ANNEX B. ORNITHOLOGICAL SURVEY METHODOLOGY

A suite of ornithological surveys have been conducted at the proposed Glentarken Wind Farm (the Proposed Development). The methodologies used in these surveys are summarised in the sections below; more detailed descriptions are provided in the NatureScot guidance (2017[i]) 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 2017[i], 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) (SNH 2017[i], 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 2017[i], 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 20 m above ground level[1];
- Reconnaissance surveys were undertaken to refine VP locations;
- The VP locations and associated viewsheds are shown in **Figure 6.3**, **Figure 6.4**, **Figure 6.5** and **Figure 6.6 (EIAR Volume 2)**;
- Care was taken to maximize the area visible whilst minimising disturbance to birds;
- The final 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. This objective was achieved for the majority of the turbines, although two turbines (T6 and T8) were not covered by any of the viewsheds during the 2021 and 2022 breeding or 2021/2022 and 2022/2023 non-breeding seasons; but were covered by the viewsheds used during the 2023 breeding season. All turbines were covered by the viewsheds during the 2023 breeding season (**Annex E** details how this is taken into account in the collision modelling);
- 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 2017[i], 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);
- For surveys from April 2021 until September 2022, the birds' flight heights were defined into five prescribed height bands (0-20 m, 21-40 m, 41-100 m, 101-150 m and >151 m). Surveys from October 2022 onwards used six prescribed height bands (0-20 m, 21-40 m, 41-100 m, 101-150 m, 151-200 m and >201 m). Flight heights 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 proposed rotor height is 18 – 180 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 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 2017[i], 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 (1993[ii]) 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*. (2000[iii]). 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;
- The survey covered all areas within 500 m of the Site; 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.

- 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
- 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 licensed[2] field ornithologists. Extreme care was taken to avoid unnecessary disturbance to breeding birds.

Guidance from NatureScot (SNH 2017[i], 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 2017[i], P12-13);
- 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.

Golden Eagle

Methodology outlined in Hardey *et al.* (2013[vi]) was used as guidance. Extreme care was taken not to disturb potential nests, especially where nesting was confirmed or during periods of extremely wet, hot or cold conditions (Hardey *et al.* 2013[vi]).

- All habitats within 2 km of the Site boundary with the potential to accommodate golden eagle were searched including; Caledonian pine woodland, montane areas, heather moorland, open and unimproved habitat, and where present, sea cliffs;
- Searches carried out between January and March focussed on watching for territorial displays and nest building activities. Occupancy of the home range was confirmed by seeing two adult birds together, or by seeing one bird incubating in the later months (Hardey *et al.* 2013[vi]);
- When searches of a nesting site were carried out, they were done so from a distance, so as to not cause disturbance to any displaying, nesting or incubating birds; and
- Where breeding was confirmed, scans of the nests were carried out in June, to check for the presence of young. Further scans were carried out in late July to search for fledged young.

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 within 2 km were observed for the presence of nests. Searches for goshawk nests were focused on mature forest 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.

[2] All surveyors hold NatureScot Schedule 1 Licences.

Hen Harrier

Methodology outlined in Hardey *et al*. (2013[vi]) was used as guidance for the surveying of areas for potential hen harrier breeding within 2 km. 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 habitat[3] within 2 km 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
- 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 within 2 km.

- 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 2 km 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 within 2 km 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 within 2 km 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;

[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.

- Suitable habitat within 2 km 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 be made in June to watch birds, locate nest-sites and confirm breeding behaviour wherever possible.

White-Tailed Eagle

Methodology outlined in Hardey *et al.* (2013[vi]), as mentioned in NatureScot guidance (SNH 2017[i], P.12) was used as guidance for the surveying of areas for potential white-tailed eagle breeding. Active nests were observed from a distance so as to minimise disturbance.

- All suitable habitats (including open coastal or fresh water, large and small crags and suitable trees) within a 2 km radius were checked for signs of nest sites, breeding territories or communal roosts;
- Surveys within nesting ranges were carried out between November and mid-February, focussing on locating refurbished nest sites;
- Surveys between mid-March and August focussed on locating active nests and young; and
- All suitable crags and trees within nesting ranges were checked for signs of roosts. These include droppings, down, feathers and pellets.

B.5 Black Grouse Survey

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

- Breeding black grouse were surveyed within 1.5 km of the Site boundary 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.
[vi] Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. and Thompson, D. (2013) Raptors: a field guide for surveys and monitoring (3rd edition). The Stationery Office, Edinburgh.