OP_2	Carrying nesting material. Same bird as Ref_ID 182.
06/04/2022	JR	Osprey	1	Male	Adult	OP_2	Carrying nesting material. Same bird as Ref_ID 182.
06/04/2022	JR	Sparrowhawk	1	-	-	-	Probable identification; surveyor could not rule out goshawk; displaying over Tombocke Hill.
06/04/2022	JR	Sparrowhawk	1	-	-	-	Probable identification; surveyor could not rule out goshawk; hunting near Tombocke Hill.
07/04/2022	JR	Buzzard	1	-	-	-	
07/04/2022	JR	Buzzard	1	-	-	-	
07/04/2022	JR	Buzzard	1	-	-	-	
02/05/2022	JR	Osprey	1	Male	Adult	OP_2	Carrying fish.
03/05/2022	JR	Buzzard	1	-	-	-	
04/05/2022	JR	Kestrel	2	-	-	-	Pair.
04/05/2022	JR	Osprey	1	-	Adult	-	Hunting.
04/05/2022	JR	Osprey	1	-	Adult	-	
04/05/2022	JR	Tawny owl	-	-	-	-	Active nest with young at NS 452 748.
05/05/2022	JR	Buzzard	1	-	-	-	Adult.
05/05/2022	JR	Kestrel	-	-	-	-	
31/05/2022	JR	Buzzard	-	-	-	-	
31/05/2022	JR	Osprey	1	-	Adult	OP_1	
31/05/2022	JR	Osprey	1	-	Adult	OP_1	
01/06/2022	JR	Buzzard	2	-	-	-	Family.
01/06/2022	JR	Buzzard	1	-	-	-	
01/06/2022	JR	Buzzard	1	-	-	-	At nest.
01/06/2022	JR	Kestrel	1	-	-	-	
01/06/2022	JR	Kestrel	1	-	-	-	Female
01/06/2022	JR	Osprey	1	-	Adult	OP_2	Territorial interaction with another osprey (Ref_ID 211).

Date	Observer	Species	Number recorded	Sex	Age	Nest ID	Notes
01/06/2022	JR	Osprey	1	-	Adult	OP_1	Territorial interaction with another osprey (Ref_ID 210).
01/06/2022	JR	Osprey	1	-	Adult	OP_1	Same bird as Ref_ID 211.
01/06/2022	JR	Osprey	1	-	Adult	OP_2	Same bird as Ref_ID 210.
02/06/2022	JR	Buzzard	-	-	-	-	
02/06/2022	JR	Osprey	3	Male	Adult	OP_1	Nesting male defending territory against two intruding ospreys.
03/06/2022	JR	Buzzard	2	-	-	-	Pair.
03/06/2022	JR	Buzzard	2	-	-	-	Pair; alarm calling.
29/07/2022	EB	Buzzard	1	-	-	-	
29/07/2022	EB	Buzzard	1	-	-	-	
01/08/2022	JR	Buzzard	2	-	-	-	Adult and juvenile.
01/08/2022	JR	Buzzard	4	-	-	-	Adult pair and 2 juveniles at nest.
01/08/2022	JR	Buzzard	4	-	-	-	Adult pair and 2 juveniles at nest.
01/08/2022	JR	Kestrel	2	-	-	-	Juveniles.
01/08/2022	JR	Kestrel	1	-	-	-	
01/08/2022	JR	Kestrel	2	-	-	-	Juveniles.
01/08/2022	JR	Kestrel	1	-	-	-	
01/08/2022	JR	Osprey	1	-	Adult	-	Hunting over reservoir then flew off south-east.

D.5 Black Grouse Records

No black grouse were recorded during 2019 surveys. Refer to **Annex B** for survey methodology and **Annex C** for weather data.

D.6 Bird Species Index

A total of 106 bird species or signs was recorded at, or adjacent, to the Site during the ornithological surveys.

Table D-5 comprises a list of all these species along with their conservation status.

Table D-5 All bird species recorded at Vale of Leven (March 2019 and August 2022)

Species	Conservation status	Species	Conservation status
Black grouse	BoCC ³ Red	Lesser redpoll	BoCC Red
Blackbird	BoCC Green	Linnet	BoCC Red
Blackcap	BoCC Green	Little grebe	BoCC Green
Black-headed gull	BoCC Amber	Magpie	BoCC Green
Blue tit	BoCC Green	Mallard	BoCC Amber
Bullfinch	BoCC Amber	Meadow pipit	BoCC Amber
Buzzard	BoCC Green	Merlin	Annex 1, Schedule 1, BoCC Red
Canada goose	No status	Mistle thrush	BoCC Red
Carrion crow	BoCC Green	Moorhen	BoCC Amber
Chaffinch	BoCC Green	Mute swan	BoCC Green
Chiffchaff	BoCC Green	Nuthatch	BoCC Green
Coal tit	BoCC Green	Osprey	Annex 1, Schedule 1, BoCC Amber
Collared dove	BoCC Green	Oystercatcher	BoCC Amber
Common crossbill	Schedule 1, BoCC Green	Peregrine falcon	Annex 1, Schedule 1, BoCC Green
Common gull	BoCC Amber	Pheasant	No status
Common redstart	BoCC Amber	Pied wagtail	BoCC Green
Common sandpiper	BoCC Amber	Pink-footed goose	BoCC Amber
Common whitethroat	BoCC Amber	Raven	BoCC Green
Cormorant	BoCC Green	Red grouse	BoCC Green
Cuckoo	BoCC Red	Red-legged partridge	Not assessed
Curlew	BoCC Red	Redshank	BoCC Amber
Dipper	BoCC Amber	Redwing	Schedule 1, BoCC Amber
Duncock	BoCC Amber	Reed bunting	BoCC Amber
Feral pigeon	Not assessed	Ring ouzel	BoCC Red
Fieldfare	Schedule 1, BoCC Red	Robin	BoCC Green
Garden warbler	BoCC Green	Rook	BoCC Amber
Goldcrest	BoCC Green	Sand martin	BoCC Green
Golden plover	Annex 1, BoCC Green	Sedge warbler	BoCC Amber
Goldeneye	BoCC Red	Siskin	BoCC Green
Goldfinch	BoCC Green	Skylark	BoCC Red
Goosander	BoCC Green	Snipe	BoCC Amber
Goshawk	Schedule 1, BoCC Green	Song thrush	BoCC Amber
Grasshopper warbler	BoCC Red	Sparrowhawk	BoCC Amber
Great black-backed gull	BoCC Amber	Spotted flycatcher	BoCC Red
Great crested grebe	BoCC Green	Starling	BoCC Red
Great spotted woodpecker	BoCC Green	Stock dove	BoCC Amber
Great tit	BoCC Green	Stonechat	BoCC Green
Green woodpecker	BoCC Green	Swallow	BoCC Green
Greenfinch	BoCC Red	Swift	BoCC Red
Grey heron	BoCC Green	Tawny owl	BoCC Amber
Grey wagtail	BoCC Amber	Tree pipit	BoCC Red
Greylag goose	BoCC Amber	Tree sparrow	BoCC Red
Hen harrier	Annex 1, Schedule 1, BoCC Red	Treecreeper	BoCC Green
Herring gull	BoCC Red	Twite	BoCC Red
House martin	BoCC Red	Wheatear (Northern)	BoCC Amber
House sparrow	BoCC Red	Whinchat	BoCC Red
Jack snipe	BoCC Green	White-fronted goose	BoCC Red

Species	Conservation status	Species	Conservation status
Jackdaw	BoCC Green	Whooper swan	Annex 1, Schedule 1, BoCC Amber
Jay	BoCC Green	Willow warbler	BoCC Amber
Kestrel	BoCC Amber	Woodcock	BoCC Red
Kingfisher	Annex 1, Schedule 1, BoCC Green	Woodpigeon	BoCC Green
Lapwing	BoCC Red	Wren	BoCC Green
Lesser black-backed gull	BoCC Amber	Yellowhammer	BoCC Red

³ BoCC – Birds of Conservation Concern (Stanbury et al. 2021)

ANNEX E. COLLISION RISK ASSESSMENTS

A Collision Risk Analysis Area (CRAA) was created using a 500 m buffer of the Proposed Development’s outermost wind turbine locations (Figure 7.3). Using this buffer around the wind turbines accounts for possible inaccuracies in the recording of flightlines and ensures the assessment is precautionary.

The ultimate aim is to have 100 % coverage of the turbines and associated CRAA by the viewsheds, however in practice this is often unachievable as a result of the topography of the Site and limited to no access outwith the Application Boundary. For the Proposed Development, although some small areas of the CRAA remain ‘invisible’ at 70 m above ground level (Figure 7.3), much of the airspace above 70 m would be visible, key to this being altitudes of 78 m and above, which equate to the proposed rotor height.

Table E-1, Table E-2 and Table E-3 present the parameters which apply to each Collision Risk Model (CRM).

Table E-1 Wind farm parameters

Size of wind farm envelope	530.89	hectares (ha)
Number of turbines	10	turbines
Rotor diameter	172	metres (m)
Hub height	164	m
Max. rotor depth	1.11	m (at 15° pitch angle)
Max. chord	4.3	m
Pitch	15	degrees (°)
Rotation period	4.96	seconds (secs)
Turbine operation time	85	percent (%)
Risk height: highest	250	m
Risk height: lowest	78	m
Flight risk volume	913132292	m ³

Table E-2 CRM parameters per species

Species	Length (m)	Wingspan (m)	Assumed flight speed, v (ms ⁻¹)	Avoidance rate	Probability of collision	Bird transit time (secs)
Golden plover	0.28	0.72	17.9	0.98	0.0425	0.0778
Goshawk	0.62	1.65	9.7	0.98	0.0840	0.1787
Greylag goose	0.825	1.635	17.1	0.998	0.0634	0.1133
Herring gull	0.64	1.5	12.8	0.98	0.0686	0.1369
Osprey	0.58	1.7	11.4	0.98	0.0723	0.1485
Pink-footed goose	0.675	1.525	17.3	0.998	0.0579	0.1003

Table E-3 Visible area within the CRAA per vantage point

VP	Area (ha)
1	129.89
2	372.11
3	433.34

Birds are assumed to be active during all the daylight hours and this is estimated by calculating the number of hours per day between sunrise and sunset (adjusting for correct latitude) for the survey seasons as defined in Table E-4 below.

Table E-4 Season definitions per species/species group

Species	Breeding season			Non-breeding season		
	Start date	End date	Hours presumed present	Start date	End date	Hours presumed present
Geese and swans	15 th May	31 st August	1,803	1 st September	14 th May	2,695
Raptors	15 th March	31 st August	2,658	1 st September	14 th March	1,840
Waders	1 st April	31 st July	2,448	1 st August	31 st March	2,050
Other	15 th March	31 st August	2,658	1 st September	14 th March	1,840

Outputs for the CRM for the following species are presented in the following order below:

- Golden plover;
- Goshawk;
- Greylag goose;
- Herring gull;
- Osprey; and
- Pink-footed goose.

E.1 Golden Plover

Non-Breeding Season 2019/2020

Table E-5 Golden plover flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr ¹)
1	0.00	4795.40	0.00
2	198.00	14419.28	0.000002
3	0.00	14950.37	0.00

Table E-6 Golden plover mortality estimates

Mean activity in wind farm at rotor height	0.0009	hr ¹
Total Combined rotor swept volume	323648	m ³
Bird occupancy	1.7517	hrs/season
Bird occupancy of rotor swept volume	2.2351	bird-sec
No. of transits through rotors	28.7224	per season
Estimated collisions	1.2220	per season
Estimated collisions after correction for operation	1.0387	per season
Estimated collisions after avoidance factor	0.0208	per season
Equivalent to 1 bird every	48.1387	seasons

E.2 Goshawk

Breeding Season 2019

Table E-7 Goshawk flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr ¹)
1	0.00	4675.90	0.00
2	0.00	13395.98	0.00
3	74.96	14602.40	0.000001

Table E-8 Goshawk mortality estimates

Mean activity in wind farm at rotor height	0.0003	hr ¹
Total Combined rotor swept volume	402648	m ³
Bird occupancy	0.8992	hrs/season
Bird occupancy of rotor swept volume	1.4274	bird-sec
No. of transits through rotors	7.9899	per season
Estimated collisions	0.6715	per season
Estimated collisions after correction for operation	0.5708	per season
Estimated collisions after avoidance factor	0.0114	per season
Equivalent to 1 bird every	87.5954	seasons

E.3 Greylag Goose

Non-Breeding Season 2019/2020

Table E-9 Greylag goose flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr ¹)
1	0.00	4795.40	0.00
2	187.13	14419.28	0.000002
3	0.00	14950.37	0.00

Table E-10 Greylag goose mortality estimates

Mean activity in wind farm at rotor height	0.0008	hr ¹
Total Combined rotor swept volume	450280	m ³
Bird occupancy	2.1765	hrs/season
Bird occupancy of rotor swept volume	3.8638	bird-sec
No. of transits through rotors	34.0939	per season
Estimated collisions	2.1609	per season
Estimated collisions after correction for operation	1.8368	per season
Estimated collisions after avoidance factor	0.0037	per season
Equivalent to 1 bird every	272.2175	seasons

E.4 Herring Gull

Breeding Season 2019

Table E-11 Herring gull flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr ¹)
1	281.90	4675.90	0.000002
2	603.83	13395.98	0.000005
3	984.77	14602.40	0.000008

Table E-12 Herring gull mortality estimates

Mean activity in wind farm at rotor height	0.0084	hr ¹
Total Combined rotor swept volume	407295	m ³
Bird occupancy	22.4388	hrs/season
Bird occupancy of rotor swept volume	36.0311	bird-sec
No. of transits through rotors	263.1022	per season
Estimated collisions	18.0373	per season
Estimated collisions after correction for operation	15.3317	per season
Estimated collisions after avoidance factor	0.3066	per season
Equivalent to 1 bird every	3.2612	seasons

E.5 Osprey

Breeding Season 2019

Table E-13 Osprey flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr ⁻¹)
1	0.00	4675.90	0.00
2	139.31	13395.98	0.000001
3	0.00	14602.40	0.00

Table E-14 Osprey mortality estimates

Mean activity in wind farm at rotor height	0.0006	hr ⁻¹
Total Combined rotor swept volume	393354	m ³
Bird occupancy	1.6712	hrs/season
Bird occupancy of rotor swept volume	2.5917	bird-sec
No. of transits through rotors	17.4521	per season
Estimated collisions	1.2610	per season
Estimated collisions after correction for operation	1.0718	per season
Estimated collisions after avoidance factor	0.0214	per season
Equivalent to 1 bird every	46.6486	seasons

E.6 Pink-Footed Goose

Non-Breeding Season 2019/2020

Table E-15 Pink-footed goose flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr ⁻¹)
1	0.00	4795.40	0.00
2	0.00	14419.28	0.00
3	18682.82	14950.37	0.0002

Table E-16 Pink-footed goose mortality estimates

Mean activity in wind farm at rotor height	0.0806	hr ⁻¹
Total Combined rotor swept volume	415427	m ³
Bird occupancy	217.3036	hrs/season
Bird occupancy of rotor swept volume	355.9025	bird-sec
No. of transits through rotors	3443.7260	per season
Estimated collisions	199.5605	per season
Estimated collisions after correction for operation	169.6264	per season
Estimated collisions after avoidance factor	0.3393	per season
Equivalent to 1 bird every	2.9477	seasons