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Chapter 7

Ornithology

Contents

Glossary

Term	Definition
Baseline	The existing conditions that prevail against which the effects of the proposed development are compared.
Birds of Conservation Concern (BoCC)	A five-yearly assessment of ornithological conservation priorities, provided by a review of the population status of birds regularly found in the UK, Channel Islands and the Isle of Man conducted by the UK's leading bird conservation organisations.
Ecological Impact Assessment (EcIA)	Ecological Impact Assessment is a process of identifying, quantifying and evaluating potential effects of development-related or other proposed actions on habitats, species and ecosystems.
Environmental Impact Assessment Report (EIAR)	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations.
Habitat	The area or environment where a species naturally occurs.
Mitigation	Measures, including any process, activity or design to avoid, reduce, remedy or compensate for potential negative effects of a development.
Protected Species	Animals or plants protected by European and/or domestic legislation.
Ramsar Site	A Ramsar Site is a wetland site designated of international importance under the Ramsar Convention.
Scottish Biodiversity List	A list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland.
Site of Special Scientific Interest (SSSIs)	Sites of Special Scientific Interest are protected areas that represent the UK's most important wildlife and/or geological sites.
Special Protection Area (SPA)	Special Protection Area, an internationally important area for nature conservation, specifically birds, classified under the Birds Directive.

List of abbreviations

Abbreviation	Description
BoCC	Birds of Conservation Concern
BTO	British Trust for Ornithology
CEMP	Construction Environmental Management Plan
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CRM	Collision Risk Modelling
CRZ	Collision Risk Zone
ECoW	Environmental Clerk of Works
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
ECU	Scottish Government's Energy Consents Unit
EIAR	Environmental Impact Assessment Report
ES	Environmental Statement
IUCN	International Union for Conservation of Nature
FLS	Forestry and Land Scotland (previously known as Forestry Commission Scotland -FCS)
GL	Glasgow Life
IOF	Important Ornithological Feature
JNCC	Joint Nature Conservation Committee
LBAP	Local Biodiversity Action Plan (for Dumfries and Galloway)
Natural Power	Natural Power Consultants Limited
NHZ	Natural Heritage Zone
PAN	Planning Advice Note
PCH	Potential Collision Height
RSG	Raptor Study Group
RSPB	Royal Society for the Protection of Birds
RWE	RWE Renewables UK Development Limited
SBL	Scottish Biodiversity List
SEI	Supplementary Environmental Information
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage (now known as NatureScot)
SOC	Scottish Ornithologists' Club
SPA	Special Protected Area
SPP	Species Protection Plan
SSSI	Sites of Special Scientific Interest
SWSEIC	South-West Scotland Environmental Information Centre
VP	Vantage Point

Abbreviation	Description
ZoI	Zone of Influence

7.1 STATEMENT OF COMPETENCE

7.1.1 This Environmental Impact Assessment Report (EIAR) chapter has been prepared by suitably qualified and experienced ecologists and all data were collected by suitably qualified and experienced surveyors.

7.1.2 The author of this chapter has 15 years of experience in environmental consultancy and has been working as an Ecological Consultant for the last five and half years. During this time, he has been involved with design, implementation and management of ecological assessments, production and review of EIAR chapters, scoping reports, technical baseline reports and operational monitoring reports as well as client and consultee liaison. The author obtained his M.Sc. Eng. in Environmental Protection from Warsaw University of Life Sciences, Poland. The author was assisted by a Senior Environmental Consultant with five years of experience in undertaking Ecological Impact Assessment (EcIA) and EIAR compilation, and an Associate Technical Director with 10 years of experience in EcIA and EIAR compilation.

7.2 INTRODUCTION

7.2.1 This ornithological chapter of the EIAR has been prepared by Natural Power Consultants (Natural Power) on behalf of RWE Renewables UK Developments Limited (RWE) (the “Applicant”) in respect of the proposed Daer Wind Farm (hereafter referred to as ‘the Proposed Development’). This chapter describes the ornithological interests at the Proposed Development and assesses the predicted effects of the Proposed Development on these interests. It details the methods used to identify the baseline bird community within the Proposed Development Area and the surrounding locale, and the process used to determine the nature conservation value of the bird populations present. The chapter then sets out the potential effects of the Proposed Development on birds during construction, operation and decommissioning, and assesses the significance of potential impacts on bird populations, including cumulative effects, at appropriate bio-geographic scales. An assessment of residual impacts, taking into consideration proposed mitigation measures, is provided. Non-avian ecology is assessed in Chapter 6: Ecology, of the Environmental Impact Assessment Report (EIAR) and complements this chapter.

7.2.2 This EIAR chapter has been prepared following a scoping process which lead to a scoping report issued to consultees in 2018. However, as the baseline monitoring was still ongoing at the time of writing the scoping report, no ornithological features have been scoped out of the assessment at the scoping stage, and all are included in the EcIA. In line with the principles of proportionate Environmental Impact Assessment (EIA), embedded mitigation is considered at the outset of the assessment (see Section 7.6). Furthermore, to ensure proportionality based on the likelihood of potential effects, only ornithological features for which it is considered there may be significant effects in the absence of mitigation are identified as Important Ornithological Features (IOFs) and taken forward for a full EcIA.

7.2.3 Ornithological baseline conditions have been assessed through a combination of desk study and the results of baseline ornithological surveys carried out between March 2018 and September 2019, and between March and August 2020 (see Section 7.3 and Technical Appendix 7.1 for further details). Species are described and evaluated in terms of the recognised criteria outlined in Section 7.3.

7.2.4 The boundary parameters of the Proposed Development Area changed during the period in which baseline surveys were conducted. Initially, the Proposed Development Area consisted of two land portions, Daer and Rivox, both of which were surveyed during 2018 to 2019. However, in August 2019 the Rivox Land Portion was removed from the proposal, and an additional area (Kinnelhead) was added (see Paragraph 7.2.7), with surveys of this additional area undertaken in 2020. The Primary Proposed Access Route was added to the Proposed Development Area in August 2020, after the bird breeding season, and so specific ornithology survey work has not been conducted for this element. Only results concerning the Proposed Development Area in respect of which the application is submitted, are being presented and discussed in this chapter.

7.2.5 All Latin names for species mentioned in this chapter are listed in the Technical Appendix 7.1. Summaries of survey times and dates are also given in the technical appendix. Full survey data, including details of survey dates, times and weather conditions, plus results data, can be provided on request.

7.2.6 The following Figures accompany this EIAR:

- 7.1a: Ornithology Survey Areas 2018-2019;
- 7.1b: Ornithology Survey Areas 2020;
- 7.2: Vantage Point Locations and Viewsheds;
- 7.3a: VP Surveys: Breeding Season 2018: Raptors;
- 7.3b: VP Surveys: Breeding Season 2018: All except raptors;
- 7.3c: VP Surveys: Non-breeding Season 2018/19: Raptors
- 7.3d: VP Surveys: Non-breeding Season 2018/19: All except raptors;
- 7.3e: VP Surveys: Breeding Season 2019: Raptors;
- 7.3f: VP Surveys: Breeding Season 2019: All except raptors;
- 7.3g: VP Surveys: Breeding Season 2020: Raptors (Kinnelhead Development Area);
- 7.3h: VP Surveys: Breeding Season 2020: All except raptors (Kinnelhead Development Area);
- 7.4: Black Grouse Survey Results 2018, 2019 and 2020 (including Kinnelhead Development Area 2020).
- 7.5a: Breeding Bird Survey Results 2018;
- 7.5b: Breeding Bird Survey Results 2019;
- 7.5c: Breeding Bird Survey Results 2020 (Kinnelhead Development Area); and
- 7.6: (Confidential) Raptor Surveys Results 2018-2019.

Terminology

7.2.7 The following areas are defined within this chapter:

- The ‘Proposed Development’: the turbines and all associated infrastructure required for Daer Wind Farm;
- The ‘Proposed Development Area’: all land within the current application boundary, including the Primary Proposed Access Route added in August 2020. No specific ornithological surveys have been undertaken for the access;
- The ‘Primary Proposed Access Route’: the access routing for Daer Wind Farm – leaves the public road to the south east of the Proposed Development Area and approaches the site making use of existing forestry and wind farm tracks (included as part of the Proposed Development Area);
- The ‘Original Site Boundary’: the original application boundary (including Daer and Rivox land portions), which comprised a larger area than the Proposed Development. All 2018-2019 ornithological surveys took place within this boundary (see Figure 7.1a);
- The ‘Daer Land Portion’: Scottish Water Land Ownership, comprising of land south of Daer Reservoir. Wholly within the South Lanarkshire Local Authority Area;
- The ‘Rivox Land Portion’: this Forestry and Land Scotland (FLS - formerly Forestry Commission) owned area of commercial forestry sits to the east of the Proposed Development. It was formerly included within the Original Site Boundary but is not being considered for turbine placement at the EIA report stage. Situated wholly within the Dumfries and Galloway Local Authority Area. Some of the Primary Proposed Access Route goes through this land;
- The ‘Kinnelhead Land Portion’: the entirety of the Kinnelhead Land Ownership, comprising of the Kinnelhead Development Area as well as extended areas to the south and east, covering Mid Height, Harestanes Heights and Peat Hill down to Kinnelhead itself. Situated wholly within the Dumfries and Galloway Local Authority Area.
- The ‘Kinnelhead Development Area’: component area of the Proposed Development Area to the southeast of the Original Site Boundary. The Kinnelhead Development Area is the northern section of the Kinnelhead Land Portion. This consists of land around and in between Hamarty Hill, Lamb Hill, Whiteside Hill and Hoarlaw (see Figure 7.1b). Situated wholly within the Dumfries and Galloway Local Authority Area. All 2020 ornithological survey areas took place within this boundary;
- The ‘Main Wind Farm Area’: the area comprising both the Daer Land Portion and the Kinnelhead Development Area. The area in which the wind turbines, met masts, substation and construction area (plus associated tracks) are proposed to be located;
- ‘Collision Risk Zone’ (CRZ): this is the area derived by applying a buffer around each turbine with a radius equal to the length of the turbine blades, plus an additional precautionary 200 m;
- ‘The Survey Area’: the area within which ornithological baseline surveys were carried out, comprising the following:
  - Vantage Point (VP) surveys: viewsheds extended to 2 km from VP locations (see Figure 7.2);
  - Breeding raptor surveys: all suitable breeding habitat within the Original Site Boundary and the Kinnelhead Development Area (see Figures 7.1a-b);
  - Breeding bird surveys: open habitat within the Original Site Boundary and the Kinnelhead Development Area (see Figures 7.1a-b); and
  - Black grouse surveys: all suitable lekking habitat within the Original Site Boundary and the Kinnelhead Development Area (see Figures 7.1a-b); and
- ‘Zone of Influence (ZoI)’: this is “the area over which ecological features may be subject to significant effects as a result of the proposed project or associated activities” (Chartered Institute of Ecology and Environmental Management (CIEEM)).

Legislation, policy and guidance

7.2.8 The ornithological baseline surveys and subsequent assessment have been carried out with reference to a number of national policy documents, as addressed in Chapter 4: Climate Change, Legislative and Policy Context and Chapter 6: Ecology, of the EIAR. Legislative and guidance documents with specific relevance to ornithology are listed below:

Legislation:

- Directive 2009/147/EC on the Conservation of Wild Birds (the Birds Directive);
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), which transposes the Habitats Directive into law in Scotland (except relating to reserved matters); and
- The Conservation of Habitats and Species Regulations 2017 (as amended), relating to reserved matters in Scotland including the granting of consent under section 36 of the Electricity Act (together, "the Habitats Regulations");
- Wildlife and Countryside Act 1981 (as amended);
- The Nature Conservation (Scotland) Act 2004; and
- The Wildlife and Natural Environment (Scotland) Act 2011.

Policy:

- PAN 60: Planning for Natural Heritage (Scottish Government 2000); and
- Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives: Scottish Executive Circular 6/1995 as amended (June 2000).

Guidance:

7.2.9 Scottish Natural Heritage (SNH) officially changed their name to NatureScot in August 2020 and Forestry Commission Scotland (FCS) officially changed to Forestry and Land Scotland (FLS) in April 2019. References to documents published by these bodies are referred to using the name at the time that the relevant document was written, meaning that some document references within this chapter use the former names of these bodies.

- CIEEM (2018) Guidelines for EcIA in the United Kingdom and Ireland[1];
- SNH (2017) Recommended bird survey methods to inform impact assessment of onshore wind farms[2];
- Birds and Wind Farms: Risk Assessment and Mitigation[3];
- Developing field and analytical methods to assess avian collision risk at wind farms[4];
- SNH (2000) Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action[5];
- SNH (2018) Assessing significance of impacts from onshore windfarms on birds outwith designated areas[6];
- SNH (2009) Monitoring the impacts of onshore wind farms on birds[7];
- SNH (2009) Guidance on methods for monitoring bird populations at onshore wind farms[8];
- SNH (2018) Avoidance rates for the onshore NatureScot wind farm collision risk model[9];
- SNH (2018) Assessing the cumulative impact of onshore wind energy developments[10];
- SNH (2016) Assessing connectivity with Special Protection Areas (SPAs)[11];
- Natural Research (2017) A Review of Disturbance Distances in Selected Bird Species[12];
- British Standard 42020:2013 Biodiversity – code of practice for planning and development;
- Natural Heritage Zone (NHZ) bird population estimates. Scottish Windfarm Bird Steering Group (SWBSG). Commissioned report number 1504[13];
- Bird Monitoring Methods[14];
- A method for censusing upland breeding waders[15];
- Raptors: A Field Guide to Survey and Monitoring[16];
- SR; SNH; SEPA (2010) Good Practice during Wind Farm Construction[17];
- Birds of Conservation Concern (BoCC) 4: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man[18];
- The Local Biodiversity Action Plan (LBAP)[19]; and
- Scottish Biodiversity List (SBL).

7.3 METHOD OF ASSESSMENT

Key issues

7.3.1 It is widely accepted that wind turbines present three main areas of potential risk to birds[20, 3]:

1. Direct habitat loss resulting from the construction of a wind farm and associated infrastructure;
2. Displacement of birds from wind farms due to disturbance during the construction and operational phases; this may be temporary or permanent. Displacement can include barrier effects in which birds alter their migration flyways or local flight paths to avoid a wind farm; and
3. Death due to collision or interaction with rotating turbine blades, overhead wires, guy lines and fencing. Collision risk depends on a range of factors related to bird species, numbers and behaviour, weather conditions, and topography, and the nature of the wind farm itself, but is generally considered to be of particular relevance for sites located in areas known to support raptors or large concentrations of wildfowl.

7.3.2 These issues are considered in this assessment (Section 7.6).

7.3.3 The potential key avian ecology issues relating to the Proposed Development are as follows:

- The potential to adversely affect defined populations of bird species afforded the highest level of statutory protection via inclusion in Annex I of Directive 2009/147/EC on the Conservation of Wild Birds and/or Schedule

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[1] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester. Version 1.1 – Updated September 2019.

[2] SNH (2017) Recommended bird survey methods to inform impact assessment of onshore wind farms. Scottish Natural Heritage, Battleby.

[3] de Lucas, M., Janss, G. & Ferrer, M. (eds.) (2007) *Birds and Wind Farms: risk assessment and mitigation*. Quercus, Madrid.

[4] Band, W., Madders, M. & Whitfield, D.P. (2007) Developing field and analytical methods to assess avian collision risk at wind farms. In de Lucas, M., Janss, G. & Ferrer, M. (eds.) *Birds and Wind Farms*: *risk assessment and mitigation*. Quercus, Madrid.

[5] SNH (2000) Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action. Scottish Natural Heritage, Edinburgh.

[6] SNH (2018) Assessing significance of impacts from onshore windfarms on birds outside designated areas. Scottish Natural Heritage, Inverness.

[7] SNH (2009) Monitoring the impact of onshore wind farms on birds (Guidance note). Scottish Natural Heritage, Edinburgh.

[8] SNH (2009) Guidance on methods for monitoring bird populations at onshore wind farms. Scottish Natural Heritage, Edinburgh.

[9] SNH (2018) Avoidance rates for the onshore SNH wind farm collision risk model. Scottish Natural Heritage, Battleby.

[10] SNH (2018) Assessing the cumulative impacts of onshore wind farms on birds: guidance. Scottish Natural Heritage, Inverness.

[11] SNH (2016) Assessing connectivity with Special Protection Areas (SPAs) (Guidance note: Version 3). Scottish Natural Heritage, Edinburgh.

[12] Ruddock, M. & Whitfield, D.P., (2007) *A Review of Disturbance Distances in Selected Bird Species*. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

[13] Wilson, M.W., Austin, G.E., Gillings, S. & Wernham, C.V. (2015) *Natural Heritage Zone bird population estimates*. SWBSG commissioned report number 1504. Pp72. Available from www.swbsg.org

[14] Gilbert, G., Gibbons, D.W. & Evans, J. (1998) *Bird Monitoring Methods*. RSPB, Sandy.

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

[16] Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. & Thompson, D. (2013) *Raptors: a field guide to survey and monitoring*. 3rd Edition. The Stationery Office, Edinburgh.

[17] Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland (2010) *Good practice during windfarm construction.*

[18] Eaton M.A., Aebischer N.J., Brown A.F., Hearn R.D., Lock L., Musgrove A.J., Noble D.G., Stroud D.A. and Gregory R.D. (2015) *Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man.* British Birds 108, 708–746.

[19] The Dumfries and Galloway Local Biodiversity Action Plan (2009) Available at https://swseic.org.uk/resource/dglbap-part1/

[20] Drewitt, A.L. & Langston, R.H.W. (2006) Assessing the impacts of wind farms on birds. *Ibis*, 148: 29-42 (and references therein).

1 of the Wildlife and Countryside Act 1981 (as amended). Such an effect may arise through habitat loss, disturbance or displacement, more directly through collisions with the turbines, or indirectly through cumulative impacts;

- The potential to adversely affect defined populations of geese and other wildfowl due to the risk of turbine collisions as they fly through the area on migration or while commuting locally;
- The potential to adversely affect defined populations of breeding and/or non-breeding raptor and owl species through turbine collision risk, habitat loss and/or displacement; and
- The potential to adversely affect defined populations of breeding wader species, through habitat loss, disturbance, displacement and collisions with the turbines.

Target species

7.3.4 NatureScot guidance[2] suggests that assessment of the effects of wind farms on birds should, in most circumstances, be limited to those protected species and other species of conservation concern that, as a result of their flight patterns or response behaviour, are likely to be affected by or subject to significant and adverse impacts from wind farms. The guidance states that there are three overarching lists describing protected species and species of conservation concern:

1. Species listed in Annex I of the Council Directive 2009/147/EC on the Conservation of Wild Birds (Annex I species);
2. Species protected under Schedule 1 of the Wildlife & Countryside Act 1981 (as amended) (Schedule 1 species); and
3. Red-listed Birds of Conservation Concern as identified in BoCC (Red listed species).

7.3.5 In addition, consideration should be given to LBAP species, SBL species and any other species for which a proposed development site hosts a particular concentration.

7.3.6 Within these lists, NatureScot recommends that the greatest attention should be paid to those species which as a result of their flight patterns or response behaviour, may be subject to impact from wind farms (such as raptors) and any species that are not particularly manoeuvrable in flight (e.g. geese and swans). Such species are termed 'target species'.

7.3.7 In accordance with NatureScot guidance[2], surveys focused on the following target species:

- All raptors and owls listed in Annex I of the EC Birds Directive and/or Schedule 1 and 1A of the WCA 1981 (as amended);
- All species of wildfowl (with the exception of Canada goose and mallard);
- Black grouse; and
- All wader species.

7.3.8 Secondary species[21] (species of lesser conservation concern) included the following:

- All other waterfowl (e.g. mallard and grey heron);
- All other raptor species;
- Raven;
- Gull species;
- Crossbill species; and
- Any large aggregations of red-listed passerines.

7.3.9 Proposed wind farm sites may differ considerably in their ornithological sensitivity; NatureScot guidance[2] therefore recommends that survey programmes and the level of survey effort should be tailored to an individual site's needs.

Desk study

7.3.10 A desk study was undertaken in August 2019 to collate public domain survey data, data not in the public domain from third-party bodies, and the outcome of consultations. The purpose of the desk study was to provide information on bird populations in and around the Proposed Development. This information, combined with baseline survey results, was utilised to put each target bird species recorded within the Survey Area into context in terms of its importance at the Proposed Development.

7.3.11 Existing ornithological records within a 5 km radius of the Survey Area, held by the Raptor Study Group (RSG), Royal Society for the Protection of Birds (RSPB), Glasgow Life (GL), and the South-West Scotland Environmental Information Centre (SWSEIC) were acquired. Searches for species data were limited to data from within the past 10 years (2009-2019). Data from the record centres were received before the removal of the Rivox Land Portion from, and addition of the Kinnelhead Land Portion to, the proposal and so these records relate to a 5km radius of the original site boundary. However, RSG data was received later and so the request was amended to include a 5km buffer of the Kinnelhead Land Portion. Due to the timing of the addition of the Primary Proposed Access Route (August 2020), no desk study data has been obtained for a full buffer of this part of the Proposed Development Area. However, as there will be limited land take and no turbine infrastructure associated with this area of the Proposed Development, and pre-construction surveys of the track will be carried out as part of the embedded mitigation proposals to prevent disturbance to breeding birds (see Paragraphs 7.6.30 to 7.6.32) it is not considered that additional data for the buffer of the track are necessary for understanding of the impacts associated with it.

7.3.12 A search was made for all sites with an international and national authority designation for ornithological interests. This included SPAs, Ramsar sites, and Sites of Special Scientific Interest (SSSIs) within a 10 km radius of the Survey Area. In addition, all SPAs, Ramsar sites and SSSIs within 25 km of the Survey Area with geese or gulls listed as a qualifying feature were also included in the search. The following sources were accessed to obtain information on designated sites:

- Joint Nature Conservation Committee (JNCC)[22]; and
- NatureScot Sitelink website[23].

Ornithological survey programme

7.3.13 In order to assess the potential effects of a wind farm on birds, both the value of the site itself to birds and the level of flight activity within and around the site should be determined. In view of the target species identified as potentially occurring within the Proposed Development Area, and following consultation with NatureScot, the surveys listed below were undertaken, in line with NatureScot guidance[2].

- Breeding season VP surveys in 2018 and 2019 (March to August inclusive; covering the Original Site Boundary);
- Breeding season VP surveys in 2020 (March to August inclusive; Kinnelhead Development Area only);
- Non-breeding season VP surveys in 2018/19 (September to February, inclusive; covering the Original Site Boundary);

[21] Secondary species are species which may also be sensitive to wind farm development, but which are of lesser conservation concern or lower sensitivity than target species. Some secondary species may be targets at some sites (e.g. near an SPA designated for gull species).

[22] http://www.jncc.gov.uk

[23] https://sitelink.nature.scot/home

- Breeding raptor surveys: April to July 2018 and 2019 (covering the Original Site Boundary);
- Breeding raptor surveys: April to July 2020 (covering the Kinnelhead Development Area only);
- Upland breeding bird survey: April to July 2018 and 2019 (covering the Original Site Boundary);
- Upland breeding bird survey: April to July 2020 (covering the Kinnelhead Development Area only);
- Black grouse lek survey: April and May 2018 and 2019 (covering the Original Site Boundary);
- Black grouse lek survey: April and May 2020 (covering the Kinnelhead Development Area only);
- Barn owl survey: May and July 2018 (excluding Kinnelhead Development Area); and
- Nightjar lek survey (within Rivox Land Portion only): June 2019.

7.3.14 A summary of each of the baseline ornithology survey methods is given below. Further survey method details, along with dates of survey visits and analysis methods are given in Technical Appendix 7.1. Full survey details including survey timings and weather conditions can be provided on request.

Vantage Point surveys (flight activity survey)

7.3.15 As agreed with NatureScot during the consultation process (see Table 7.5), flight activity surveys covering two breeding seasons and one winter were undertaken between March 2018 and August 2019. These surveys were undertaken from 10 VP locations which covered the Original Site Boundary (see Figure 7.1a); from these surveys only data which is included in the current Main Wind Farm Area are used for this assessment. An additional six months of surveys were undertaken for the Kinnelhead Development Area from one VP location (Figure 7.1b) between March and August 2020 (see Table 7.6).

7.3.16 The flight activity survey focuses on identifying flight lines and flight heights of target species, such as wildfowl and raptors, and allows any regular patterns of flight lines to be identified, allowing turbine locations to be designed to minimise collision risk to birds. The data generated can also be used to estimate the theoretical collision risk of a particular species.

7.3.17 All incidental records of target species (i.e. birds that were not in flight, birds that were heard but not seen, birds that were observed well beyond the survey area and records outside of the formal VP surveys) were also recorded to provide context, although these records do not contribute to any analysis of flight activity. Flight activity of secondary species was also recorded in accordance with NatureScot guidance[2].

7.3.18 The time and duration of the flight were recorded, and the altitude of the target bird(s) was recorded at the start of the observation and at 15 second intervals thereafter into one of five height bands: (1) <20 m, (2) 20-100 m, (3) 100-150 m, (4) 150-200 m and (5) >200 m. These height bands are further referred to as height band 1, 2, 3, 4 and 5.

Breeding raptor surveys

7.3.19 Breeding raptor surveys were undertaken within the Original Site Boundary between April and July 2018 and 2019, and in the Kinnelhead Development Area between April and July 2020. A combination of VP surveys, and walkover surveys over suitable breeding habitat was undertaken. VP surveys were carried out with the aim of identifying courtship displays and territorial behaviour and walkover surveys were to check for signs of breeding raptors and, where relevant, to locate nest sites. All surveys followed the methods described in Hardey *et al*. (2013)[16] and were carried out under a Schedule 1 Licence by suitably experienced surveyors.

Breeding bird surveys

7.3.20 Breeding bird surveys were undertaken in the breeding seasons of 2018 and 2019 within the Original Site Boundary, and in the Kinnelhead Development Area in 2020, covering all areas of open habitat. Surveys used the standard methodology for assessing upland wader populations, as described by Brown and Shepherd (1993)[15]. This generic upland bird methodology is used to survey breeding upland wading birds to map the distribution and estimate the abundance of breeding birds in proposed development area. The latest NatureScot recommendation[2] is that only waders, skuas, gulls, red grouse and some wildfowl species are targeted during upland breeding bird surveys and recording of moorland passerine species is generally not required. Although moorland passerine species were recorded during the breeding bird surveys, no territory analysis was carried out for these species.

7.3.21 Four survey visits were carried out within the Survey Area between April and July, as recommended by Calladine *et al*. (2009)[24]. After the last survey visit, records from all visits were combined and analysed to estimate the location of breeding territories. Territories were identified using a cluster analysis method, as outlined in Bibby *et al.* (2000)[25].

Black grouse surveys

7.3.22 Surveys for lekking black grouse were carried out within the Original Site Boundary between April and May of 2018 and 2019, and again in the Kinnelhead Development Area in April and May of 2020 following the 'National Black Grouse Survey Instructions'[26] summarised in Gilbert *et al*. (1998)[14], though in 2018 survey access to some areas was limited due to livestock (see Paragraphs 7.3.33 to 7.3.37). Known lek locations were visited, and areas of suitable lekking habitat were identified within 1.5 km (access permitting) of the proposed turbine locations. Once identified, these areas of suitable habitat were visited 2-3 times on different days around the hours of dawn to identify whether lekking males were present. Where a lek site was detected, lekking males and any females attending the site were observed from a suitable VP, and the numbers of birds counted.

Barn owl surveys

7.3.23 Barn owl surveys were carried out in 2018 in potentially suitable nesting habitat within the Original Site Boundary. Barn owls or their signs, such as pellets and splashing were recorded. Owing the absence of any evidence of breeding barn owl within the Original Site Boundary, and as agreed in consultation with NatureScot, these surveys were not repeated in 2019 and 2020.

Nightjar surveys

7.3.24 Nightjar surveys were carried out in summer 2019 in the Rivox Land Portion of the Original Site Boundary. Survey visits were undertaken in line with guidance outlined in Gilbert *et al*. (1998)[14]. A daytime visit in late May was carried out to identify areas of suitable habitat for nightjar (including clear-fell, young forestry plantation and lowland heath) and two further visits were undertaken in June and July within all suitable habitat at dusk. No evidence of nightjar presence was found during these surveys. As the Rivox Land Portion is no longer considered for turbine placement, and the Daer Land Portion and Kinnelhead Land Portion don't contain suitable breeding habitat for nightjars, this species is not considered further in this assessment.

Collision risk modelling

7.3.25 Collision risk modelling (CRM) is often used at proposed wind farm developments to predict the number of individuals of target bird species that might collide with the wind turbine rotors. A popular method for doing this is the Band *et al.* (2007)[4] collision risk model, recommended by NatureScot[5], and this approach was followed in this assessment.

[24] 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.

[25] Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S. (2000) *Bird census techniques*. Elsevier.

[26] Etheridge, B. & Baines, D. (1995) Instructions for the Black Grouse Survey 1995/6. Unpublished document, RSPB/GCT/JNCC/SNH, Edinburgh.

7.3.26 Where there was sufficient flight activity within the Collision Risk Zone (CRZ) at Potential Collision Height (PCH), CRM was used to predict the number of individuals per target species that might collide with the wind turbine rotors. The CRZ is defined as a 277.5 m buffer of the proposed turbine locations, representing the longest rotor blade length to be used at the site plus a 200 m precautionary buffer zone. Since the height within which the proposed turbine blades will rotate falls within height bands 2, 3 and 4, only flights within these height bands were considered at potential collision risk.

7.3.27 In the interests of proportionality, in order to exclude species rarely present for which significant collision impacts due to the Proposed Development are highly unlikely sufficient flight activity to qualify for CRM was defined as ≥ 3 flights or ≥ 10 individuals at PCH in the CRZ over either the breeding or non-breeding seasons. Breeding season was defined as March to August (inclusive) and the non-breeding season was defined as September to February (inclusive).

7.3.28 Two rounds of CRM were carried out to estimate the number of collisions that would occur over the Main Wind Farm Area. Data collected between March 2018 and August 2019 from VP1-VP7 (see Figures 7.3a-f) constitute one dataset (the Daer Land Portion dataset). Additional data collected between March and August 2020 from a single VP overlooking the Kinnelhead Development Area (see Figures 7.g-h) constitute a second dataset (the Kinnelhead Development Area dataset). These estimates are presented and discussed separately.

7.3.29 All of the species eligible for collision risk modelling according to the criteria above are species expected to spend time travelling within the site ('non-directional flight') rather than passing directly through, with the exceptions of greylag and pink-footed geese. For these non-directional species, the observed time spent flying within the CRZ at PCH is calculated and extrapolated up to predict the number of transits through the rotor-swept volume per season. This analysis was used to predict curlew, golden plover, hen harrier, red kite, lapwing, marsh harrier, oystercatcher, peregrine and snipe collisions during the breeding seasons 2018-2019, and red kite and curlew in 2020. Non-breeding season estimates (September 2018 to February 2019 inclusive) were obtained for golden plover, red kite and peregrine collisions.

7.3.30 As greylag and pink-footed geese are typically commuter species that pass directly through a site, the mean linear direction of flights for each species was calculated. The longest length between two turbines, perpendicular to the linear means was extracted and added to twice the CRZ buffer. This gave the species-specific risk window length, which contributes to the proportion of risk area that is rotor swept. The number of birds observed is extrapolated up to predict the number of birds per season, then multiplied by the proportion of rotor swept risk area. This analysis was used to predict greylag goose collisions during summer (breeding) seasons 2018-2020 and pink-footed goose collisions during the wintering (non-breeding) season (September 2018 to February 2019 inclusive).

7.3.31 The number of flights or flight activity is then used to estimate the number of birds expected to pass through the rotor swept area or volume respectively, and combined with the probability of a bird colliding with a blade if it does pass through the rotor swept area, to give a predicted number of collisions in the absence of avoidance behaviour. This is then combined with a parameter representing avoidance behaviour likely to be displayed by birds flying towards turbine blades. Collision estimates were calculated based on a range of avoidance rates including species-specific avoidance rates as recommended by NatureScot[9].

7.3.32 For each species, the risk of collision for an individual is calculated by estimating the likelihood of collision based on the characteristics of the birds and of the turbines. Wind farm specifications and bird characteristics used in the model are provided in Technical Appendix 7.1.

Survey limitations

Access restrictions

7.3.33 Whilst access within the Main Wind Farm Area was not restricted, due to land ownership restrictions it was not possible for surveyors to access survey buffers outwith the Main Wind Farm Area. In 2018 and 2019, this meant that only land within the Original Site Boundary could be accessed (see Figure 7.1a), and in 2020 only land which fell within either the Original Site Boundary or the Kinnelhead Land Portion could be accessed (see Figure 7.1b). As such, the recommended buffers of infrastructure for raptors, upland breeding birds, black grouse and barn owl were not accessed by surveyors where they fell outwith the Daer, Rivox or Kinnelhead Land Portions. However, in order to provide as much survey coverage as possible to these areas, the surveyors scanned the extent of the buffer that was visible from the edge of the ownership boundary with binoculars. In this way data could be collected on the presence of, for example, displaying raptors and lekking black grouse, in areas beyond those accessible to surveyors.

7.3.34 Also, due to restricted access outwith the Survey Area the VP locations had to be located within the Main Wind Farm Area. This limitation was mitigated by increasing the number of VP locations to ensure full coverage of the Main Wind Farm Area, and that all proposed turbine locations were overlooked by VPs which were not in close proximity to them. Surveys were planned such that VPs which may influence bird behaviour in the viewshed of another VP were not undertaken concurrently.

7.3.35 As a result of unfavourable weather conditions during early spring 2018 and associated problems with lambing, the access to some areas of the Daer Land Portion was withdrawn by the tenant farmer during late April and early May 2018 to prevent disturbance to livestock during surveys. To address these limitations a series of measures was implemented, such as rescheduling surveys and conducting surveys from alternative locations scanning the restricted areas from their boundaries. These constraints were discussed with NatureScot and further details are provided in Section 7.4 (Table 7.6). The survey programme during the second breeding season (2019) was not affected by similar access issues.

Changes to the Proposed Development

7.3.36 The boundary parameters of the Proposed Development have changed during the period in which baseline surveys were conducted. The major changes were withdrawing the Rivox Land Portion from development and adding the smaller Kinnelhead Development Area following completion of survey work in the Original Site Boundary. Some of the airspace over this additional area was covered by VP viewsheds used to survey the Original Site Boundary, and so given:

- the comparatively small area covered by the Kinnelhead Development Area;
- the existing VP coverage of some areas within the Kinnelhead Development Area;
- the similarity in habitat and landscape character of the Kinnelhead Development Area to areas surveyed previously within the Original Site Boundary;
- the relatively low levels of flight activity recorded during the non-breeding season compared to the breeding season in the Original Site Boundary; and
- application timescales

7.3.37 Natural Power initially proposed undertaking impact assessment for the Proposed Development using the data already collected for the Original Site Boundary and taking a precautionary approach where data gaps exist. In an email from John Gibson dated 29 October 2019, NatureScot confirmed that they were satisfied with this approach (see Table 7.6) and agreed that requirement for further 18 months of survey of the Kinnelhead Development Area would not be proportionate and would delay the application unnecessarily, However as application timescales allowed, six months of surveys covering the Kinnelhead Development Area were conducted during the breeding season 2020 in order to reduce data gaps caused by the late change in the Proposed Development Area. In light of the factors outlined above, it is considered that the data collected during the 2020 breeding season in the Kinnelhead Development Area, in addition to data from 2018-2019 collected for the Original Site Boundary, is sufficient to characterise the baseline conditions at the Proposed Development and identify those IOFs for which there is the potential for significant effects.

Approach to impact assessment

7.3.38 This section presents the approach taken to the EcIA within this chapter and provides an overview of how the potential for impact has been determined and the method by which impact significance has been ascertained. The approach to the EcIA adopted within this assessment follows the CIEEM guidelines[1], and in line with these guidelines professional judgement has been applied where appropriate. The criteria used and the underlying rationale are described further within the following sections.

Evaluating ornithological features

7.3.39 The assessment process involves identifying IOFs, in accordance with CIEEM guidelines[1]. Assigning a value level to ornithological features is undertaken with reference to the criteria defined in Table 7.1. It should be noted that these criteria are intended as a guide and are not definitive; professional judgement has also been applied in determining value level for ornithological features.

Table 7.1: Approach used to evaluate ornithological features by defined geographical context

Level of value	Example of IOF
International	A regularly occurring species listed as a qualifying feature of an internationally designated site (e.g. SPA or Ramsar wetland site) within the ZoI of the development.
	Species populations present with sufficient conservation importance to meet criteria for SPA selection[27].
National	A regularly occurring species listed as a qualifying feature of a nationally designated site (e.g. SSSI) within the ZoI of the development.
	Species populations present with sufficient conservation importance to meet criteria for SSSI selection[28, 29, 30].
Regional	A species occurring within SPAs, Ramsar sites and SSSIs, but not crucial to the integrity of the site.
	Species populations present falling short of SSSI selection criteria but with sufficient conservation importance to likely meet criteria for selection as a local site e.g. important in the context of NatureScot Natural Heritage Zone populations.
Local	Species described above but which are present very infrequently or in very low numbers.
	Other species of conservation concern, including species included on the UK BoCC Red and Amber Lists[18].
Negligible	All other species that are widespread and common and which are not present in locally important (or greater) numbers and which are considered to be of low conservation concern (e.g. UK BoCC Green List species[18]).

7.3.40 The assessment of ornithological features recorded during the baseline surveys also considers the importance of the Proposed Development Area for the species under consideration, rather than only considering the nature conservation importance of the species itself. As such a species of international conservation importance may only have local or negligible importance in the context of the proposed development if very rarely recorded at the site.

7.3.41 Therefore, while the importance of the species is taken into account, in order to assess the nature conservation importance of the site the number of individuals of that species using it and the nature and level of this use is also taken into account. An assessment is then made of the importance of the Proposed Development Area to the species in question, in order to determine whether they are an IOF.

7.3.42 In line with the principles of proportionate EIA, embedded mitigation is considered at the outset of the assessment. IOF status has only been assigned where there is still considered to be the potential for significant effects to the feature at the assigned value level arising from the Proposed Development, after the application of embedded measures.

Characterising potential effects on ornithological features

7.3.43 Effects on IOFs are judged in terms of magnitude and duration.

7.3.44 Magnitude refers to the size of an impact and is determined on a quantitative basis where possible. This may relate to the area of habitat lost to the development footprint in the case of a habitat feature, or predicted loss of individuals in the case of a population of a particular species of bird. Within this EcIA, magnitude is assessed within six levels, as detailed in Table 7.2 below.

Table 7.2: Criteria used within this EcIA to determine the magnitude of ecological impacts

Impact magnitude	Description
Very highly negative	Total or almost complete loss of an ornithological feature resulting in a permanent adverse effect on the integrity[31] of the feature. The conservation status of the feature would be permanently affected.
Highly negative	Result in large-scale, permanent changes in an ornithological feature, likely to change its ecological integrity. These impacts are therefore likely to result in overall changes in the conservation status of the feature.
Moderately negative	Includes moderate-scale long-term changes in an ornithological feature, or larger-scale temporary changes; however, the integrity of the feature is not likely to be affected. This may result in temporary changes in the conservation status of the feature, but these are reversible and unlikely to be permanent.
Low negative	Includes impacts that are small in magnitude, with small-scale temporary changes, and where integrity of an ornithological feature is not affected. These effects are unlikely to result in overall changes in the conservation status of the feature.
Negligible	No perceptible change in an ornithological feature.
Positive	The changes in an ornithological feature are considered to be beneficial to its ecological integrity or nature conservation status.

[27] An area is used regularly by 1% or more of the Great Britain (or in Northern Ireland, the all-Ireland) population of a species listed in Annex I of the Birds Directive (79/409/EEC as amended) in any season; an area is used regularly by 1% or more of the biogeographical population of a regularly occurring migratory species (other than those listed in Annex I) in any season; an area is used regularly by over 20,000 waterfowl (waterfowl as defined by the Ramsar Convention) or 20,000 seabirds in any season.

[28] Drewitt, A.L., Whitehead, S. and Cohen, S. 2020. Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 17 Birds (version 1.1). Joint Nature Conservation Committee, Peterborough.

[29] Areas which regularly support 1% or more of the total British breeding population of any native species (as per Woodward *et al.*, 2020), including lekking and feeding areas and seabird colonies of over 10,000 breeding pairs; Areas which regularly support 1% or more of the total British non-breeding population of any native species in any season and non-breeding waterbird assemblages of over 20,000 individuals (as per Woodward *et al.*, 2020).

[30] Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D.A. & Noble, D. (2020). Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 113: 69–104.

[31] Note that integrity in this context refers to ecological integrity of a population of a species at a defined value level, i.e. the maintenance of the conservation status of a population of a species at a specific location or geographic scale. This should not be confused with the specific term 'Site Integrity' used in Appropriate Assessment for Natura 2000 sites.

7.3.45 In the case of designated sites, spatial magnitude is assessed in respect of the area within the designated site boundary. For non-designated sites, spatial magnitude is assessed at an appropriate scale depending on the feature's importance e.g. impacts on breeding bird populations are assessed in a regional context.

7.3.46 Effects and spatial magnitude are assessed within the appropriate bio-geographic regions as recommended in NatureScot guidance[6]. These are detailed below:

- Effects on breeding bird populations are assessed in a regional context. The appropriate regional bio-geographic unit has been identified by NatureScot as Natural Heritage Zones (NHZ). NHZ classifications represent areas with a high level of bio-geographic coherence and are unrelated to administrative boundaries;
- The Proposed Development lies within the Western Southern Uplands and Inner Solway NHZ (NHZ 19) and regional impacts are assessed within this area as far as is practicable; and
- Effects on non-breeding bird populations are assessed in a national context.

7.3.47 Duration is defined as the time for which the impact is expected to last before recovery, i.e. return to pre-construction baseline conditions. The criteria used for describing duration in this EcIA is summarised in Table 7.3 below.

Table 7.3: Criteria used in this EcIA for describing duration

Duration	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees which need > 25 years to reach maturity, or restoration of ground after removal of a development. Such exceptions are termed "very long-term effects").
Temporary	Long-term (15 - 25 years or longer; see above) Medium term (5 – 15 years) Short-term (up to 5 years)

7.3.48 Knowledge of how rapidly the population or performance of a species is likely to recover following loss or disturbance (e.g. by individuals being recruited from other populations elsewhere) is used to assess duration, where such information is available.

7.3.49 In addition, birds are assessed with consideration for their behavioural sensitivity and ability to recover from temporary negative conditions. Behavioural sensitivity is determined subjectively based on the species' ecology and behaviour, using the broad criteria set out in Table 7.4 below. The judgement takes account of information available on the responses of birds to various stimuli (e.g. predators, noise and disturbance by humans).

Table 7.4: Behavioural sensitivity of birds

Sensitivity	Definition
High	Species or populations occupying habitats remote from human activities, or that exhibit strong and long-lasting (guide: > 20 minutes) reactions to disturbance events.
Moderate	Species or populations that appear to be warily tolerant of human activities, or that exhibit short-term reactions (guide: 5-20 minutes) to disturbance events.
Low	Species or populations occupying areas subject to frequent human activity and exhibiting mild and brief reaction (including flushing behaviour) to disturbance events.

7.3.50 It should be noted that behavioural sensitivity can differ between similar species and between different populations of the same species. Thus the behavioural responses of birds are likely to vary with both the nature and context of the stimulus and the experience of the individual bird. Sensitivity also depends on the activity of the bird, for example, a species is likely to be less adaptable to disturbance whilst breeding than at other times. In addition, individual birds of the same species will differ in their tolerance depending on the level of human disturbance that they regularly experience in a particular area, and have become habituated to (e.g. individuals that live in an area with high levels of forestry activity and associated disturbance are likely to have a greater tolerance than those that occupy remote locations with little or no human disturbance). However, tolerance is likely to increase as breeding progresses.

Determining significance of potential ornithological effects

7.3.51 Only features for which there is considered to be the potential for significant effects are identified as IOFs and taken forward for EcIA. Having followed the process of identifying an IOF, determining its sensitivity, and characterising potential impacts, the significance of the effect is then determined. The CIEEM guidelines[1] use only two categories to classify effects: "significant" or "not significant". In this EIAR chapter, significance of effects is assessed following an assumption of the application of embedded mitigation measures (see Paragraph 7.6.23). The significance of an effect is determined by considering the importance of the feature, the magnitude of the effect and applying professional judgement as to whether the integrity of the feature will be affected. The assessment includes potential impacts on each IOF from all phases of the development, e.g. construction, operation and decommissioning, and considers direct, indirect, secondary and cumulative impacts and whether the impacts and their effects are short, medium, long-term, permanent, temporary, reversible, irreversible, positive and/or adverse.

7.3.52 Effects are more likely to be considered significant where the feature affected is of higher conservation importance or where the magnitude of the effect is high. Effects not considered to be significant would be those where the integrity of the feature is not threatened, effects on features of lower conservation importance, or where the magnitude of the effect is low.

7.3.53 With reference to CIEEM[1], paragraph 5.25 provides "A significant effect is simply an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. A significant effect is a positive or negative ecological effect that should be given weight in judging whether to authorise a project".

7.3.54 Where potential impacts on an IOF of the proposed development are assessed as significant, specific mitigation measures are identified following the recognised hierarchy of 'avoid, minimise, off-set' in order to avoid, reduce and/or compensate' for potentially significant impacts.

7.3.55 The significance of residual effects on features after the effects of implementation of mitigation measures has been considered can then be determined, along with any monitoring requirements (in line with the recommendations outlined in NatureScot guidance[8]).

Trends and predicted future baseline

7.3.56 In the absence of development, it is assumed that the land use within the Main Wind Farm Area and the surrounding locale would remain the same for the foreseeable future (i.e. upland sheep farming and rotationally harvested commercial conifer plantation). No major changes are expected to the character of the upland landscape, which comprises mostly marshy rush/purple moorgrass pasture to the north and modified or intact bog to the south. There are also fairly large areas of upland acid grassland spread across the Main Wind Farm Area and some larger areas of flush and fen to the south. Some blanket bog areas within the Main Wind Farm Area are being drained and periodically burned to improve the grazing resources. As such, no change in these habitats is

anticipated in the short to medium term and consequently the bird community is likely to remain broadly similar. However, in the longer term, the ongoing agricultural improvement of the habitats in the Main Wind Farm Area will lead to greater modification and drying of the peatland habitat, with an associated reduction in habitat quality for the upland bird species which are positively associated with the presence of blanket bog, such as curlew, dunlin and black grouse.

7.3.57 It is more difficult to predict changes that may occur in the long-term, especially in the wake of climate change, which is thought to cause range shifts in some bird species[32]. Climate change may alter habitat types by impacting the composition and health of the plant communities present, thereby affecting the suitability of the Proposed Development Area for some of the bird species which currently occupy the site. Baseline surveys carried out for the Proposed Development represent a snapshot of the bird community at the time and cannot be extrapolated to predict future population trends in the event of climate change.

Information gaps

7.3.58 The addition of the Kinnelhead Development Area to the Proposed Development resulted in additional VP surveys covering the previously unsurveyed area over a single breeding season (2020). Consequently, two iterations of CRM were carried out independently of each other using two datasets; one covering the Original Site Boundary (data collected between March 2018 and August 2019) and another covering only Kinnelhead Development Area (data collected between March and August 2020). The assumption of both CRMs is that the data are representative of the whole Proposed Development Area and the reported collision risk covers all 17 turbines, albeit, neither dataset covers the Main Wind Farm Area in its entirety. For this reason, the mortality rates calculated using these two datasets cannot be combined or interpreted as completely representative of the Proposed Development. The CRM results derived from the Original Site Boundary dataset can be considered more accurate than these based on the Kinnelhead Development Area, as the latter dataset covered a much smaller area and comprised data collected from a single VP over shorter period of time. As such, factors like the annual variation in bird flight activity could not be accounted for, which in turn would increase the margin of error when extrapolating the results. Therefore, the predicted mortality rates based on the Kinnelhead Development Area data should be treated with a degree of caution and can be only supplemental to the mortality rates calculated using the Original Site Boundary dataset.

7.3.59 Breeding bird survey data was not collected for the Primary Proposed Access Route as this was added to the Proposed Development after the end of the bird breeding season. Pre-construction surveys will be undertaken along the route as part of the embedded mitigation included in the CEMP, to allow protection of breeding birds against disturbance or damage to/destruction of their nests.

7.4 CONSULTATION

7.4.1 The ‘Daer Wind Farm Scoping Report’ was submitted to the Scottish Government’s Energy Consents Unit (ECU) on 11 December 2018. The formal scoping response issued from the ECU was received in March 2019. Those responses considered relevant to this chapter are summarised in Table 7.5.

Table 7.5: Consultee scoping responses relating to ornithology

Consultee	Date	Issues raised and recommendations	Scoping response addressed
RSPB	Feb 2019	RSPB Scotland has concerns about the potential impact of this development on a range of upland breeding birds, in particular black grouse and curlew.	Black grouse and curlew are included in the EcIA (see Section 7.6). The Proposed Development has been designed to strike an appropriate balance taking account of all relevant constraints. The locations of turbines have been identified to avoid key foraging areas for raptors and areas with higher wader numbers (e.g. the edge of the reservoir) where practicable.
		Previous surveys have indicated that the site holds regionally important numbers of upland breeding birds, including curlew and black grouse. We are concerned that there is the potential for the proposed wind farm to have negative effects on these species through displacement and risk of collision. The Environmental Statement must assess and present these impacts in the context of regional numbers and trends of these species. In particular, the location of turbines should seek to avoid key foraging areas for raptors and areas with high wader numbers. Cumulative impacts should be examined.	
		We are generally satisfied with the proposed baseline non-breeding and breeding season ornithological survey programme. As above, we wish to see cumulative effects on species assessed.	Noted, cumulative impact assessment has been carried out for IOFs for which greater than negligible magnitude residual effects are predicted (see Section 7.9).
NatureScot	Feb 2019	NatureScot confirmed ongoing consultation with Natural Power throughout the 2018 and 2019 baseline surveys, including regarding the constraints to ornithological surveys, the 2018 breeding season results and preliminary findings of the 2018/19 non-breeding season. NatureScot agreed the best way forward for the coming breeding season, including surveys to scope out.	The baseline ornithological survey programme has been designed and consulted with NatureScot at various stages; (for details see Table 7.6).
		NatureScot confirmed that they are content that appropriate features and potential effects have been identified.	Noted

7.4.2 Throughout the baseline survey period ongoing consultations between Natural Power and NatureScot on the scope of the monitoring programme were taking place and these are summarised in Table 7.6.

Table 7.6: Summary of consultation between Natural Power and NatureScot during baseline survey period

Date	NatureScot guidance/response	Comment/action taken by Natural Power
10 May 2018	**Key points raised in email from John Gibson at NatureScot in regards to survey access restrictions (no access outwith the site boundaries, access partly restricted due to lambing season)**	

[32] Huntley, B., Green, R.E., Collingham, Y.C. and Willis, S.G. (2007). A Climatic Atlas of European Breeding Birds. Durham University, The RSPB and Lynx Editions, Barcelona.

Date	NatureScot guidance/response	Comment/action taken by Natural Power
	NatureScot expressed concerns that starting surveys late in the season in 2018 may mean that the presence of some species was missed. They recommended conducting a desk study and contacting local raptor workers to provide additional context data and that a second breeding season of surveys should be undertaken.	Survey visits were rearranged to ensure that all missing VP and walkover hours for March and April 2018 were completed by the beginning of May: • A black grouse survey was undertaken as a vantage point from Type Knowes towards the historic lek site near the track to the west of Earlside, to remotely establish black grouse presence and numbers. This was followed up by a walkover visit in the first suitable weather window after the access restriction was lifted (mid-May 2018); • The land to which surveyors did not have access was scanned from the boundary, including ad-hoc VPs, to establish likely presence of breeding raptors. Surveys were carried out at appropriate times and conditions to identify breeding behaviour of the species considered most likely to be present (e.g. merlin, short-eared owl, red kite, goshawk); • Full breeding raptor walkover surveys commenced as soon as the access restriction was lifted (mid-May 2018); • Upland breeding bird survey work was resumed on previously restricted land from mid-May 2018, with four visits, at least seven days apart, in suitable weather conditions between mid-May and mid-July; and • A complete second breeding season survey programme was undertaken in 2019 without any access restrictions in place.
	NatureScot expressed concerns about the placement of VPs not covering all turbine locations and VPs located too close to turbine locations due to the landscape on site. They acknowledged that it's an odd shaped site and so the VPs are almost certainly likely to be located close to possible turbine sites. They also acknowledged that there are constraints over which the Applicant has	VP locations were chosen to give the best balance of coverage of the developable area of the site with proportionate survey effort to characterise the baseline. Natural Power is confident that the layout of proposed VPs was efficient and provided the best coverage that was possible under these circumstances. All proposed turbine locations were covered by viewsheds and so was the majority of the 500 m buffer

Date	NatureScot guidance/response	Comment/action taken by Natural Power
	little or no control, and that there is no option but to deal with the situation as it is, but stated they cannot provide any firm assurance that this won't have an adverse effect on any subsequent assessment.	surrounding the turbines, and surveys were timed to avoid clashes between and disturbance from other surveys.
25 July 2018	**Key points raised in email from John Gibson at NatureScot in response to a survey method statement for the first breeding season period of survey work at Daer**	
	NatureScot looked at the survey method statement for the Daer and Rivox proposals and agreed that the methods looked reasonable given the problems with access and weather. NatureScot expressed concerns that these issues may affect the assessment. NatureScot stated that a second year of survey to address these issues was likely to be recommended.	Given the late start to the spring witnessed across Scotland in 2018, and the alternative survey methods that have been put in place, it is considered that the data collected in 2018 were not compromised in terms of their suitability to describe baseline conditions of the site. A second breeding season of surveys was conducted to ensure a full breeding season (March to August) of data collection, in compliance of guidance[2] (access restrictions within the recommended survey buffers excepted).
4 February 2019	**Key points raised in email from John Gibson at NatureScot in response to survey requirements for the second breeding season period of survey work at Daer**	
	NatureScot confirmed that they were content with the scope of survey for the second breeding season, and welcomed ongoing consultation.	Natural Power proposed the following: • Breeding season ornithology surveys to comprise: - VP survey (minimum 6 hours/VP/month); - Black grouse survey; - Breeding raptor survey; and - Brown and Shepherd upland bird survey; • Spring migration VPs or specific pink-footed goose roost/stop over surveys of the reservoir to be scoped out (no likely direct connectivity to an SPA); • A repeat of specific barn owl survey to be scoped out; • Surveys will be timed around any sensitive periods for access to prevent gaps in survey coverage; and • The RSPB, local raptor study group and local environmental record centre to be

Date	NatureScot guidance/response	Comment/action taken by Natural Power
		contacted requesting records they hold for the buffer of the site.
2 August 2019	**Email from John Gibson at NatureScot in response to Natural Power enquiry on requirement to carry out the second non-breeding season of surveys**	
	NatureScot confirmed that they were content with surveys to date and there was no need for second non-breeding season surveys.	The number of flights for each species recorded during the first non-breeding season is unlikely to result in significant collision impacts for any species of concern recorded at the site. On that basis, the second non-breeding season of surveys was scoped out.
29 October 2019	**Key points raised in email from John Gibson at NatureScot in response to survey requirements for the additional development area (Kinnelhead)**	
	Following the addition of a new development area at Daer (Kinnelhead) and the removal of the proposed development area in Rivox plantation, Natural Power was of an opinion that delaying application to undertake a further 18 months of flight activity surveys focussed on the new area would not be proportionate, and proposed to undertake assessment using the VP surveys data collected for the original site boundary. The direction of view during these surveys was such that airspace above the majority of Kinnelhead Land Portion was covered by survey effort from VPs 4, 5 and 6. NatureScot confirmed that they were satisfied with the proposed approach, given previous VP coverage and agreed that another 18 months survey for this small additional area would not be proportionate and only delay the project unnecessarily.	Due to the timescales for submission allowing, additional raptor, breeding birds and black grouse surveys covering the Kinnelhead Land Portion were conducted during the breeding season 2020. Also, six months of VP surveys from an additional location to fill the viewshed gaps over the new development area were carried out.

7.5 BASELINE RESULTS

Desk study

Existing records

7.5.1 The RSG, RSPB, SWSEIC and GL provided data on bird species recorded within a 10 km radius of the Survey Area. A total of 86 protected bird species and/or birds of conservation concern were recorded between 2009 and 2019 (54 species excluding passerines). This included eight Schedule 1 raptor species and thirteen species of waders, some of which breed within the Main Wind Farm Area; these records are summarised below. A complete list, including number of records and conservation designations is provided in Technical Appendix 7.1.

7.5.2 Schedule 1 raptor species recorded within 10 km of the Survey Area comprise:

- Osprey;
- Golden eagle;
- White-tailed eagle;
- Goshawk;
- Hen harrier;
- Red kite;
- Merlin; and
- Peregrine.

7.5.3 Wader species recorded within 10 km of the Survey Area (in bold are species found breeding within the Main Wind Farm Area) comprise:

- **Oystercatcher**;
- **Lapwing**;
- Golden plover;
- **Ringed plover**;
- Little ringed plover;
- Dotterel;
- **Curlew**;
- **Dunlin**;
- Woodcock;
- **Snipe**;
- **Common sandpiper**;
- Green sandpiper; and
- **Redshank**.

Statutory sites of ornithological importance

7.5.4 No sites designated for ornithological interests were identified within 10 km of the Survey Area, or within 25 km for SPAs and Ramsar sites with geese or gulls as a designated feature.

7.5.5 Statutory sites designated for non-avian interests are presented in Chapter 6: Ecology.

Baseline surveys

VP surveys

7.5.6 Table 7.7 below summarises baseline flights of target species recorded over the Daer Land Portion during the breeding seasons 2018 and 2019 and the non-breeding season 2018/19 (see Figures 7.3a-f). Table 7.8 summarises baseline flights of target species recorded over the Kinnelhead Development Area in the breeding season 2020 (see Figures 7.3g-h). Species which qualified for CRM are also identified (those recorded for which there were a minimum of either three flights or 10 individuals with a period in the CRZ and at PCH).

Table 7.7: Number of flights and individuals recorded during both breeding seasons 2018 and 2019 and the non-breeding season 2018/19 over the Daer Land Portion. Species and seasons for which CRM was carried out are in bold

Species	Season	Total flights	Total individuals	Risk flights	Risk individuals	CRM carried out
Greylag goose	**breeding**	30	92	7	16	**Yes**
	non-breeding	3	27	0	0	No
Pink-footed goose	**non-breeding**	64	3964	32	1981	**Yes**
Teal	breeding	1	2	0	0	No
Goosander	breeding	6	17	1	1	No
	non-breeding	4	6	2	3	No
Black grouse	breeding	6	7	2	3	No
	non-breeding	2	2	0	0	No
Unidentified diver	non-breeding	1	1	0	0	No
Osprey	breeding	5	5	2	2	No
	non-breeding	1	1	1	1	No
Goshawk	breeding	6	6	2	2	No
	non-breeding	1	1	1	1	No
Marsh harrier	**breeding**	5	5	4	4	**Yes**
Hen harrier	**breeding**	19	19	3	3	**Yes**
	non-breeding	7	7	0	0	No
Red kite	**breeding**	43	46	21	22	**Yes**
	non-breeding	16	16	5	5	**Yes**
Oystercatcher	**breeding**	56	275	4	12	**Yes**
Lapwing	**breeding**	33	67	3	6	**Yes**
Golden plover	**breeding**	1	11	1	11	**Yes**
	non-breeding	1	19	1	19	**Yes**
Ringed plover	breeding	4	5	0	0	No
Curlew	**breeding**	248	581	37	69	**Yes**
Snipe	**breeding**	13	14	8	9	**Yes**
Redshank	breeding	3	3	0	0	No
Merlin	breeding	7	7	2	2	No
	non-breeding	6	6	1	1	No
Peregrine	**breeding**	11	12	6	7	**Yes**
	non-breeding	12	12	7	7	**Yes**

Table 7.8: Number of flights and individuals recorded during the breeding season 2020 over the Kinnelhead Development Area. Species and seasons for which CRM was carried out are in bold

Species	Season	Total flights	Total individuals	Risk flights	Risk individuals	CRM carried out
Greylag goose	**breeding**	1	11	1	11	**Yes**
Osprey	breeding	2	2	2	2	No
Red kite	**breeding**	19	19	4	5	**Yes**
Oystercatcher	breeding	6	11	0	0	No
Lapwing	breeding	1	1	0	0	No
Golden plover	breeding	1	4	0	0	No
Curlew	**breeding**	39	58	7	10	**Yes**
Snipe	breeding	10	13	0	0	No

7.5.7 Incidental records of target species and records of secondary species recorded during VP surveys in 2018 – 2020 are summarised in Technical Appendix 7.1.

Breeding raptor surveys

7.5.8 Goshawk, hen harrier, red kite, merlin and peregrine were recorded during raptor surveys in 2018 and 2019. No active raptor nests were located within the Main Wind Farm Area, though goshawk were confirmed as breeding within the Original Site Boundary. A goshawk nest was found within the Rivox Land Portion, outwith the 2 km buffer of the Daer Land Portion, but within 235 m of the Primary Proposed Access Route (Confidential Figure 7.6), with another suspected but unidentified nest in forestry in the north of the Rivox Land Portion. Red kite were observed displaying nesting behaviour and it is possible that they were breeding in the vicinity of the Main Wind Farm Area. The record of a merlin juvenile female was made late in the breeding season (on 28 July 2018) and so this species may have bred nearby, although there were no earlier records of merlin during the breeding season suggesting that this species didn't breed in the Main Wind Farm Area.

7.5.9 One unoccupied raptor nest was found in 2018 in a Scots Pine next to the Crook Burn, near Daer Reservoir. There was no sign of active use in 2018 or 2019 and it was not possible to determine the species.

7.5.10 Target species records from raptor surveys in 2018 and 2019 are shown in Confidential Figure 7.6 with more details provided in Technical Appendix 7.1. No target raptor species were recorded during breeding raptor surveys in 2020 in the Kinnelhead Development Area.

Breeding bird surveys

7.5.11 A total of 63 bird species were recorded during the breeding bird surveys 2018-2020 within the Survey Area. Territory mapping analyses were conducted for target waterfowl and wader species, and the results are shown on Figures 7.5a-c. Eight wader species were recorded as breeding within the Main Wind Farm Area, the most numerous were snipe and curlew. Table 7.9 summarises the number of territories of target species recorded during each survey year within the Main Wind Farm Area. A full list of species recorded during breeding bird surveys is provided in Technical Appendix 7.1.

Table 7.9: Breeding bird territories detected during 2018, 2019 (Original Site Boundary) and 2020 (Kinnelhead Development Area only) breeding bird surveys. Wader species are shown in bold

Species	No. territories 2018	No. territories 2019	No. territories Kinnelhead 2020
Greylag goose	No Territories	1	Not Recorded
Teal	No Territories	1	Not Recorded
Goosander	1	No Territories	Not Recorded
Oystercatcher	4	4	1
Lapwing	2	5	Not Recorded
Ringed plover	2	2	Not Recorded
Curlew	7	9	2
Dunlin	1	1	Not Recorded
Snipe	7	10	3
Common sandpiper	4	3	1
Redshank	2	Not Recorded	No Territories

Black grouse surveys

7.5.12 A maximum of four males were recorded lekking in 2018 in the Main Wind Farm Area southeast of Sweetshaw Rig (the Sweetshaw lek). A single male was also observed lekking in the vicinity of the main lek (1-1.5 km) south of Sweetshaw Burn, however, there was no field evidence to suggest that this is currently an established separate lekking site. A single male was also recorded briefly lekking to the west of the Proposed Development, near Crookburn.

7.5.13 In 2019, there was an established lek, also within the Main Wind Farm Area, on the western slopes of Crookburn Law (the Crookburn lek), with a maximum of three males being present at the same time. Also, up to two males were recorded lekking at the Sweetshaw lek in 2019 (the same lek location as recorded in 2018). Sporadic observations of black grouse were also made in proximity to the two known lekking sites. A summary of black grouse records at the lek sites is given in Table 7.10. Figure 7.4 provides a graphic representation of the most important records of lekking and loafing black grouse; all black grouse records are summarised in Technical Appendix 7.1.

7.5.14 No black grouse were recorded in 2020 in the Kinnelhead Development Area.

Table 7.10: Locations of active black grouse leks identified in the Main Wind Farm Area in 2018 and 2019

Year	Lek	Maximum count	Distance to nearest infrastructure	Distance to nearest turbine
2018	Sweetshaw	4 lekking males	240 m to the proposed wind farm track	350 m (T7)
2019	Sweetshaw	2 lekking males	200 m to the proposed wind farm track	370-450 m (T7, T8)
2019	Crookburn	3 lekking males, 1 female	1.2 km to borrow pit	1.1 km (T17)

Other species-specific surveys

7.5.15 No evidence of breeding barn owls were found within the Original Site Boundary and relevant search buffers.

Collision risk modelling

7.5.16 At the Proposed Development, 11 target species fulfilled criterion for CRM. During the breeding season these were: greylag goose, marsh harrier, hen harrier, red kite, oystercatcher, lapwing, golden plover, curlew, snipe and peregrine. During the non-breeding season these were: pink-footed goose, golden plover, red kite and peregrine. The risk of collision for each species, calculated with avoidance factors of 95%, 98%, 99%, 99.5% and 99.8%, are presented in Table 7.11 and 7.12 (the mortality estimates for the Kinnelhead Development Area were calculated separately). Values shown in bold represent species-specific avoidance levels recommended for collision risk analysis by NatureScot[9]. Details of the calculations used to produce these estimates are provided in Technical Appendix 7.1.

Table 7.11: Estimated number of collisions per season based on data collected in the Daer Land Portion during the breeding/summer seasons 2018 and 2019 (March to August) and non-breeding/wintering season 2018/19 (September to February) – numbers in bold represent results using NatureScot recommended avoidance rates[9]

			Estimated mortality assuming avoidance of:				
Species	Model type	Season	95%	98%	99%	99.5%	99.8%
Greylag goose	Directional	Summer	1.1	0.44	0.22	0.11	**0.04**
Pink-footed goose	Directional	Wintering	105.87	42.35	21.17	10.59	**4.23**
Marsh Harrier	Random	Breeding	0.08	**0.03**	0.02	0.01	0
Hen harrier	Random	Breeding	0.01	0	**0**	0	0
Red kite	Random	Breeding	0.4	0.16	**0.08**	0.04	0.02
Red kite	Random	Non-breeding	0.11	0.04	**0.02**	0.01	0
Oystercatcher	Random	Breeding	0.04	**0.02**	0.01	0	0
Lapwing	Random	Breeding	0.07	**0.03**	0.01	0.01	0
Golden plover	Random	Breeding	0.14	**0.05**	0.03	0.01	0.01
Golden plover	Random	Non-breeding	0.01	**0**	0	0	0
Curlew	Random	Breeding	0.45	**0.18**	0.09	0.05	0.02
Snipe	Random	Breeding	0.06	**0.02**	0.01	0.01	0
Peregrine	Random	Breeding	0.07	**0.03**	0.01	0.01	0
Peregrine	Random	Non-breeding	0.03	**0.01**	0.01	0	0

Table 7.12: Estimated number of collisions per season based on data collected in the Kinnelhead Development Area during the breeding/summer season 2020 (March to August) – numbers in bold represent results using NatureScot recommended avoidance rates[9]

			Estimated mortality assuming avoidance of:				
Species	**Model type**	**Season**	**95%**	**98%**	**99%**	**99.5%**	**99.8%**
Greylag goose	Directional	Summer	0.6	0.24	0.12	0.06	**0.02**
Red kite	Random	Breeding	1.49	0.59	**0.3**	0.15	0.06
Curlew	Random	Breeding	0.6	**0.24**	0.12	0.06	0.02

7.6 IMPACT ASSESSMENT

7.6.1 This section assesses the potential impacts during construction, operation and decommissioning of the Proposed Development on IOFs. The Proposed Development has undergone several design iterations to minimise potential environmental impacts (see Chapter 2: Site Selection and Design Evolution, for further details). Consequently, ornithological constraints have been considered during the scheme evolution, and areas with e.g. the highest densities of breeding waders have been avoided for turbine placement. Potential impacts are assessed against this final design.

7.6.2 The main ways in which a wind farm may affect ornithological receptors are via:

- Habitat loss due to land-take;
- Disturbance and/or displacement; and
- Collision with turbines.

7.6.3 In addition to effects which are directly related to the development, there may be other impacts which arise as a result of the combined effects of multiple wind farms (or other developments) within the local or regional area. These cumulative impacts may also result in effects, which individually would not be significant, becoming more important and significant in context.

7.6.4 Each of these potential impacts is discussed in turn below for each stage of the development (construction, operation, and decommissioning).

Potential effects during construction

Habitat loss

7.6.5 Felling of trees, and construction of turbine bases, access tracks and other structures will lead to direct habitat loss and without adequate mitigation could also result in destruction or damage to nests, eggs and/or chicks. The effects of habitat loss will depend upon the extent of land-take and the type of habitat affected. Under the WCA 1981 (as amended) it is an offence to kill or injure any wild bird, or to damage or destroy nests and eggs; embedded mitigation measures will be put in place to prevent damage to or destruction of nests, as discussed below in this section.

Disturbance and displacement

7.6.6 The construction stage of wind farm developments can have potential impacts of associated noise and visual disturbance and if unmitigated could lead to the temporary displacement or disruption of breeding and foraging birds. The level of impact depends on the timing of potentially disturbing activities, the extent of displacement (both spatially and temporally), and the availability of suitable habitats in the surrounding area for displaced birds to occupy.

7.6.7 Potential impacts are likely to be greatest during the breeding season (predominantly between March and August, depending on the species under consideration); behavioural sensitivity to the effects will vary between species.

7.6.8 Disturbance of birds due to construction activities of this type have not been sufficiently quantified and the available information is often contradictory. However, it is likely that construction impacts will be greater on species that are intolerant of noise and other sources of disturbance. Larger bird species, those higher up the food chain or those that feed in flocks in the open tend to be more vulnerable to disturbance than small birds living in structurally complex or closed habitats such as woodland[33].

7.6.9 The potential impacts associated with construction activities are only likely to occur for as long as the construction phase continues. They are thus short-term and can be readily mitigated by avoiding sensitive areas (through the implementation of appropriately defined buffer zones), and by timing construction activities to avoid periods where sensitive species are present (if and where possible) such as the breeding season. The exception to this would be if an adverse effect on the breeding success of a receptor were such that the local population becomes extinct and replacement through recruitment or re-colonisation does not occur.

Potential effects during operation

Disturbance and displacement

7.6.10 The operation of turbines and associated human activities for maintenance purposes also has the potential to cause disturbance and displace birds from the development. Disturbance impacts during the operational phase may be less than during the construction phase, as species may become habituated to turbines and disturbance due to human activities will be considerably reduced.

7.6.11 Studies have shown that, in general, species are not disturbed beyond 500 to 800 m from turbines[34, 35] and in some cases, birds do not appear to have been disturbed at all[36, 37, 38, 39]. However, this may depend on the sensitivity of the species in question; specific disturbance impacts are discussed in the feature assessment below.

7.6.12 There is less consensus of opinion about disturbance impacts closer to wind farm infrastructure. Several studies have examined this in detail, and these are summarised below.

[33] Hill, D.A. Hockin, D. Price, D. Tucker, G. Morris, R. and Treweek, J. (1997) Bird Disturbance: Improving the Quality of Disturbance research. *Journal of Applied Ecology* 34, 275-288.

[34] Hötker, H., Thomsen, K.M. and Koster, H. (2006) The Impact of Renewable Energy Generation on Biodiversity With Reference to Birds and Bats – Facts, Gaps in our Knowledge, Areas for Further Research and Ornithological Criteria for the Expansion of Renewables. NABU Report, Germany.

[35] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. and Bullman, R. (2009) The Distribution of Breeding Birds Around Upland Wind Farms. *Journal of Applied Ecology* 46, 1323-1331.

[36] Devereux, C.L., Denny, M.J.H. and Whittingham, M.J. (2008). Minimal Effects of Wind Turbines on the Distribution of Wintering Farmland Birds. *Journal of Applied Ecology* 45, 1689–1694.

[37] Whitfield, D.P., Green, M. and Fielding, A.H. (2010) Are Breeding Eurasian Curlew Numenius Arquata Displaced by Wind Energy Developments? Natural Research Projects Ltd, Banchory, Scotland.

[38] Douglas, D.J.T., Bellamy, P.E. and Pearce-Higgins, J.W. (2011) Changes in the Abundance and Distribution of Upland Breeding Birds at an Operational Wind Farm. *Bird Study* 58, 37-43.

[39] Fielding, A.H. and Haworth, P.F. (2013) Farr Wind Farm: A Review of Displacement Disturbance on Golden Plover Arising from Operational Turbines 2005-2013. Haworth Conservation, Isle of Mull, Scotland.

7.6.13 Pearce-Higgins *et al*. (2009)[35], found evidence of lower frequencies of occurrence of some species within the vicinity of wind turbines during the breeding season, with a significant reduction in frequency of occurrence, compared to control sites, in seven of the 12 species studied. The authors extrapolated these findings to predict a percentage reduction in breeding densities within 500 m of turbines and found that seven of the 12 species showed a significantly lower frequency of occurrence: buzzard, hen harrier, golden plover, snipe, curlew, meadow pipit and wheatear, while there was no significant effect of wind farm proximity on kestrel, red grouse, lapwing, skylark and stonechat distribution. A more recent study of displacement impacts of wind farms on 10 species of upland breeding birds, by the same lead author[40] found evidence for population declines in red grouse, snipe and curlew associated with wind farm construction, but little evidence for consistent post-construction population declines in any species. However, a recent study by Sansom *et al*. (2016)[41] reported no displacement of golden plover during wind farm construction, but a significant reduction in abundance during the operational phase. Further studies of golden plover[42] and curlew[37], involving long-term monitoring found no evidence of displacement due to wind farm infrastructure in either species. In addition, a synthesis of European work found no statistically significant adverse effect on breeding population density of any bird species, including several species found within the Main Wind Farm Area such as skylark and meadow pipit[20].

7.6.14 In terms of non-breeding population densities, Hötker *et al*. (2006)[34] reported a significantly adverse effect on geese (several species combined), golden plover and lapwing and a significantly positive effect on starling, although the distances involved were relatively limited (mean distances were between 30 m for starling and 373 m for geese). In their study of the effects of wind turbines on the distribution of wintering farmland birds, Devereux *et al*. (2008)[36] found no effect on four species groups (seed-eaters, corvids, gamebirds and skylarks); the only exception was pheasant.

7.6.15 Therefore, it is clear that potential disturbance and displacement impacts associated with wind farm construction and operation vary between species, sites, years and seasons and should be considered on a case-by-case basis.

7.6.16 Individual turbines, or a wind farm as a whole, may present a barrier to the movement of birds, restricting or displacing birds from much larger areas. The effect this would have on a population is subtle and difficult to predict with any degree of certainty. If birds regularly have to fly over or around obstacles or are forced into suboptimal habitats, this may result in reduced feeding efficiency and greater energy expenditure. By implication, this will reduce the efficiency with which they accumulate reserves, potentially affecting breeding success or survival.

Collision with turbines

7.6.17 Collision of a bird with turbine rotors or towers is almost certain to result in the death of the bird. In low density populations (e.g. raptors) this could have a more adverse effect on the local population than in higher density populations (e.g. skylark) because a higher proportion of the local population would be affected in a low-density population. The frequency and likelihood of a collision occurring depends on a number of factors. These include aspects of the size and behaviour of the bird (including their use of a development site), the nature of the surrounding environment, and the structure and layout of the turbines.

7.6.18 Collision risk is perceived to be higher for birds that spend much of the time in the air, such as foraging raptors and those that have regular flight paths between feeding and breeding/roosting grounds (e.g. geese). The risk of bird collisions at wind farms is greatest in areas where large concentrations of birds are present (such as on major migration routes), and in poor flying conditions, such as rain, fog, strong winds that affect birds' ability to control flight manoeuvres, or on dark nights when visibility is reduced[43, 20]. Birds may also be more susceptible if the wind farm is located in an area of high prey density.

7.6.19 It should be noted that operational disturbance and collision risk impacts are mutually exclusive in a spatial sense; i.e. a bird that avoids the wind farm area due to disturbance cannot be at risk of collision with the turbine rotors at the same time. However, they are not mutually exclusive in a temporal sense; i.e. a bird may initially avoid the wind farm but habituate to it and would then be at risk of collision.

7.6.20 Passerines nesting within a wind farm site would be expected to be regularly flying between turbines and could therefore be expected to be most at risk of collision. However, passerines tend to fly below PCH and evidence suggests that passerines collide with turbines too infrequently for there to be a significant effect of collision at the population level. Moreover, most of the species concerned are of low or negligible conservation value.

7.6.21 A summary of collisions recorded to date at European wind farm sites for target species recorded at the Proposed Development for which CRM was undertaken is presented in Table 7.13.

Table 7.13: Reported collisions at European wind farms of target species (after Hötker *et al.* (2006)[34] and Dürr, 2020[44])

Species	Collisions (individuals)	Countries in which collisions occurred	European population (BirdLife International, 2020[45])
Greylag goose	32	Austria (1) Belgium (1) Germany (17) Spain (3) The Netherlands (6) Norway (4)	259,000-427,000 pairs
Pink-footed goose	Not recorded	-	57,000-74,000 pairs 279,000 – 285,000 mature individuals wintering
Marsh harrier	63	Austria (3) Belgium (1) Germany (39) Spain (12) Greece (1) The Netherlands (5) Poland (2)	99,300-184,000 breeding females
Hen harrier	13	Germany (1) Spain (1)	30,000-54,400 breeding females

[40] Pearce-Higgins, J.W., Stephen, L., Douse, A. and Langston, R. H. W. (2012) Greater Impacts of Wind Farms on Bird Populations During Construction Than Subsequent Operation: Results of a Multi-site and Multi-species Analysis. Journal of Applied Ecology 49, 386–394.

[41] Sansom, A., Pearce-Higgins, J.W., and Douglas, D.J.T. (2016) Negative impact of wind energy development on a breeding shorebird assessed with BACI study design. *IBIS* 158, 3, 541-555.

[42] Douglas, D.J.T., Bellamy, P.E. and Pearce-Higgins, J.W. (2011) Changes in the Abundance and Distribution of Upland Breeding Birds at an Operational Wind Farm. *Bird Study* 58, 37-43.

[43] Langston, R.H.W. and Pullan, J.D. (2003) Windfarms and Birds: an Analysis of the Effects of Wind Farms on Birds, and Guidance on Environmental Assessment Criteria and Site Selection Issues. Report T-PVS/Inf. 2003. 12, by BirdLife International to the Council of Europe, Bern Convention on the Conservation of European Wildlife and Natural Habitats. RSPB/BirdLife in the UK.

[44] Vogelverluste an Windenergieanlagen / Bird fatalities at wind turbines in Europe; Daten aus der zentralen Fundkartei der Staatlichen Vogelschutzwarte im Landesamt für Umwelt Brandenburg zusammengestellt: Tobias Dürr; Stand vom: 7 January 2020.

[45] IUCN 2020. The IUCN Red List of Threatened Species. Version 2020-2. https://www.iucnredlist.org. Downloaded on 20 October 2020

Species	Collisions (individuals)	Countries in which collisions occurred	European population (BirdLife International, 2020[45])
		France (4) UK (6) Norway (1)	
Red kite	605	Belgium (5) Germany (532) Denmark (1) Spain (30) France (19) UK (5) Luxemburg (1) Sweden (12)	25,200-33,400 pairs
Oystercatcher	28	Belgium (5) Germany (4) The Netherlands (16) Norway (3)	284,000-354,000 breeding pairs 846,000-902,000 wintering population[46]
Lapwing	27	Belgium (3) Germany (19) France (2) The Netherlands (3)	1,590,000-2,580,000 pairs
Golden plover	42	Germany (25) Spain (3) France (3) The Netherlands (3) Norway (7) Sweden (1)	630,000-860,000 pairs
Curlew	12	Germany (4) France (1) The Netherlands (7)	212,000-292,000 pairs
Snipe	18	Germany (2) Spain (1) France (1) UK (1) The Netherlands (1) Norway (11) Portugal (1)	2,670,000-5,060,000 pairs
Peregrine	31	Austria (1) Belgium (3) Germany (19) Spain (6) UK (1) The Netherlands (1)	14,900-28,800 pairs

Potential effects during decommissioning

7.6.22 Turbine removal may cause disturbance to birds breeding, foraging or roosting within the Proposed Development Area. The level of impact will depend on the bird species present at the time of decommissioning and cannot be reliably predicted at this stage. However, as decommissioning activities are of a similar type and intensity as construction activities, the assessment considers that the potential effects of decommissioning will be similar in nature to the potential effects of construction, with the exception that habitat is likely to be restored and displaced birds will be able to return to abandoned territories.

Embedded mitigation

7.6.23 Embedded mitigation is built into the project to minimise the potential for any negative effects associated with the Proposed Development, and to ensure compliance with the WCA (1981) as amended, as well as potentially providing positive effects in the longer term. Various measures have been and are proposed to be implemented to provide compliance with legislation, and to follow good practice guidance and consultation recommendations with regard to breeding birds. Where experience of developing projects of this nature has shown that embedded mitigation is sufficient to prevent significant adverse impacts on IOFs, this has been built into the assessment in order to produce an EcIA which is proportionate to the risks posed by the Proposed Development. These embedded mitigation measures are outlined below.

Construction phase

7.6.24 All relevant construction phase embedded mitigation measures, such as appointment of an Environmental Clerk of Works (ECoW), would be implemented through a Construction Environmental Management Plan (CEMP), which will be agreed with the local planning authorities in consultation with NatureScot and Scottish Environment Protection Agency (SEPA).

Environmental Clerk of Works (ECoW)

7.6.25 In line with good practice, an independent ECoW will be appointed prior to the commencement of construction and will be present on site during enabling works and throughout the construction period. They will be a suitably experienced individual, whose role will be to oversee that all works are carried out in accordance with environmental legislation and good practice, and with agreed construction phase management plans such as the CEMP and Species Protection Plan (SPP).

7.6.26 Prior to the start of construction/the bird breeding season, contractors will be made aware of the ornithological sensitivities within the Proposed Development Area (particularly with regard to the potential presence of Schedule 1 breeding species). The ECoW will give regular Toolbox Talks to contractors regarding the status and locations of protected and sensitive species and habitats at the Proposed Development.

7.6.27 The ECoW will carry out pre-construction survey checks during the bird breeding season (March to August, inclusive) in advance of vegetation stripping or excavation works to check for the presence of any breeding birds. Any active nests found will be cordoned off to a suitable distance for the species concerned (in line with appropriate guidance) and construction operations delayed within the cordon until the young have fledged and/or the nest

[46] http://datazone.birdlife.org/userfiles/file/Species/erlob/supplementarypdfs/22733462_haematopus_ostralegus.pdf

becomes vacant naturally. There will be a clear line of responsibility for establishing that these measures are adhered to. This will reduce the possibility of illegal damage, destruction or disturbance to occupied bird nests during the construction phase. Full details of the ECoW's role and responsibilities will be provided in the CEMP and secured through appropriate planning condition.

Legal compliance regarding breeding birds

7.6.28 Under the WCA (1981) as amended it is an offence, with only limited exceptions, to:

- Intentionally or recklessly take, interfere with, damage or destroy the nest of any wild bird whilst it is in use or being built (applies year round for nests of birds included in Schedule 1A);
- Obstruct or prevent any wild bird from using its nest;
- Intentionally or recklessly take, interfere with or destroy the egg of any wild bird;
- Intentionally or recklessly disturb any wild bird listed on Schedule 1 while it is nest building, or at (or near) a nest containing eggs or young, or disturb the dependent young of such a bird;
- Intentionally or recklessly harass any wild bird included in Schedule 1A; or
- Knowingly cause or permit any of the above acts.

7.6.29 Good practice via timing of works and pre-construction surveys will be necessary to reduce the possibility of illegal damage, destruction or disturbance to occupied bird nests during the construction phase. Adherence to this will be overseen by the ECoW.

Species Protection Plan (SPP)

7.6.30 A SPP will be produced; this plan will detail specific embedded mitigation measures required prior to and during construction for protected bird species potentially breeding at the Proposed Development, including Schedule 1 raptors, black grouse and upland waders, particularly in the vicinity of historic nest sites or suitable nesting habitat. It is proposed that this may be secured through planning condition. Surveys for Schedule 1 raptors will be undertaken prior to construction, following Hardey *et al.* (2013)[16], should construction be proposed during the breeding season within 1 km of any suitable habitat. Should breeding Schedule 1 raptors be identified during pre-construction surveys, a suitable species-specific exclusion zone around the breeding site will be installed following guidance[12]. The effectiveness of this exclusion zone will be monitored by the ECoW and be reduced/increased if deemed appropriate. Nest checks would also be carried out prior to the removal of any trees for the Primary Proposed Access Route during the breeding season.

7.6.31 Measures to prevent disturbance to lekking black grouse would be included in the SPP and would be overseen during construction by the ECoW. Operations during the spring lekking period will be managed to minimise the potential for disturbance/displacement of black grouse, for example restricting works around the hours of dawn and dusk in the areas closest to the leks during mid-March to mid-May. All known black grouse leks located in the vicinity of the proposed construction works will be monitored for breeding activity prior to and during any construction during the breeding period, and if lekking/nesting behaviour is recorded then restrictions on timing of construction works within an appropriate exclusion zone will be implemented, with the ECoW undertaking a watching brief to monitor for signs of disturbance. Restrictions on construction times and locations may then be adjusted as appropriate based on the results of this monitoring.

7.6.32 The SPP would also include measures required to minimise the risks to black grouse of collision with fencing, including minimising fencing used for the Proposed Development as far as possible, and marking essential fencing to make it more easily visible to black grouse.

Operational phase

Other embedded mitigation

7.6.33 With the exception of the operation of the wind turbines and general maintenance of the turbines, there will be little on-site activity during the operational phase and therefore levels of disturbance will be considerably reduced relative to the construction period. Areas of open ground around turbines will be managed for the operational lifetime of the wind farm to reduce suitability for nesting and foraging for raptor species, to avoid raptors being attracted into the turbine area.

Decommissioning

7.6.34 Embedded mitigation of decommissioning activities will follow that proposed for the embedded mitigation of construction activities, including pre-decommissioning surveys and ecological supervision of activities.

Feature assessment

7.6.35 On the basis of the baseline survey results outlined in Section 7.5, the ornithological features of relevance to the Proposed Development have been assigned assessment values in Table 7.14 below. Based on this, they have been assessed as an IOF, or not, in the context of the Proposed Development. Regional population and Scottish context estimates are given in the context of NHZ 19 and/or, when it is relevant, Dumfries and Galloway. Although the Proposed Development lies partly within the South Lanarkshire Local Authority Area (the Daer Land Portion), South Lanarkshire is not a separate region in the context of Scottish Ornithologists' Club (SOC) bird recording. The Daer Land Portion forms the southern tip of the Clyde SOC recording area, which is defined as: South Lanarkshire, North Lanarkshire, City of Glasgow, East Renfrewshire, Renfrewshire, Inverclyde, East Dunbartonshire, West Dunbartonshire, Stirlingshire (Clyde/Loch Lomond drainage areas, the Campsie Fells, and Carron Valley Reservoir), Argyll & Bute (former Dunbartonshire part, i.e. Loch Lomond/Clyde drainage including east side of Loch Long to Arrochar (then Loin Water as boundary). The majority of this recording area lies in NHZ 17: West Central Belt, whereas NHZ 19 overlaps the Dumfries and Galloway SOC recording area.

7.6.36 Given:

- the built up and lowland nature of large areas within the Clyde region; and
- the situation of the Daer Land Portion on the far southern tip bordering the more sparsely populated and upland Dumfries and Galloway recording region,

the species population estimates of Dumfries and Galloway are considered more representative to provide context when assessing the ornithological features present at the Proposed Development.

Table 7.14: Determination of Important Ornithological Features (IOFs) occurring within the Proposed Development

Species	Conservation designation*	Value	Population estimate[30, 47, 13]	Scottish context[47] (unless referenced within)	Baseline	IOF	Justification
Greylag goose	Amber	Local	GB/UK: 47,000 pairs in the breeding season	The species is a common resident in Scotland with a native population in the	There were 34 flights (130 individuals) of greylag goose recorded during the VP	No	This species is of local value as a target species of medium conservation concern (species on the UK BoCC Amber List) that is

[47] Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. & Grundy D.S. (eds). 2007. The Birds of Scotland. The Scottish Ornithologists' Club, Aberlady

Species	Conservation designation*	Value	Population estimate[30, 47, 13]	Scottish context[47] (unless referenced within)	Baseline	IOF	Justification
			UK: 230,000 wintering individuals No NHZ estimate	north and west (20,000 birds post-breeding) and a naturalised, probably re-established population in the south and east (5,000 birds post-breeding; at least 700 pairs). After the breeding season, these birds are joined by >85,000 immigrants from Iceland that winter in lowland areas. In Dumfries and Galloway, Icelandic greylag goose is a common winter visitor on coasts and inland waters, with up to approximately 4,400 birds present each winter[48]. Greylag goose is also widespread as a breeding bird in Dumfries and Galloway found on many inland lochs and most river systems. However, reporting rates are low and, as such, regional breeding population estimates are not available.	surveys (31 flights during the breeding season). Predicted collision mortality for greylag is 0.04 birds per summer (0.02 birds using the Kinnelhead Development Area dataset). One pair nested within the Main Wind Farm Area in 2019, at the edge of Daer Reservoir.		present in locally important numbers but is not a qualifying feature of any statutory sites within 25 km of the Survey Area. Studies have estimated the minimum disturbance distance for geese in relation to operational onshore wind farms as 373 m, but this is species and site specific (range: 50-850 m) and displacement distances for geese are given as 30-600 m[49]. Although it is possible that foraging birds may be displaced due to construction and/or operation of the Proposed Development, alternative foraging habitat is available in the surrounding area and it is likely that any displaced birds would relocate to other suitable habitat nearby. Predicted collision mortality for greylag (0.04 birds per summer) would be undetectable against background annual mortality (annual mortality of greylag geese older than six months that overwinter in the UK has been estimated at 16%[50]). Therefore, significant effects to the local population associated with construction and operation of the Proposed Development are considered unlikely and this species is not considered to be an IOF.
Pink-footed goose	Amber	Local	GB/UK: 510,000 wintering individuals NHZ 19: 34,621 wintering individuals	Pink-footed goose is an abundant winter visitor; with peak numbers recorded in October before some birds continue south to England. Scotland is a key wintering area for birds breeding in Iceland and Greenland (Scotland's wintering population is 50% of the global total); large feeding and roosting flocks are present in eastern and central Scotland, especially in autumn and early winter. As winter progresses, redistribution to other parts of the wintering range occurs. In October 2017, a total of 515,852 pink-footed geese were counted in the UK - in Dumfries and Galloway 10,499 birds were counted in October, 20,182 in November, and 23,482 in March 2018[51].	There were 64 flights (3,964 individuals) recorded during VP surveys in the non-breeding season. Predicted collision mortality for pink-footed goose is 4.23 birds per winter.	No	This species is of local value as a target species of medium conservation concern (species on the UK BoCC Amber List) that is present in locally important numbers but is not a qualifying feature of any statutory sites within 25 km of the Survey Area. Predicted collision mortality for pink-footed goose is 4.23 birds per winter, which represents 0.01% of total population estimate of NHZ 19, and <0.001% of the most recent Scottish wintering population estimate. As no pink-footed goose collisions have been reported at European wind farms[44] (Table 7.7) it appears that collisions of this species are relatively rare. It is likely that, even if actually realised, the predicted collision rate would be undetectable against background annual mortality; annual mortality of pink-footed geese older than approximately six months that overwinter in the UK has been estimated at 14%[52]. Therefore, significant effects to the local population associated with construction and operation of the Proposed Development are considered unlikely and this species is not considered to be an IOF.
Teal	Amber	Negligible	GB/UK: 2,700-4,750 breeding pairs	Teal is widespread but uncommon and localised breeding species in Scotland, occurring more commonly across much	There was one flight (two individuals) recorded in the breeding season during	No	This species is of negligible value as a non-Schedule 1 / Annex I target species which is not a qualifying feature of any statutory sites within 10 km of the Survey Area, and was recorded in very low numbers during

[48] https://app.bto.org/webs-reporting/numbers.jsp

[49] Rees, E.C. (2012) Impacts of wind farms on swans and geese: a review. Wildfowl 62, 37-72.

[50] Trinder, M. (2012) The Potential Consequences of Elevated Mortality on the Population Viability of Whooper Swans in Relation to Wind Farm Developments in Northern SCOTLAND. Scottish Natural Heritage Commissioned Report No.459

[51] Brides, K, C. Mitchell, A. Sigfússon & S. N.V. Auhage. (2018) Status and distribution of Icelandic breeding geese: results of the 2017 international census. Wildfowl & Wetlands Trust Report, Slimbridge.19pp.

[52] Trinder, M., Rowcliffe, M., Pettifor, R., Rees, E., Griffin, L., Ogilvie, M. and Percival, S. (2005) Status and Population Viability Analyses of Geese in Scotland. Scottish Natural Heritage Commissioned Report No. 107.

Species	Conservation designation*	Value	Population estimate[30, 47, 13]	Scottish context[47] (unless referenced within)	Baseline	IOF	Justification
			UK: 435,000 wintering individuals Scotland: 1,950-3,400 breeding pairs; c.37,500 wintering individuals No NHZ estimate	of the country as winter visitor and passage migrant from Northern Europe and Fennoscandia. In Dumfries and Galloway teal is a common winter visitor on coast and inland waters and scarce breeder at inland waters[53].	VP surveys and one nesting pair recorded in 2019 within the Main Wind Farm Area.		baseline surveys. Flight activity was low, with no flights recorded within the CRZ at PCH (insufficient flight activity to undertake CRM). A single pair bred in 2019 at the southern edge of Daer Reservoir and given that this species usually nests within 5-10 m of the water's edge, there is an abundance of suitable nesting habitat away from the Proposed Development. As such, effects of displacement due to disturbance associated with construction and operation of the Proposed Development are unlikely to be significant to the local teal population and this species is not considered to be an IOF.
Goosander	None	Negligible	GB/UK: 4,800 breeding pairs UK: 14,500 wintering individuals Scotland: 2,000-3,000 breeding pairs; 2,600-12,200 wintering individuals No NHZ estimate	Goosander is a common resident (it breeds and winters in broadly similar regions) although individuals can move large distances in search for food and to suitable moulting places. It is most abundant in southern Scotland, where it can reach density of 0.3 pairs/km of river[54].	There were 10 flights (23 individuals) recorded during both breeding and non-breeding seasons at VP surveys. One nesting pair was recorded within the Main Wind Farm Area in 2018.	No	This species is of negligible value as a target species that is of low conservation concern, widespread and common, and was recorded in very low numbers during baseline surveys. Flight activity was low, with too few flights recorded within the CRZ at PCH to undertake CRM. A single pair bred in 2018 at the north-eastern edge of Daer Reservoir and given that this species is closely associated with freshwater habitats (rivers and lochs), there is an abundance of suitable nesting habitat away from the Proposed Development. As such, effects of displacement due to disturbance associated with construction and operation of the Proposed Development are unlikely to be significant to the local goosander population and this species is not considered to be an IOF.
Black grouse	Red; SBL; LBAP	Regional	GB/UK: 4,850 males (breeding season) Scotland: 3,344 displaying males NHZ 19: 121 displaying males	Two thirds of the UK birds are now found in Scotland and here numbers declined by 29% between 1995/96 and 2005[55]. Trends varied between region with stability in the Scottish Highlands. Scottish population size is estimated at 3,550-5,750 lekking males with 7,500-19,000 winter population.	The maximum count of lekking male black grouse within the Main Wind Farm Area during baseline surveys was four in 2018. Two lekking sites were identified within the Main Wind Farm Area in 2019. A total of eight flights were recorded during VP surveys (most of them were individual birds during breeding season).	**Yes**	This species is of regional value as a target species of high conservation concern (LBAP species and species on the UK BoCC Red List) that is present in regionally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. Given the high conservation status of black grouse in the region and established presence of lekking sites within the Main Wind Farm Area, this species is considered to be an IOF and is taken forward for a full EcIA.
Osprey	Sch 1.1, Ann I, SBL, LBAP, Amber	Local	UK: 240 breeding pairs NHZ 19: 6 breeding pairs	Osprey is a scarce summer migrant with range slowly expanding as numbers increase following historic persecution and recolonization in the mid-20th century. It requires lochs, rivers or estuaries for hunting. The Scottish breeding population has been estimated at 182-200 pairs, but the species is increasing as a summer visitor to much of mainland Scotland as it recovers previously lost range. Migrant birds are also seen outside the breeding areas, in	There were eight flights/individuals recorded during the VP surveys in years 2018-2020. There was no evidence of breeding within the Main Wind Farm Area.	No	This species is of local value as a target species that is afforded special protection (Schedule 1, Annex I, SBL and LBAP species, and species on the UK BoCC Amber List) but is not a qualifying feature of any statutory sites within 10 km of the Survey Area, and it was recorded infrequently and in low numbers during baseline surveys. Flight activity was low, with too few flights recorded within the CRZ at PCH to undertake CRM. There was no evidence of breeding within the Main Wind Farm Area. Therefore, displacement due to disturbance is not likely to occur during construction or operation of the Proposed Development, and as such osprey is not considered to be an IOF.

[53] Chambers, G. & Henderson, B.D. (2018) Birds in Dumfries and Galloway. Dumfries and Galloway Bird Report. No. 29. Scottish Ornithologists Club.

[54] Rehfisch, M. M., Wernham, C. V. and Marchant, J. H. (1999) Population, distribution, movements and survival of fish-eating birds in Great Britain, London: DETR.

[55] Sim, I.M., Eaton, M., Setchfield, R.P., Warren, P., & Lindley, P. (2008) Abundance of male Black Grouse Tetrao tetrix in Britain in 2005, and change since 1995–96. Bird Study, 55, 304 - 313.

Species	Conservation designation*	Value	Population estimate[30, 47, 13]	Scottish context[47] (unless referenced within)	Baseline	IOF	Justification
				all parts of the country. In 2018, Scottish raptor workers located 183 territories occupied by pairs (with total Scottish population estimated at 224 pairs), of which 14 were located in Dumfries and Galloway[56].			
Goshawk	Sch 1.1	Local	UK: 620 pairs in the breeding season (minimum – underreporting considered likely) NHZ 19: 31 breeding pairs	Goshawk is a scarce breeding bird, mostly found in large coniferous forests where birds are least vulnerable to disturbance. Following historical population demise as a result of habitat loss and persecution, goshawk numbers and range are slowly expanding, although the species remains a scarce breeding bird in Scotland. Being a secretive species and remaining inconspicuous for much of the year, goshawk is notoriously difficult to monitor and likely under reported, thus any population estimates are probably highly conservative. The Scottish goshawk population was estimated at 130 pairs between 2000 and 2004; the most recent estimations are for 174 pairs in 2018, of which 20 were located in Dumfries and Galloway[56].	There were seven flights/individuals recorded during the VP surveys (in 2018 and 2019). Goshawk were confirmed as breeding within the Rivox Land Portion (within 235 m of the Primary Proposed Access Route).	No	This species is of local value as a target species that is afforded special protection (Schedule 1) but is not a qualifying feature of any statutory sites within 10 km of the Survey Area, and it was recorded infrequently and in low numbers during baseline surveys. Flight activity was low, with too few flights recorded within the CRZ at PCH to undertake CRM. Goshawk is a species which is generally at low risk of collision due to their foraging behaviour being at low level and within and adjacent to woodland cover. The turbines are all located in open upland habitat, unlikely to be regularly used by goshawk. There are no collisions formally reported and only one anecdotal collision in the UK and a very low rate of reported collisions throughout Europe (16)[44], therefore any potential collision risk at the Proposed Development would be negligible. An occupied goshawk nest was found within the Original Site Boundary in Rivox in proximity to the of the Primary Proposed Access Route (235 m). Evidence suggests that goshawks can be disturbed at distances of between 300 m and 500 m[47, 57]. Details of embedded mitigation measures to prevent or minimise any disturbance to breeding goshawks, whilst maintaining access to the wind farm, will be included in the SPP. This will include pre-construction nest monitoring for breeding activity, implementing and maintaining an appropriate exclusion zone around any active nests, monitoring for disturbance and controlling the construction traffic. Any tree felling which may be necessary in the exclusion zone will be delayed until the nest is confirmed by the ECoW as being inactive. Alternative forestry stands within the Rivox forestry will provide continuity of goshawk nesting habitat. Combined with the exclusion zone, this will prevent disturbance to breeding goshawks and ensure the retention of their wider nesting habitat for the duration of the breeding season. The embedded mitigation measures will be sufficient to prevent disturbance to breeding goshawks, and as such a measurable effect on the local population is unlikely, thus this species is not considered to be an IOF in the context of the Proposed Development.
Marsh harrier	Sch 1.1, Ann I, SBL, LBAP, Amber	Negligible	UK: 590-695 pairs in the breeding season No NHZ estimate	In 2018, the Scottish marsh harrier population was estimated at less than 10 pairs, the stronghold being Tayside region (there were no breeding records	There were five flights recorded during the VP surveys in 2018, four of which occurred in the CRZ at PCH. There were no records of marsh harrier in 2019.	No	Marsh harrier is a target species that is afforded special protection (Schedule 1, Annex I, SBL and LBAP species, and species on the UK BoCC Amber List) but is not a qualifying feature of any statutory sites within 10 km of the Survey Area, and it was recorded infrequently and

[56] Challis, A., Eaton, M., Wilson, M.W., Holling, M., Stevenson, A. & Stirling-Aird, P. (2019) Scottish Raptor Monitoring Scheme Report 2018. BTO Scotland, Stirling.

[57] Whitfield, D.P., Ruddock, M. & Bullman, R. 2008. Expert opinion as a tool for quantifying bird tolerance to human disturbance. Biological Conservation 141, 2708-2717.

Species	Conservation designation*	Value	Population estimate[30, 47, 13]	Scottish context[47] (unless referenced within)	Baseline	IOF	Justification
				from Dumfries and Galloway where marsh harrier is uncommon visitor usually during summer[56]).	Predicted collision mortality for marsh harrier is 0.03 birds per breeding season. There was no evidence of breeding within the Main Wind Farm Area.		in low numbers during baseline surveys. However, given the rarity of this species in the region, and the fact that all marsh harrier flight activity was recorded in the space of five days in late July 2018 (post-breeding) and related to two individuals recorded on different days (four records of the same immature female and one record of a male), it is considered that Marsh Harrier are of negligible importance in the context of the Proposed Development. Although this species is known to collide with wind turbines in other countries (there are 63 reported fatalities from European wind farms to date[44]), due to scarcity of marsh harrier in Scotland, the predicted mortality rate of 0.03 birds per breeding season is unlikely to be realised. This species doesn't normally breed in Dumfries and Galloway (and is a very scarce breeder in Scotland) and with no evidence of breeding within the Main Wind Farm Area, displacement due to disturbance is not likely to occur during construction or operation of the Proposed Development. As such marsh harrier is not considered to be an IOF.
Hen harrier	Sch 1.1, Ann I, SBL, LBAP, Red	Regional	UK: 545 pairs in the breeding season NHZ 19: 18 breeding pairs (likely to be an under-estimate)	Hen harrier is a widespread but generally a scarce breeding species, found mostly in upland areas. Some birds move to lower altitudes or indeed south in winter. Persecution of this species across Scotland is well documented and remains severe in certain areas. In 2018, Scottish raptor workers located 277 territories occupied by pairs (with total Scottish population estimated at 460 pairs), of which 12 were located in Dumfries and Galloway[56].	There were 26 flights/individuals recorded during the VP surveys (in 2018 and 2019). This species was present within the Main Wind Farm Area all year round, however, there was no evidence of hen harrier using it for anything other than occasional foraging. Of the 19 hen harrier flights recorded during breeding season VPs, three were through the CRZ at PCH. CRM was therefore conducted for this season and, assuming a 99% avoidance rate[9], this would result in zero collision mortality during the breeding season. There was no evidence of breeding within the Main Wind Farm Area.	No	This species is of regional value as a target species that is afforded special protection Schedule 1, Annex I, SBL and LBAP species, species on the UK BoCC Red List) that is present in regionally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. Hen harrier rarely collides with turbines (there have been 13 fatalities recorded at European wind farms to date[44]) and CRM predicted no collisions at the Proposed Development. The lack of breeding evidence suggests that birds are largely making use of the Main Wind Farm Area for foraging during the breeding and non-breeding seasons. Although there is a risk that foraging birds may be disturbed during construction activities or operation, hen harrier are known to continue to use suitable foraging habitat after wind farms are built. In addition, there is suitable foraging habitat in the surrounding area and it is unlikely that construction and/or operation activities would have any significant effects on the local hen harrier population, and so they are not considered to be an IOF in the context of the Proposed Development.
Red kite	Sch 1.1, Ann I, SBL, LBAP	Regional	UK: 4,400 pairs in the breeding season NHZ 19: 83 breeding pairs	Red kite is an uncommon resident breeding bird in Scotland, following successful reintroduction programmes. The populations remain small but are increasing, with most birds remaining close to their natal areas throughout the year. The sedentary Scottish population forms communal winter roosts at a variety of traditional sites from September to March. In 2018, Scottish raptor workers located 266 territories	There were 78 flights (81 individuals) recorded during VP surveys in years 2018-2020. Predicted collision mortality for red kite is 0.08 birds per breeding season (0.3 birds using the Kinnelhead Development Area dataset) and 0.02 birds per non-breeding season. There was no evidence of breeding within the Main Wind Farm Area.	**Yes**	This species is of regional value as a target species that is afforded special protection (Schedule 1, Annex I, SBL and LBAP species) that is present in regionally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. Given the level of flight activity recorded during baseline surveys and predicted mortality rates at the Proposed Development for this species, red kite is considered to be an IOF and is taken forward for a full EcIA.

Species	Conservation designation*	Value	Population estimate[30, 47, 13]	Scottish context[47] (unless referenced within)	Baseline	IOF	Justification
				occupied by pairs, of which 123 were located in Dumfries and Galloway[56].			
Oystercatcher	Amber	Local	UK: 95,500 breeding pairs Scotland: 84,500-116,500 breeding pairs; 80,000-120,000 wintering individuals No NHZ estimate	Oystercatcher is a widespread and common breeding species both on farmland and coastal areas. Most Scottish birds migrate to England, Ireland and the continent during winter, but are replaced by immigrants from further north. A 39% decline in the Scottish breeding population has been recorded between 1995 and 2018[58]. A common breeder in Dumfries and Galloway, though declines have been noted in some areas[53].	There were 61 flights (286 individuals) recorded during VP surveys in years 2018-2020. Predicted collision mortality for oystercatcher is 0.02 birds per breeding season. Up to four breeding territories were estimated within the Main Wind Farm Area in both 2018 and 2019, and a single territory was identified within the Kinnelhead Development Area in 2020.	No	This species is of local value as a target species of medium conservation concern (species on the UK BoCC Amber List) that is present in locally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. This species rarely collides with turbines (there have been 28 fatalities recorded at European wind farms to date[44]) and predicted collision mortality at the Proposed Development for oystercatcher (0.02 birds per summer; less than one fatality throughout the lifespan of Daer Wind Farm) is unlikely to be detectable against background annual mortality (12%[59]). Although it is possible that low numbers of breeding birds may be displaced during construction and/or operation of the Proposed Development, there is abundant alternative breeding habitat within the Main Wind Farm Area and in the surrounding locale. As such, effects of collision risk and/or of displacement due to disturbance associated with construction and operation of the Proposed Development are unlikely to be significant to the local oystercatcher population and this species is not considered to be an IOF.
Lapwing	SBL, LBAP, Red	Local	UK: 97,500 breeding pairs Scotland: 71,500-105,600 breeding pairs; 65,000-69,000 wintering individuals No NHZ estimate	Lapwing is a common and widespread resident in Scotland, with highest breeding densities on the Northern Isles, the Inner and Outer Hebrides, and in lowland agricultural areas of the south and east. In winter, breeding birds move to lower ground and estuaries with some migrating south. A 56% decline in the Scottish breeding population has been recorded between 1995 and 2018[58]. In Dumfries and Galloway lapwing is a common resident on coast, farmland and inland waters[53].	There were 34 flights (68 individuals) recorded during VP surveys in years 2018-2020. Predicted collision mortality for lapwing is 0.03 birds per breeding season. Two and five breeding territories were estimated within the Main Wind Farm Area in 2018 and 2019 respectively.	No	This species is of local value as a target species of high conservation concern (SBL and LBAP species, and species on the UK BoCC Red List) that is present in locally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. This species rarely collides with turbines (there have been 27 fatalities recorded at European wind farms to date[44]) and predicted collision mortality at the Proposed Development for lapwing (0.03 birds per summer; i.e. less than one fatality throughout the lifespan of the Proposed Development) is unlikely to be detectable against background annual mortality (29.5%[60]). Although it is possible that low numbers of breeding birds may be displaced during construction and/or operation the Proposed Development, there is alternative breeding habitat within the Main Wind Farm Area and in the surrounding area. As such, effects of collision risk and/or of displacement due to disturbance associated with construction and operation of the Proposed Development are unlikely to be significant to the local lapwing population and this species is not considered to be an IOF.
Golden plover	Ann I, SBL, LBAP	Local	GB/UK 33,500 – 50,500 breeding pairs UK: 410,000 wintering individuals	Numbers of golden plover in Scotland have experienced mixed fortunes in recent decades with significant declines in southern Scotland and significant increases in north-west Scotland and the	There were three flights (34 individuals) recorded during VP surveys (in 2018 and 2020). Predicted collision mortality for golden plover is 0.05 birds per breeding season (and zero collision mortality during	No	Target species of high conservation concern (Annex I, SBL and LBAP species) but is not a qualifying feature of any statutory sites within 10 km of the Survey Area and it was present very infrequently during baseline surveys. Only three flocks were recorded during baseline surveys (a single flock in each: the breeding season 2018, the non-

[58] Harris, S.J., Massimino, D., Balmer, D.E., Eaton, M.A., Noble, D.G., Pearce-Higgins, J.W., Woodcock, P. & Gillings, S. (2020) The Breeding Bird Survey 2019. BTO Research Report 726. British Trust for Ornithology, Thetford.

[59] J. D. Goss-Custard, S. E. A. Le V. dit Durell, H. P. Sitters & R. Swinfen (1982) Age-structure and survival of a wintering population of Oystercatchers, Bird Study, 29:2, 83-98.

[60] Peach, W., Thompson, P., & Coulson, J. (1994) Annual and Long-Term Variation in the Survival Rates of British Lapwings Vanellus vanellus. Journal of Animal Ecology, 63(1), 60-70.

Species	Conservation designation*	Value	Population estimate[30, 47, 13]	Scottish context[47] (unless referenced within)	Baseline	IOF	Justification
			NHZ 19: 778 breeding pairs	Outer Hebrides[61]. The Scottish population is estimated as 15,000 breeding pairs and 25,000-35,000 wintering birds. The recent long-term data from Scotland show that Scottish breeding population of golden plover is steady although slightly declining (by 7% between 1995 and 2018[58]). In Dumfries and Galloway golden plover is uncommon winter visitor to inland farmland and a scarce summer visitor to upland areas[53].	the non-breeding season). No golden plovers were recorded breeding within the Main Wind Farm Area.		breeding season 2018/19 and the breeding season 2020), which resulted in predicted mortality rate of 0.05 birds per breeding season (which is equivalent to 1.75 birds colliding throughout the lifespan of the Proposed Development). Golden plover collisions with turbines are relatively rare (there have been 42 fatalities recorded at European wind farms to date, none of which were in the UK[44]), and given that the mortality rate calculated for the Proposed Development is based on a single record of 11 individuals, it is unlikely to be realised. There was no evidence of golden plover breeding within the Main Wind Farm Area. Therefore, displacement due to disturbance is not likely to occur during construction or operation of the Proposed Development, and as such golden plover is not considered to be an IOF.
Ringed plover	Red	Local	GB/UK 5,450 breeding pairs UK: 42,500 wintering individuals Scotland: 4,900-6,700 breeding pairs; 23,000-25,000 wintering individuals No NHZ estimate	A widespread breeding species associated mostly with coastal habitats, ringed plover can also breed in small numbers inland on freshwater lochs and adjacent arable fields. It is a common passage and a winter visitor to coasts and inland riparian areas. In Dumfries and Galloway ringed plover is a common resident on coasts and a rare summer visitor to inland waters[53].	There were four flights (five individuals) recorded during VP surveys (in 2018 and 2020). Two breeding territories were estimated within the Main Wind Farm Area in both 2018 and 2019.	No	This species is of local value as a target species of high conservation concern (species on the UK BoCC Red List) that is present in locally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. No ringed plover flights were recorded in the CRZ at PCH, therefore risk of collision is considered as negligible. Two pairs bred in 2018 and 2019 at the eastern edge of Daer Reservoir. Although disturbance, and potential displacement, of breeding birds during construction and the operational phase are possible, ringed plover are considered to be extremely tolerant of disturbance and habituate rapidly to anthropogenic activities[62]. It is stated that at distances in excess of 100 m ringed plover rarely show any sign of disturbance to human activity and given the locations of breeding territories (at the edge of Daer Reservoir) and that there is abundance of suitable nesting habitat within the Main Wind Farm Area, away from the Proposed Development, effects of displacement due to disturbance associated with construction and operation of the Proposed Development are unlikely to be significant to the local ringed plover population. As such, this species is not considered to be an IOF.
Curlew	SBL, LBAP, Red	Local	GB/UK 58,500 breeding pairs UK: 125,500 wintering individuals Scotland: 58,800 breeding pairs; 85,700 wintering individuals NHZ 19: 4,284 breeding pairs	Curlew is a widespread resident breeding on farmland and uplands; a common passage and winter visitor to coasts and nearby fields. Recent records for Scotland indicate a 59% decline in breeding birds between 1995 and 2018[58]. In Dumfries and Galloway curlew is a common passage migrant and winter visitor. Breeding numbers are declining and curlew is now of important conservation concern[53].	There were 287 flights (639 individuals) recorded during VP surveys during breeding seasons in years 2018-2020. Predicted collision mortality for curlew is 0.18 birds per breeding season (and 0.24 birds using the Kinnelhead Development Area dataset). Up to nine breeding territories were estimated within the Main Wind Farm Area.	**Yes**	This species is of local value as a target species of high conservation concern (SBL and LBAP species and species on the UK BoCC Red List) that is present in locally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. Given the high conservation status of curlew, the abundance of breeding birds within the Main Wind Farm Area and high flight activity recorded during baseline surveys, this species is considered to be an IOF and is taken forward for a full EcIA.

[61] Sim, I.M.W., Gregory, R.D., Hancock, M.H. and Brown, A.F. (2005) Recent changes in the abundance of British upland breeding birds. Bird Study, 52, 261-275.

[62] Cutts, N., Hemingway, K. & Spencer, J. (2013) Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning & Construction Projects. Produced by the Institute of Estuarine & Coastal Studies. University of Hull.

Species	Conservation designation*	Value	Population estimate[30, 47, 13]	Scottish context[47] (unless referenced within)	Baseline	IOF	Justification
Dunlin	Ann I, SBL, LBAP, Amber	Regional	GB/UK 8,600-10,500 breeding pairs UK: 350,500 wintering individuals Scotland: 8,000-10,000 breeding pairs NHZ 19: 36 breeding pairs	The species is widely distributed through Britain and Ireland in the winter, but the breeding population is concentrated primarily in Scotland[63], which hosts 8,000-10,000 pairs; 85% of the British breeding population of the *schinzii* subspecies. In Dumfries and Galloway dunlin is a common winter visitor to coast, and also summer visitor and rare breeder[53].	A single breeding territory was identified in 2018 and 2019 within the Main Wind Farm Area.	No	This species is of regional value as a target species of high conservation concern (Annex I, SBL and LBAP species, and species on the UK BoCC Amber List) that is present in regionally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. No flights of dunlin were recorded during VP surveys, although a single pair was found breeding at the edge of Daer Reservoir in 2018 and 2019. Given that there is abundance of suitable nesting habitat within the Main Wind Farm Area away from the Proposed Development, effects of displacement due to disturbance associated with construction and operation of the Proposed Development are unlikely to be significant to the local dunlin population. As such, this species is not considered to be an IOF.
Snipe	Amber	Local	UK: 66,500 breeding pairs; 1,100,000 wintering individuals Scotland: 34,000-40,000 breeding pairs; 10,000-30,000 wintering individuals NHZ 19: 1,252 breeding pairs	This species is a fairly common, widespread breeding species; in winter birds move south and to lower elevations, and Scottish birds are joined by migrants from Scandinavia and northern Europe. Breeding occurs in most areas except the most heavily farmed land. A 22% increase in the Scottish breeding population was recorded between 1995 and 2018[58]. In Dumfries and Galloway snipe is a common resident and declining breeder[53].	There were 23 flights (27 individuals) recorded during VP surveys during breeding seasons in years 2018-2020. Of these flights, eight were through the CRZ at PCH in 2018-2019. CRM was therefore conducted for this period and this would result in 0.02 mortalities during the breeding season. Up to 10 breeding territories were estimated within the Main Wind Farm Area.	No	This species is of local value as a target species of medium conservation concern (species on the UK BoCC Amber List) that is present in locally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. Flight activity was low and given the size of breeding population in NHZ 19 (1,252 pairs), the predicted collision rate would be undetectable against background annual mortality (*c.* 50%[64]), resulting in negligible collision risk. Although small numbers of snipe may be displaced by the Proposed Development there is alternative breeding habitat within the Main Wind Farm Area and in the surrounding area. This species is a common and widespread breeder throughout Scotland, therefore effects of displacement due to disturbance associated with construction and operation of the Proposed Development are unlikely to be significant to the local snipe population. As such, this species is not considered to be an IOF.
Common sandpiper	Amber	Local	UK: 13,000 breeding pairs; 52 wintering individuals Scotland (outdated numbers): 17,000-24,000 breeding pairs No NHZ estimate	This species is a widely distributed breeding bird across upland Scotland. It is also common and widespread as a spring and autumn passage migrant, with very small numbers overwintering. A 24% decline in the Scottish breeding population has been recorded between 1995 and 2018[58]. In Dumfries and Galloway, common sandpiper is a common breeder and summer visitor on rivers, lochs and coasts[53].	Up to four breeding territories were estimated within the Main Wind Farm Area.	No	This species is of local value as a target species of medium conservation concern (species on the UK BoCC Amber List) that is present in locally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. This species is closely associated with freshwater margins, and it can nest along burns, rivers and the shores of lochs. At the Proposed Development all common sandpiper's territories were found along the Daer Water and the shores of Daer Reservoir. Given that there is abundance of suitable nesting habitat away from the Proposed Development within the Main Wind Farm Area, effects of displacement due to disturbance associated with construction and operation of the Proposed Development are unlikely to be significant to the common sandpiper population. As such, this species is not considered to be an IOF.
Redshank	Amber	Local	UK: 22,000 breeding pairs;	This species is a common and widespread resident and migrant in Scotland, breeding throughout the	The only records of redshank were made in 2018. Three flights/individuals were recorded at VP surveys during the	No	This species is of local value as a target species of medium conservation concern (species on the UK BoCC Amber List) that is present in locally important numbers but is not a qualifying feature of

[63] Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. and Fuller, R.J. (2013) Bird Atlas 2007-11: The Breeding and Wintering Birds of Britain and Ireland. BTO, Thetford.

[64] Cramp, S.; Perrins, C. M. 1977-1994. Handbook of the birds of Europe, the Middle East and Africa. The birds of the western Palearctic. Oxford University Press, Oxford.

Species	Conservation designation*	Value	Population estimate[30, 47, 13]	Scottish context[47] (unless referenced within)	Baseline	IOF	Justification
			100,000 wintering individuals Scotland: 11,700-17,500 breeding pairs; 4,000-25,000 wintering individuals No NHZ estimate	country; also, a common and regular passage and winter visitor. Redshank is an uncommon breeder in Dumfries and Galloway[53].	breeding season. Two breeding territories were estimated within the Main Wind Farm Area in 2018.		any statutory sites within 10 km of the Survey Area. Flight activity was very low, with no flights recorded within the CRZ at PCH. Two breeding territories were recorded in 2018 across the Main Wind Farm Area but given that there is abundance of suitable nesting habitat away from the Proposed Development within the Main Wind Farm Area, effects of displacement due to disturbance associated with construction and operation of the Proposed Development are unlikely to be significant to redshank. As such, this species is not considered to be an IOF.
Merlin	Sch1.1; Ann I; SBL, LBAP, Red	Local	GB/UK: 1,150 breeding pairs NHZ 19: 12 breeding pairs	Merlin is a scarce resident breeder on upland heather moors, and a passage and winter visitor mainly to coastal and low-lying areas. In Scotland this species occurs widely, and they are common in the Highlands and North-East Scotland. In 2018, Scottish raptor workers located 194 territories occupied by pairs (with total Scottish population estimated at 689 pairs), of which eight were located in Dumfries and Galloway[56].	There were 13 flights/individuals recorded during VP surveys during breeding and non-breeding seasons in years 2018-2019. No breeding birds were found within the Main Wind Farm Area, although juvenile birds were recorded in the post-breeding period.	No	This species is of local value as a species that is afforded special protection (Schedule 1, Annex I, SBL and LBAP species, and species on the UK BoCC Red List) that is present in locally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. Flight activity was low, with too few flights recorded within the CRZ at PCH to undertake CRM. There was no evidence of breeding within the Main Wind Farm Area. Therefore, displacement to breeding merlin due to disturbance is not considered likely to occur during construction or operation of Proposed Development, and as such merlin is not considered to be an IOF.
Peregrine	Sch1.1; Ann I; SBL, LBAP	Local	GB/UK: 1,750 breeding pairs NHZ 19: 34 breeding pairs	Peregrine is a scarce, though widespread, resident breeder and winter visitor. Mostly found in open, upland habitats but also in lowlands and cities. Some birds move locally outside the breeding season. Although numbers, distribution and breeding performance of the UK peregrine population have all largely recovered from declines caused by the detrimental effects of organochlorine pesticides in the 1950s and 1960s[18], populations and breeding performance have since declined in northwest Scotland and the Northern Isles[65]. In 2018, Scottish raptor workers located 315 territories occupied by pairs (with total Scottish population estimated at 523 pairs), of which 62 were located in Dumfries and Galloway[56].	There were 23 flights (24 individuals) recorded during VP surveys during breeding and non-breeding seasons in years 2018-2019. Predicted collision mortality for peregrine is 0.03 birds per breeding season and 0.01 birds per non-breeding season. No breeding birds were found within the Main Wind Farm Area, although juvenile birds were recorded in the post-breeding period.	No	This species is of local value as a target species that is afforded special protection (Schedule 1, Annex I, SBL and LBAP species) that is present in locally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. Predicted collision mortality for peregrine in breeding season is 0.03 birds, which represents 0.08% of total population estimate of NHZ 19, and <0.006% of the most recent Scottish breeding population estimate. A total of 31 peregrine collisions have been reported at European wind farms, one of which was in the UK[44] (Table 7.7). Whilst is it acknowledged that there are likely to be other, unpublished collisions of this species, peregrine collisions nevertheless appear to be a relatively rare event. The predicted collision rates for the Proposed Development in both breeding and non-breading seasons are very low, and as such the potential for a detectable effect to the local population as a result of collision risk is considered to be of negligible for this species. There was no evidence of breeding within the Main Wind Farm Area. Therefore, displacement due to disturbance is not likely to occur during construction or operation of the Proposed Development, and as such peregrine is not considered to be an IOF.

** Key: Sch1.1 = Schedule 1 part 1 of the Wildlife & Countryside Act 1981 (as amended); Ann I = Annex I of the EC Birds Directive; SBL = Scottish Biodiversity List; LBAP = Local Biodiversity Action Plan (Dumfries and Galloway) priority species; Red = UK Birds of Conservation Concern (BoCC) Red-listed species; Amber = UK BoCC Amber-listed species*

[65] Crick, H.Q.P. and Ratcliffe, D.A. (1995). The Peregrine (Falco peregrinus) breeding population of the United Kingdom in 1991. Bird Study 42, 1-19.

7.6.37 No sites designated for ornithological interests were identified within 10 km of the Survey Area (or within 25 km for SPAs and Ramsar sites with geese or gulls as a designated feature).

7.6.38 The species considered to be IOFs in the context of the Proposed Development, and therefore considered further in this EcIA are:

- Black grouse;
- Red kite; and
- Curlew.

7.6.39 Impact assessment for each of these species is provided below.

Black grouse

Introduction

7.6.40 Black grouse is a LBAP priority species and is included on the SBL. The species is also Red-listed due to both historical and recent population declines[18]. The National Survey carried out in 2005 estimated the Scottish population of displaying male black grouse at 3,344[66] (7,500-19,000 winter population) although it is not widespread in southern Scotland where in the 2011-2015 period it was estimated to be 581 males[67]. The population in NHZ 19 is estimated at 121 displaying black grouse males.

7.6.41 In Dumfries and Galloway black grouse is a scarce and localised resident breeder. Between 1968-72 and 2007-2011, the range of black grouse population in southern Scotland contracted by 48%[63], and now it appears to be isolated from populations to the north (in the Scottish Highlands) and to the south (in northern England). A reported 34 km gap exists between population in southern Scotland and England[68]. The reasons for the decline in southern Scotland are linked to either the direct loss of moorland fringe habitats, or their degradation and fragmentation through agricultural intensification[69] and/or commercial afforestation[70].

7.6.42 Black grouse are known to breed at the Proposed Development, with established leks located within the Main Wind Farm Area. Breeding records for this species for the area within the Original Site Boundary were also included in the data received from RSPB and SWSEIC (see Technical Appendix 7.1).

Baseline

7.6.43 Two established black grouse lekking sites were recorded within the Main Wind Farm Area: the Sweetshaw lek and the Crookburn lek (see Figure 7.4). There were a number of sightings of individual black grouse during baseline surveys during various times of year, but they were concentrated around these two discrete lek locations. These included eight flights recorded during VP surveys (four flights in the breeding season 2018, two flights in the non-breeding season 2018/19 and two flights in the breeding season 2019). Two of these flights occurred in the CRZ at PCH, however this level of flight activity was not sufficient to conduct CRM for this species. Also, there were nine incidental records of black grouse, with a maximum of four birds recorded in September 2018 in the vicinity of the Sweetshaw lek.

7.6.44 The number of lekking males within the Main Wind Farm Area can be estimated at five to six. In 2018, up to four males were displaying at the Sweetshaw lek, and satellite males were recorded displaying in two locations (1-1.5 km northeast of the Sweetshaw lek and 700-800 m west of the Crookburn lek). In 2019, the maximum count was two displaying males at the Sweetshaw lek, and three displaying males at the Crookburn lek. A satellite displaying male was also recorded 800 m west of the Crookburn lek. Despite delayed start of black grouse survey (the first visit was carried out on 27 April) and reduced survey effort in 2018, the numbers of lekking males and the locations of leks appear to be consistent between the two years of survey (2018-2019). No black grouse were recorded in the Kinnelhead Development Area during 2020 surveys.

Potential collision risk impacts

7.6.45 It is acknowledged that theoretical risk of collision does exist for black grouse (there were six collisions reported from Austria[44] and two from Scotland[71]), however grouse species are known to collide with deer fences, power lines or turbine towers, rather than turbine blades. A study conducted at four black grouse lek sites in Scotland[72], monitoring flight heights for 144 hours, concluded that mean flight height was 3 m, with no flights over 15 m being recorded. This suggests that black grouse are not likely to be at risk of collision with turbine blades. The risk of collision with turbine towers cannot be quantified using standard collision risk assessment methods, but is unlikely to be as high as the risk of colliding with objects which are harder to see such as fences. Additionally, such collisions are not necessarily always fatal.

7.6.46 Eight black grouse flights were recorded during VP surveys, two of which were in the CRZ at PCH. However, given such a low level of flight activity recorded within the Main Wind Farm Area, it is considered that unmitigated collision effects will be of **low magnitude** and **not significant**. However, to minimise collision risk for black grouse, any fencing required for the wind farm and habitat management will be marked, maintained and monitored as part of the habitat management plan (HMP; see Section 7.7 below).

Potential disturbance/displacement impacts

7.6.47 Habitat loss calculations estimate the total amount of upland moorland habitat (i.e. grassland, heathland and bog) to be lost to infrastructure within the entire Proposed Development Area will be 11.93 ha (see Chapter 6: Ecology of this EIAR), which represents 0.65% of the available extent of these habitat types within the Proposed Development Area. As such the amount of suitable black grouse breeding habitat to be lost directly to components of the Proposed Development in preferred areas is likely to be relatively small; any direct loss of habitat is considered to be of low significance, as it is unlikely that the loss of this habitat would have any significant impact on breeding black grouse within the Proposed Development or surrounding area. There may also be some positive effects associated with the provision of grit by wind farm tracks and hardstandings (black grouse feed predominantly on fibrous plant matter, such as birch, larch shoots, bilberry, cotton grass and heather, so ingesting grit, often difficult to find in upland habitats, can help digest their food).

7.6.48 The Sweethsaw lek is the one closest to proposed infrastructure, being 200-240 m from the proposed wind farm track and 350-450 m from Turbines 7 and 8 (see Table 7.10 and Figure 7.4). It is also *c*. 800 m from the search area for Borrow Pit (BP) 2. The Crookburn lek is located further away from the proposed infrastructure (1.1 km from Turbine 17 and 1.1 km from BP 3). Apart from the established leks, single displaying black grouse were

[66] Sim, I. M. W., Eaton, M. A., Setchfield, R. P., Warren, P. K., Lindley, P. (2008) Abundance of male Black Grouse Tetrao tetrix in Britain in 2005, and change since 1995–96. Bird Study. 55. 304–313.

[67] Warren, P (2016) Black grouse conservation in southern Scotland - Phase 2 Development of a regional strategic conservation plan. GWCT.

[68] Warren, P. Atterton, F., Baines, D., Viel, M., Deal, Z., Richardson, M. & Newborn, D. 2015. Numbers and distribution of Black Grouse Tetrao tetrix males in England: results from the fourth survey in 2014. Bird Study, 62: 202-207.

[69] Fuller, R., & Gough, S. (1999) Changes in sheep numbers in Britain: implications for bird populations. Biological Conservation, 91, 73-89.

[70] Pearce-Higgins, J.W., Grant, M., Robinson, M., & Haysom, S.L. (2006) The role of forest maturation in causing the decline of Black Grouse Tetrao tetrix. Ibis, 149, 143-155.

[71] Bright, J.A. et al., (2009) Mapped and written guidance in relation to birds and onshore wind energy development in England. RSPB Research Report No 35, Royal Society for the Protection Birds, Bedfordshire, UK.

[72] Wright, J. (2007) Black Grouse (Tetrao tetrix) flight patterns and possible interactions with wind turbines. Masters thesis, University of Edinburgh.

recorded on the proposed wind farm track between Turbines 3 and 5, *c*. 650 m from the search area for BP 2, and also 480 m from Turbine 1.

7.6.49 Given the distance between proposed infrastructure and the lek locations, construction activity for the Proposed Development also has the potential to disturb nesting black grouse as nests are generally within 1.5 km of the lek site; for both leks this radius is likely to include some areas of construction. It is also possible that without adequate mitigation construction activity could damage or destroy ground nests of black grouse should these nests have been established before the construction activities commence. NatureScot currently recommends that no construction work takes place within 750 m of lekking black grouse. If construction works were to take place within this buffer around Turbines 1, 7, 8 and 17, or if BP 2 was used for stone extraction during lekking period, then without protection measures there is likely to be some short term (construction phase) disturbance/displacement of one to five males during this period. This would represent up to 4.1% of the population of NHZ 19, and as such would be a moderate, potentially significant short-term adverse impact. However, the exact location of birds displaying at a given lek can vary considerably between years, and even between different days, and there is alternative suitable habitat for this species in the wider area. Disturbance can be reduced if operations are restricted, particularly in relation to timing of construction works, in the areas closest to the lek. With application of protection measures via embedded mitigation, black grouse are expected to continue to use the wider area, meaning that any displacement will be localised and temporary and therefore not be significant at a regional level in the longer term. With the application of embedded mitigation measures outlined previously in this section, such as a SPP (including pre-construction surveys during the bird breeding season and an appropriate exclusion zone implemented around any black grouse breeding sites), construction phase disturbance/displacement effect on this species is predicted to be of no more than short-term, **low magnitude** and **not significant**.

7.6.50 Disturbance to lekking and nesting birds is expected to be of highest significance during construction and less significant during the operation of the Proposed Development. Recent research by Zwart *et al.* (2015)[73] found that leks more than 500 m from a proposed turbine did not move after wind farm construction. Although the Sweetshaw lek is within 500 m of proposed turbine locations (Turbines 7 and 8), birds at this lek were also recorded some distance from the main lek location, and given that there is suitable habitat available in the immediate area further away from turbines, potential disturbance/displacement effects on black grouse during the operational phase are considered to be **negligible** and **not significant**.

Red kite

Introduction

7.6.51 Red kite is an Annex I and Schedule 1 species and is listed as a SBL and LBAP priority species. Red kite is classified as 'near threatened' by the International Union for Conservation of Nature (IUCN)[74]. Red kite has successfully been reintroduced to Scotland in four schemes across the country; having originally becoming extinct in Scotland in the late 19th century. Red kite is now a scarce and localised resident breeder but numbers are increasing each year. In 2018 the Scottish population stood at 266 breeding pairs[56]. Red kites were reintroduced to Dumfries and Galloway in the Loch Ken area between 2001 and 2005. This region has seen the strongest population growth of the four Scottish release sites and holds the largest breeding population. Recent years' data shows this continued increase, e.g. 88 pairs in 2014[75], and 105 pairs in 2016[76]. In 2018, Scottish raptor workers located 123 territories occupied by pairs in Dumfries and Galloway[56].

Baseline

7.6.52 Red kite was the most frequently recorded target raptor species during the baseline VP surveys. There were 78 flights (81 individuals) recorded during VP surveys in years 2018-2020, mostly during the breeding seasons (62 flights were recorded over two breeding seasons and 16 flights during a single non-breeding season). The majority of flights during the breeding seasons were recorded in 2018 (33 flights), with 10 flights in 2019 and 19 flights in 2020. Overall, red kites are considered to be present at the Proposed Development all year round. Also, four incidental red kite flights were recorded during VP surveys and 10 flights during raptor surveys. Most flights over the Main Wind Farm Area occurred over open ground in the south and southwest. The dedicated raptor surveys did not record evidence of red kites breeding within the Main Wind Farm Area. Data requests to RSG and RSPB did not return any data regarding red kite nests or winter roosts within 5 km of the Proposed Development.

Potential collision risk impacts

7.6.53 Red kite are relatively susceptible to collision with turbines compared to the collision rate of other species. A total 605 collisions were reported at European wind farms (see Table 7.13); the vast majority of them occurring in Germany (though noting that more than half of the world's population of red kite breed in this country).

7.6.54 CRM was undertaken for this species and the output estimates, based upon an avoidance rate of 99% were of 0.08 collisions for the breeding season and 0.02 collisions for the non-breeding season this would be equivalent to 2.8 and 0.7 collisions throughout the lifespan of the Proposed Development respectively). The higher collision rate predicted for the breeding season (0.08 birds) represents 0.05% of the NHZ 19 population (83 pairs) and 0.03% of the total of Dumfries and Galloway breeding individuals (123 pairs in 2018; this does not include non-breeding birds). Even if the highly conservative (and less accurate) mortality rate calculated based on the Kinnelhead Development Area dataset is used, this would represent 0.18% of the NHZ 19 population and 0.12% of the Dumfries and Galloway population.

7.6.55 Annual survival rates for red kite have been calculated as being 0.91 for adults (wild-hatched, in areas without illegal persecution), and 0.58 for birds in their first year[75]. Thus, the predicted collision rate is unlikely to be detectable against background mortality, and any potential increase in foraging birds in the Main Wind Farm Area as a result of the increase in the size of local red kite population is not likely to change this conclusion. However, it is not certain whether red kites recorded within the Main Wind Farm Area during baseline surveys were individuals from the nearby breeding sites or whether they were, in fact, non-breeding birds overflying the Main Wind Farm Area. Nonetheless, the Dumfries and Galloway red kite population continues to grow at a time when the number of wind farms in the region is also increasing and so, thus far, there is no evidence of collisions with turbines affecting the regional population. In light of this, it is considered that collision risk to red kite is of **low magnitude** and therefore **not significant**.

Potential disturbance/displacement impacts

7.6.56 The effect of wind farms on abundance on red kites in the non-breeding season was studied on seven wind farms in 2006 and no significant evidence of an effect was found (a decrease in density of red kites following construction of a wind farm was reported on four sites, but no negative effect was found in three cases)[34]. A tracking study of red kites within their core range in Germany[77] did not show any displacement to red kite by wind farm developments and this species was seen to frequently visit wind farms to forage. It also showed that red kites spent most of their time close to their nests. Most (54%) of the fixes were located within a radius of 1 km around nests. Red kite nests are usually located in woodland patches surrounded by open countryside, often in areas of well-spaced trees close

[73] Zwart, M.C., Robson, P., Rankin, S., Whittingham, M.J. & McGowan, P.J.K. (2015) Using Environmental Impact Assessment and post-construction monitoring data to inform wind energy developments. Ecosphere 6(2), article 26.

[74] BirdLife International (2020) Species factsheet: Milvus milvus. Downloaded from http://www.birdlife.org on 05/11/2020.

[75] Sansom, A., Etheridge, B., Smart, J. & Roos, S. (2016) Population modelling of north Scotland red kites in relation to the cumulative impacts of wildlife crime and wind farm mortality. Scottish Natural Heritage Commissioned Report No. 904.

[76] RSPB (2017) Wildlife trail generates millions for economy. Press Release: 1484044030209.

[77] Hötker, H., Mammen, K., Mammen, U. and Rasran, L. (2017) Red kites and wind farms – telemetry data from the core breeding range. Wind Energy and Wildlife Interactions 3-15.

to a woodland edge[78]. The Proposed Development, located within upland landscape, comprising of predominantly open moorland, and bordered by Daer Reservoir to the northwest and a conifer plantation (Rivox Forest), to the east, does not offer many nesting opportunities for red kites. As no breeding evidence was found within or near the Main Wind Farm Area it could be that some birds utilising the Main Wind Farm Area were non-breeders and birds dispersing from the main breeding areas elsewhere. Therefore, it is unlikely that the Main Wind Farm Area forms an important foraging area for any local birds. In addition, many red kites nest close to human habitation so some tolerance to human activities can be expected[78].

7.6.57 There is no strong evidence that the Main Wind Farm Area constitutes an important foraging area for red kites, either. Although some birds were indeed observed foraging, the average duration of observed flights during the VP surveys was 3 minutes and 34 seconds, most birds were simply overflying the Main Wind Farm Area. The significantly fewer red kite flights recorded during VP surveys in 2019 compared to 2018 shows that this species is capable of changing their favoured foraging areas year to year, so should some displacement occur, red kites are considered to be able to adapt to this. In light of this, disturbance/displacement effects are likely to be of **negligible magnitude** and **not significant**.

Curlew

Introduction

7.6.58 Curlew is a Dumfries and Galloway LBAP priority species; it is also included on the BoCC UK Red List, partly due to a widespread decline in the UK breeding population[18]. With an estimated 58,500 breeding pairs (representing 20-27% of the European breeding population) curlew is a widespread resident breeder in Scottish farmland and upland habitats[47]. The species is also a common passage and winter visitor to coasts and nearby fields; *c.*85,700 birds in winter (representing 20% of the East Atlantic flyway population[47]). The NHZ 19 population is estimated at 4,284 breeding pairs[13]. Recent records for Scotland indicate a 59% decline in breeding birds between 1995 and 2018[56]. In Dumfries and Galloway curlew is described as a common passage migrant and winter visitor, however breeding in declining numbers[53].

Baseline

7.6.59 Curlew was the most frequently recorded target species during baseline surveys, although it was present in the Main Wind Farm Area only during the breeding seasons (apart from one incidental record). In years 2018-2020, there were total of 287 flights (639 individuals) recorded during VP surveys, 29.6% of flights were recorded in 2018, 51.5% in 2019 and 18.9% in 2020. A total of 44 flights occurred in the CRZ at PCH. A total of 33 incidental records were also made during VP surveys, with one flock totalling 35 birds observed in late February 2019.

7.6.60 Along with snipe, curlew was the most abundant breeding wader species at the Proposed Development, with seven pairs recorded breeding in 2018, nine pairs in 2019 and two pairs in 2020 (the latter count relates to a much smaller Kinnelhead Development Area only).

Potential collision risk impacts

7.6.61 CRM was undertaken for curlew in the breeding season (no records were made in the non-breeding season) and this predicted a collision rate at 98% avoidance[9] of 0.18 collisions per breeding season (or 0.24 collisions using more conservative, and less accurate, Kinnelhead Development Area dataset). This would equal to 6.3 (or 8.4) collisions throughout the lifespan of the Proposed Development; representing 0.002% (or 0.003%) of the NHZ 19 breeding population (8,568 breeding individuals[13]).

7.6.62 Furthermore, twelve curlew collisions have been reported at European wind farms[44] (mostly in the Netherlands) which makes it a relatively rare event. As such, the potential collision effects on curlew during the operational phase are considered to be **negligible** and **not significant**.

Potential disturbance/displacement impacts

7.6.63 Curlew are considered to be highly sensitive to disturbance, but studies assessing the disturbance effects of wind farms on curlew have shown contrasting results and to some extent there are likely to be differing responses on a site by site basis. Waders are most susceptible to disturbance at the chick-rearing stage[79] and should the disturbance level be sufficient, this can lead to displacement. It has been shown that as a result of disturbance from construction work, curlew abundance may decline by approximately 40% within 620 m of turbines[40]. Previous to this analysis, other studies have estimated the curlew avoidance distance from wind turbines to be 800 m[35] and 500 m[80]. Using the 620 m disturbance distance in this assessment for the Proposed Development, this would indicate that the 700 m separation distance between the curlew territory and the nearest proposed turbine is sufficient for a pair to avoid the effects of disturbance. Based on these predictions, up to two pairs breeding within the Main Wind Farm Area may be affected (three pairs in 2018 and four pairs in 2019 bred within 620 m from the nearest proposed turbine; a 40% reduction on a baseline of four pairs would be a loss of 1.6 pairs). This would mean that should these two pairs be particularly sensitive and be displaced by the Proposed Development, the number of curlew breeding within the Main Wind Farm Area may decrease from nine pairs to seven pairs. As a proportion of the relevant NHZ population (4,284 breeding pairs in NHZ 19[13]), the number of pairs affected would be very low (0.05% of the NHZ population). In addition, curlew move their precise nesting locations between years, and there is extensive available alternative suitable open ground habitat both within and surrounding their current territories, at a greater distance from infrastructure, and so any displacement is likely to be localised. In light of this, displacement of curlew due to disturbance during the construction phase is likely to be of a **low magnitude**, and therefore **not significant**.

7.6.64 It has been shown that disturbance to curlew during wind farm operational is lower than during the construction phase, as shown by Pearce-Higgins *et al*. (2009)[35]. In another study, involving long-term monitoring, no evidence of displacement was found due to wind farm infrastructure for curlew[37]. In fact, at one of the study sites (Black Law) three territories were recorded within 200 m of turbines. However, because curlews use different nest sites each year (albeit usually in the same general area), it is difficult to predict how many pairs will be displaced by operational turbines. It is generally assumed that if curlew were displaced from a site during construction, it is less likely that they will return to breed in the same area during wind farm operation[40]. As explained above, the predicted loss of two breeding pairs would be very low in the context of the NHZ 19 breeding population (0.05%). Due to the abundance of potentially suitable nest sites within the Main Wind Farm Area and the surrounding locale, and the relatively small area of suitable nesting habitat that will be lost, nesting habitat loss will be negligible. Moreover, as part of the HMP, some areas of peatland and blanket bog within the Main Wind Farm Area will be restored, which will provide beneficial effects for nesting curlew. In light of this, displacement of curlew due to disturbance during the operation phase is likely to be **negligible**, and therefore **not significant**.

7.7 MITIGATION

7.7.1 The Proposed Development is predicted to have a low or negligible, and therefore not significant effect, on all of the IOFs recorded. Although no species-specific mitigation is required, various embedded measures will be implemented to ensure compliance with legislation, and to follow good practice guidance with regard to breeding birds.

[78] Carter (2001) The Red Kite. Arlequin Press, Essex.

[79] Yalden, P.E. and Yalden, D.W. (1990) Recreational disturbance of breeding golden plovers Pluvialis apricarius. Biological Conservation 51, 243-262.

[80] Thomas, R. 1999. Renewable energy and environmental impacts in the UK; birds and wind turbines. MRes thesis, University College London.

Habitat Management Plan

7.7.2 It is proposed that post-consent and as part of the proposal, a detailed HMP will be produced, secured by planning condition and discharged by local planning authorities. The proposed principle aim of this plan will be:

- To restore blanket bog and other peatland habitats within the Main Wind Farm Area with associated benefits for upland species such as black grouse and breeding waders.

7.7.3 The peat restoration will be achieved by ditch blocking to rewet drained areas of peatland which will benefit upland waders nesting within the Main Wind Farm Area. A monitoring regime would be included as part of this plan in order to assess the effectiveness of management measures implemented as part of the HMP (more details are provided in Chapter 6: Ecology).

7.8 SUMMARY OF EFFECTS

7.8.1 The magnitude of pre-mitigation effects and the magnitude and significance of residual effects on each IOF during the construction and operation phases is detailed in Table 7.15 below. As the Proposed Development is not predicted to have a significant effect on any IOF, embedded mitigation will ensure compliance with legislation and good practice guidance. Some species such as waders and black grouse are expected to see longer term benefit as a result of peatland restoration measures proposed under the HMP (see Chapter 6: Ecology for further information).

Table 7.15: Summary of pre-mitigation effects and residual effects on each IOF, and the residual significance of effect

IOF	Conservation importance	Nature of potential pre-mitigation effect	Magnitude of pre-mitigation effect	Significance of pre-mitigation effect	Specific mitigation/ enhancement measure	Magnitude of residual effect	Residual significance	Level of certainty/comments
Construction/Decommissioning								
Black grouse	Regional	Disturbance and/or displacement	Low	Not significant	No specific mitigation required (after implementation of embedded mitigation).	Low	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: high.
Red kite	Regional	Disturbance and/or displacement	Negligible	Not significant	No specific mitigation required.	Negligible	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: high.
Curlew	Local	Disturbance and/or displacement	Low	Not significant	No specific mitigation required (after implementation of embedded mitigation).	Low	Not significant	A measurable effect on the local population is considered to be highly unlikely. Confidence in the prediction: high.
Operation								
Black grouse	Regional	Collision risk	Low	Not significant	No specific mitigation required, however, to reduce risk of collision any fencing required for the wind farm and around habitat enhancement areas to be marked, maintained and monitored.	Low	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: high.
		Disturbance and/or displacement	Negligible	Not significant	No specific mitigation required. Beneficial effects of habitat restoration and enhancement associated with the HMP are expected.	Negligible	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: high.
Red kite	Regional	Collision risk	Low	Not significant	No specific mitigation required.	Low	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: moderate.
		Disturbance and/or displacement	Negligible	Not significant	No specific mitigation required.	Negligible	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: high.
Curlew	Local	Collision risk	Negligible	Not significant	No specific mitigation required.	Negligible	Not significant	A measurable effect on the local population is considered to be highly unlikely. Confidence in the prediction: high.
		Disturbance and/or displacement	Negligible	Not significant	No specific mitigation required. Peatland and blanket bog restoration undertaken for the HMP will enhance nesting habitat for curlew, as well	Negligible	Not significant	A measurable effect on the local population is considered to be highly unlikely. Confidence in the prediction: high.

IOF	Conservation importance	Nature of potential pre-mitigation effect	Magnitude of pre-mitigation effect	Significance of pre-mitigation effect	Specific mitigation/ enhancement measure	Magnitude of residual effect	Residual significance	Level of certainty/comments
					as other breeding waders such as snipe and dunlin.			

7.9 CUMULATIVE EFFECTS

7.9.1 The following section assesses the predicted cumulative effects on IOFs from the Proposed Development along with all other developments within an appropriate ZoI and against the relevant NHZ population estimates, following NatureScot guidance[10].

7.9.2 In line with this guidance, any wind farm developments of fewer than three turbines (small scale wind energy proposals[81])were excluded from the cumulative impact assessment, due to the problems associated with finding appropriate data for developments of this size. Only IOFs for which a greater than negligible residual impact is predicted are considered in the cumulative impact assessment, as negligible impacts will not result in a detectable increase in cumulative impacts. All existing, consented and submitted developments (of three or more turbines) within 10 km of the Proposed Development, were considered as part of the assessment of cumulative impacts. Within this search area data were sought for a total of five developments (and one wind farm extension) for inclusion in the cumulative impact assessment which comprise:

- **Lion Hill Wind Farm (consented)** – this is a 4-turbine consent, which has not been built out, to the north of the Proposed Development Area;
- **Clyde Wind Farm (operational)** – this is a 152-turbine operational site, located further to the north of the Proposed Development Area;
- **Clyde Wind Farm Extension (operational) –** is also partially within 10 km of the Proposed Development Area, being located further north of the Clyde Wind Farm, to the north of the A74 (M). The Extension was included in the CIA due to the EIA for Clyde Wind Farm not being accessible;
- **Crookedstane Wind Farm (consented)** – this is 4-turbine consent, which has not been built out, located to the north of the Proposed Development Area, and to the west of the Clyde Wind Farm;
- **Harestanes Wind Farm (operational)** – this is a 68-turbine operational site, located to the south east of the Proposed Development Area, being found to the south of the Kinnelhead Development Area; and
- **Minnygap Wind Farm (operational)** – this is a 10-turbine operational site, located to the southeast of the Proposed Development Area to the east of the Harestanes Wind Farm.

7.9.3 It should be noted that cumulative assessments may be complicated by availability of EIAR/ES chapters and Appraisals for consented developments and, where this information is available, survey periods and methods may differ between sites. Furthermore, some wind farms may have been in existence for many years, and thus contemporary data may not be available. Information for informing the CIA was available from two consented and three operational wind farms. No ESs were available for a further two wind farms (Clyde and Minnygap); thus cumulative totals reflect minimum values only.

7.9.4 The IOFs for which cumulative effects may occur are as follows:

- Black grouse: disturbance/displacement effects;
- Curlew: disturbance/displacement and collision effects; and
- Red kite: disturbance/displacement and collision effects.

7.9.5 The residual effect of the individual operational, constructed, consented and submitted developments for which information was available and the cumulative residual effect on each of the target species most likely to be affected by cumulative effects (as listed above) is described in Table 7.16 below.

7.9.6 No significant cumulative disturbance/displacement or collision effects were concluded for any IOFs.

Table 7.16: Summary of the potential cumulative disturbance/displacement impacts of operational, consented/under construction and submitted wind energy developments within 10 km of the Proposed Development on IOFs

Site	Daer	Lion Hill	Clyde	Clyde Extension	Crookedstane	Harestanes	Minnygap	Cumulative residual effects
Site status	**17 turbines** Baseline surveys undertaken in 2018-2020.	**4 turbines** Baseline surveys undertaken in 2011 and 2012. Additional ornithology surveys undertaken in 2013.	**152 turbines** Operational since 2012. ES could not be accessed.	**54 turbines** Operational since 2017. Baseline protected surveys undertaken in 2009 and 2010. Additional ornithology surveys undertaken in 2011.	**4 turbines** Baseline surveys undertaken in 2012. Additional ornithology surveys undertaken in 2013. .	**68 turbines** Operational since 2014. Baseline protected surveys undertaken in 2002 and 2003. Access only to Supplementary Environmental Information (SEI).	**10 turbines** Operational since 2017. ES could not be accessed.	**309 turbines**
Species								

[81] SNH (2016) Assessing the impact of small-scale wind energy proposals on the natural heritage (Guidance note). Scottish Natural Heritage.

Site	Daer	Lion Hill	Clyde	Clyde Extension	Crookedstane	Harestanes	Minnygap	Cumulative residual effects
Black grouse	Eight black grouse flights recorded during VP surveys, two of which were in the CRZ at PCH (not enough flights for CRM). Two leks recorded within the Proposed Development with the maximum number of lekking males estimated at five to six (*c.* 4.1% of the population of NHZ 19).	Total of 21 black grouse flights recorded (duration 759 secs) during VP watches with one flight (duration 3 secs) in the CRZ. Not enough flights in the CRZ for CRM. During winter walkover surveys black grouse were recorded with a peak of 20 birds (19 males, one female) on 25 November 2011. Site is of local value to black grouse supporting between 0.05% and 0.5% of the UK population. Habitat enhancement was proposed for black grouse.	ES could not be accessed. Lion Hill ES mentions Clyde black grouse habitat enhancement areas due to the close proximity of the Clyde black grouse area to the proposed Lion Hill site.	Black grouse present during BBS in 2010 within 500 m of turbines and within 250 m of the proposed wind farm track. Two flights recorded along with one lek. Total of seven records over 2010/11. Not enough flights for CRM. Embedded mitigation measures to reduce disturbance to black grouse were applied during construction.	Two black grouse territories recorded during BBS. Black grouse recorded during the winter walkover survey with a peak of two birds recorded during October, November and January surveys. Site is of local value to black grouse supporting between 0.05% and 0.5% of the UK population. Embedded mitigation measures to reduce disturbance to black grouse were applied during construction.	Black grouse leks identified on site, number of records not provided. Habitat enhancement measures were implemented within an 8.1 ha area alongside creation of new forest edge habitat.	ES could not be accessed. Harestanes ES indicated a male BK and female BK were recorded on Minnygap in June 2003. Harestanes SEI indicated that Minnygap were also committed to managing habitat to be beneficial for black grouse.	**Five of the other wind farm sites recorded black grouse; with a minimum of 24 males recorded in total. However, some of these were outside the wind farms' development area or referred to non-breeding birds. The total including the lekking males at Daer (30) represents 24.8% of the NHZ 19 total of displaying males (121). Embedded mitigation to prevent disturbance to this species (e.g. restrictions on location and timing of works during the lekking period; see Section 7.6) is easily introduced during the construction phase to avoid disturbance at leks. Though they may make localised movements, breeding black grouse are known to persist at wind farms after construction[70]. Furthermore, habitat enhancement at four of these developments may have had a positive effect on the black grouse population. The cumulative disturbance/ displacement effect is predicted to be not significant.**
Curlew	Total of 287 flights (639 individuals) recorded during VP surveys. Predicted collision mortality is 0.18 birds per breeding season, representing 0.002% of the NHZ 19 population. Up to nine pairs were recorded breeding within the Proposed Development. Predicted displacement estimated at two pairs (0.05% of the NHZ 19 population).	Two curlew territories recorded during BBS. A total of 57 curlew flights (duration 3,225 secs) recorded during VP watches, of which 13 flight lines in collision risk (568 secs duration). CRM conducted for curlew: 0.15 birds per year (with 80% WTG utilisation). Site is of survey area value to curlew supporting > 0.05% of the UK population.	ES could not be accessed.	Curlew territories recorded with 14 in 2009 and nine in 2010. A total of 75 curlew flights recorded during VP watches. CRM predicted 0.632 collisions per year.	15 curlew territories recorded during BBS. Curlew were recorded during the winter bird walkover surveys with a peak of 27 birds in the February survey. One curlew flight was recorded in the CRZ (duration 15 secs). Not enough flights at collision risk to do CRM. Site is of survey area value to curlew supporting > 0.05% of the UK population.	No records in SEI.	ES could not be accessed.	**A minimum of 31 curlew territories were recorded in total in the survey areas of the listed developments. Together with curlew breeding within the Proposed Development this represents 0.93% of the NHZ 19 population of 4,284 pairs. CRM was only undertaken for two sites in addition to the Proposed Development; giving an estimate of 0.962 collisions per year across all sites (which would represent 0.01% of the NHZ 19 total of breeding birds (8,568), although this is considered likely to be an under-estimate given the lack of assessment from the other sites. However, given how rarely this species is reported to collide with turbines it is predicted that cumulative disturbance/displacement and collision effects will not be significant at the regional population level, therefore no**

Site	Daer	Lion Hill	Clyde	Clyde Extension	Crookedstane	Harestanes	Minnygap	Cumulative residual effects
								cumulative significant effects are predicted.
Red kite	Total of 78 flights (81 individuals) recorded during VP surveys in years 2018-2020. CRM predicted 0.08 collisions for the breeding season (0.05% of the NHZ 19 population) and 0.02 collisions for the non-breeding season. No breeding or roosting kites within the Proposed Development.	No records of red kite in ES.	ES could not be accessed.	No records of red kite in ES.	Red kite recorded on site during VP surveys. Not enough flights at collision risk to do CRM.	No records of red kite in SEI.	ES could not be accessed.	**There were few red kite records from other wind farm sites (they were recorded on one other site where the flight activity was too low to undertake CRM). This is likely to be due at least in part to the recent nature of reintroductions and population growth of this species, but means that it is not possible to assess population of birds in vicinity of the developments and likely cumulative disturbance/displacement, and collision effects.**

7.10 STATEMENT OF SIGNIFICANCE

7.10.1 An assessment has been made of the predicted significance of effects of the Proposed Development on ornithological interests. By applying effective embedded mitigation measures, mainly through the design process, and following good practice guidelines during construction, including production of a SPP, the magnitude of residual effects of the Proposed Development is assessed as being low/negligible in terms of magnitude, and thus not significant in terms of the EIA Regulations. An HMP is proposed which would have a positive impact on a range of breeding upland birds, and will include a monitoring plan to assess the efficacy peatland restoration measures outlined in the HMP.