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Chapter 8

Ornithology

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Glossary

Term	Definition
Baseline	The existing conditions that prevail against which the effects of the proposed development are compared.
Birds of Conservation Concern	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.
Collision Risk Zone	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.
Ecological Impact Assessment	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	Environmental Impact Assessment (EIA) is a means of drawing together by the developer, in a systematic way, a description of the development and information relating to the likely significant environmental effects arising from a Proposed Development.
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Regulation 5.
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	Sites of Special Scientific Interest are protected areas that represent the UK's most important wildlife and/or geological sites.
Special Protection Area	Special Protection Area, an internationally important area for nature conservation, specifically birds, classified under the Birds Directive.
The Additional Survey Area	The area based on the 12-turbine layout, covering Seathope Rig, within which ornithological baseline surveys were carried out in 2019 and 2020 (see Figure 8.1).
The Applicant	Fred Olsen Renewables Limited
The Original Survey Area	The area based on the 9-turbine layout, covering Glede Knowe and Scawd Law, within which ornithological baseline surveys were carried out in 2017 and 2018. It comprises the following (see Figure 8.1): – Breeding raptor surveys: all suitable breeding habitat within 2 km of the proposed turbines (see Figure 8.1); – Breeding bird surveys: open habitat within 500 m of the proposed turbines (see Figure 8.1); – Black grouse surveys: all suitable lekking habitat within 1.5 km of the proposed turbines (see Figure 8.1); and – VP surveys: viewsheds extended to 2 km from two VP locations (see Figure 8.2).
The Proposed Access	This access routing leaves the public road to the west of the Proposed Development Area and approaches the site making use of existing farm tracks and shown in Figure 8.1.
The Proposed Development	The proposed Scawd Law Wind Farm development as described in Chapter 4.
The Proposed Development Area	The development area within the red line site boundary (application area) as shown in Volume 3a Figure 1.2 Site Layout.
The Survey Area	The generic term to describe the area within which the ornithological surveys took place when no distinction between the Original and Additional Survey Areas is required.
Zone of Influence	'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)).

List of Abbreviations

Abbreviation	Description
AA	Appropriate Assessment
BoCC	Birds of Conservation Concern
BTO	British Trust for Ornithology
CEMP	Construction Environmental Management Plan

Abbreviation	Description
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CRM	Collision Risk Modelling
CRZ	Collision Risk Zone
EC	European Commission
ECoW	Environmental Clerk of Works
EcIA	Ecological Impact Assessment
ECU	Scottish Government's Energy Consents Unit
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ES	Environmental Statement
FLS	Forestry and Land Scotland (previously known as Forestry Commission Scotland - FCS)
GET	Golden Eagle Topographical (Model)
HRA	Habitats Regulation Appraisal
IOF	Important Ornithological Feature
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LBAP	Local Biodiversity Action Plan (for Scottish Borders)
LBRSG	Lothian and Borders Raptor Study Group
LSE	Likely Significant Effect
Natural Power	Natural Power Consultants Limited
NHZ	Natural Heritage Zone
PAN	Planning Advice Note
PAT	Predicting *Aquila* Territories (Model)
PCH	Potential Collision Height
RSG	Raptor Study Group
RSPB	Royal Society for the Protection of Birds
SBC	Scottish Borders Council
SBL	Scottish Biodiversity List
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
SR	Scottish Renewables
SSGEP	South of Scotland Golden Eagle Project
SSSI	Sites of Special Scientific Interest
SUP	Southern Uplands Partnership
SWBSG	Scottish Windfarm Bird Steering Group

Abbreviation	Description
T	Turbine
TWIC	The Wildlife Information Centre
VP	Vantage Point
WCA	Wildlife and Countryside Act
ZoI	Zone of Influence

8.1 STATEMENT OF COMPETENCE

8.1.1 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.

8.1.2 The author of this chapter has 16 years of experience in environmental consultancy and has been working as an Ecological Consultant for the last six years. During this time, he has been involved with design, implementation and management of ecological assessments, production and review of EIAR ornithology chapters, scoping reports, technical baseline reports and operational monitoring reports as well as client and consultee liaison. He is an expert ornithologist, well-versed in bird monitoring in various habitats using remote sensing technology and in the analysis of radar outputs for ecological impact assessment. The author was assisted by a Senior Environmental Consultant who is a BSc (hons) graduate in Environmental Science with 10 years' experience working in the environmental/conservation sector and 12 years of experience working as an ecologist for a renewable energy consultancy, and an Associate Technical Director with 10 years of experience in Ecological Impact Assessment (EcIA) and EIAR compilation.

8.2 INTRODUCTION

8.2.1 This ornithological chapter of the EIAR has been prepared by Natural Power Consultants Limited (Natural Power) on behalf of Fred. Olsen Renewables Limited (FORL) (the "Applicant") in respect of the proposed Scawd Law 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 7: Ecology, of the EIAR and complements this chapter.

8.2.2 This EIAR chapter has been prepared following a scoping process which led to a Scoping report issued to consultees in July 2020. In line with the principles of proportionate Environmental Impact Assessment (EIA), embedded mitigation is considered at the outset of the assessment (see Section 8.7). 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.

8.2.3 Ornithological baseline conditions have been assessed through a combination of desk study and the results of baseline ornithological surveys. Species are described and evaluated in terms of the recognised criteria outlined in Section 8.4.

8.2.4 The baseline surveys were carried out over two 12-month periods: between September 2017 and August 2018, and between March 2019 and February 2020 (see Section 8.4 and Technical Appendix 8.1 for further details). Supplementary surveys were also carried out between May and August 2022.

8.2.5 In October 2018 it was agreed with NatureScot that 12 months of baseline surveys were sufficient to describe the baseline conditions of the Proposed Development, however, a change to the proposed turbine layout was made in early 2019, which resulted in additional turbines being proposed on Seathope Rig (an area previously not covered by baseline surveys). Therefore, an additional year of baseline surveys was necessary (from March 2019 to February 2020) to provide survey coverage of the previously unsurveyed area around Seathope Rig. As data were collected for the two adjacent survey areas over two different 12-month periods, the baseline information for the Proposed Development still comprises one year of data overall.

8.2.6 The two surveyed areas were designed to correspond with a 9-turbine layout (the first monitoring period from September 2017 to August 2018) and then a 12-turbine layout (the second monitoring period from March 2019 to February 2020). However, the final iteration of the Proposed Development resulted in the removal of turbines proposed on Seathope Rig and the addition of one turbine at Windlestraw Law. Eight turbine locations have now been decided upon for the Proposed Development, with all turbines contained within the two surveyed areas (see Figure 8.1). Data collected during both monitoring periods form the basis of this assessment.

8.2.7 All Latin names for species mentioned in this chapter are listed in the Technical Appendix 8.1. 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 full results data, can be provided on request, but only data considered necessary to the EcIA are presented here and in the Technical Appendix.

8.2.8 The following Figures accompany this EIAR:

- 8.1: Ornithology Survey Areas
- 8.2: Vantage Point Locations and Viewsheds
- 8.3: Statutory Sites Designated for Ornithological Features within 25 km of Scawd Law Wind Farm
- 8.4a: Vantage Point (VP) Surveys: Non-breeding Season Sep 2017–Feb 2018
- 8.4b: VP Surveys: Breeding Season Mar-Aug 2018
- 8.4c: VP Surveys: Breeding Season Mar–Aug 2019
- 8.4d: VP Surveys: Non-breeding Season Sep 2019 – Feb 2020
- 8.5a: Breeding Bird Survey Results 2018, 2019
- 8.5b: Breeding Bird Surveys Results 2022
- A8.2.1: Raptor Surveys Results 2018, 2019 (Confidential Figure)
- A8.2.2: Black Grouse Survey Results 2018 (Confidential Figure)
- A8.2.3: Golden Eagle Flight Activity (May to August 2022) (Confidential Figure)

8.3 LEGISLATION, POLICY AND GUIDANCE

8.3.1 The ornithological baseline surveys and subsequent assessment have been carried out with reference to a number of national policy documents, as addressed in Chapter 2: Policy Context and Chapter 7: Ecology, of the EIAR. Legislative and guidance documents with specific relevance to ornithology are listed below:

Legislation

- EU Exit: The Habitats Regulations in Scotland;
- 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

- Planning Advice Note (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

8.3.2 Note that some documents published by NatureScot still refer to their former name of Scottish Natural Heritage (SNH).

- Chartered Institute of Ecology and Environmental Management (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];
- NatureScot Research Report 1283 (Goodship and Furness, 2022): An updated literature review of disturbance distances of 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];
- Scottish Renewables; SNH; Scottish Environment Protection Agency (2010) Good Practice during Wind Farm Construction[17];
- Birds of Conservation Concern (BoCC) 5: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man[18];
- The Scottish Borders Local Biodiversity Action Plan (LBAP)[19]; and
- Scottish Biodiversity List (SBL).

8.4 METHOD OF ASSESSMENT

Key issues

8.4.1 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 and operation 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.

8.4.2 The above issues are considered in this assessment (Section 8.7).

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

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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] Goodship, N.M. and Furness, R.W. (MacArthur Green) (2022) Disturbance Distances Review: an updated literature review of disturbance distances of selected bird species. NatureScot Research Report 1283.

[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., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., and Win I. (2021). *Birds of Conservation Concern 5: the population status of birds in the United Kingdom, Channel Islands and Isle of Man*. British Birds 114, 723–747.

[19] Scottish Borders Council, 2018. *Scottish Borders Local Biodiversity Plan 2018-2028*. Supplementary Guidance.

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

- 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 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 breeding and/or non-breeding raptor 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

8.4.4 NatureScot guidance[2] is 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 (WCA) 1981 (as amended) (Schedule 1 species); and
3. Red-listed Birds of Conservation Concern as identified in BoCC (Red listed species).

8.4.5 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.

8.4.6 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'.

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

- All raptors and owls listed in Annex I of the European Commission (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;

and included the following secondary species[21] (species of lesser conservation concern):

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

8.4.8 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

8.4.9 A desk study was undertaken in 2020 and 2021 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 collate 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.

8.4.10 Records of relevant ornithological data from within a 10 km radius of the Survey Area were requested in January 2021 from the following organisations (data on breeding raptors were requested from within a 5 km radius of the Survey Area):

- Lothian and Borders Raptor Study Group (LBRSG);
- South of Scotland Golden Eagle Project (SSGEP);
- Southern Uplands Partnership (SUP);
- Royal Society for Protection of Birds (RSPB); and
- The Wildlife Information Centre (TWIC).

Searches for species data were limited to data from within the past 10 years (2010-2020). Additional data was requested from SSGEP in summer 2022.

8.4.11 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, for all SPAs, Ramsar sites and SSSIs that have geese listed as a qualifying feature, the search area was extended to 25 km of the Survey Area due to these species larger foraging distances. 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

8.4.12 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].

- Non-breeding season VP surveys in 2017/18 (September to February, inclusive), covering the Original Survey Area;
- Breeding season VP surveys in 2018 (March to August, inclusive), covering the Original Survey Area;
- Breeding raptor surveys: March to July 2018 and 2019, covering the Original Survey Area;
- Upland breeding bird survey: April to July 2018, covering the Original Survey Area;
- Black grouse lek survey: April and May 2018, covering the Original Survey Area;
- Breeding season VP surveys in 2019 (March to August, inclusive), covering the Additional Survey Area,
- Upland breeding bird survey: April to July 2019, covering the Additional Survey Area;

[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

- Non-breeding season VP surveys in 2019/20 (September to February, inclusive), covering the Additional Survey Area; and
- Upland breeding bird surveys: May to July 2022, covering the Proposed Access.

8.4.13 Due to the changing baseline, additional flight activity surveys were also undertaken in the 2022 breeding season (May to August, inclusive), covering both the Original and Additional Survey Areas. .AThis was a result of the SSGEP, where immature golden eagles are being translocated from the Scottish Highlands and released in the Moffat Hills to boost the local golden eagle population. The first birds were released in 2018 and are now reaching sexual maturity (4-5 years). The baseline surveys, completed in February 2020, did not record golden eagle and initially this species was not included in the EIA, however, subsequent to this, up to four golden eagles have been recorded utilising the wider area around the Proposed Development, with one pair attempting to breed within 2 km of proposed turbines in 2022.

8.4.14 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 8.1. Full survey details including survey timings and weather conditions can be provided on request.

Vantage Point surveys (flight activity survey)

8.4.15 As agreed with NatureScot during the consultation process (see Table 8.5), flight activity surveys covering one non-breeding season and one breeding season were undertaken between September 2017 and August 2018. These surveys were undertaken from two VP locations (VP1 and VP2) which covered the Original Survey Area (see Figure 8.2). A third VP location (VP3) was used in 2019 to provide coverage of Seathope Rig (the Additional Survey Area), and flight activity surveys covering one breeding season and one non-breeding season were undertaken between March 2019 and February 2020 from that single VP location.

8.4.16 Additional VP surveys in 2022 covering the latest 8-turbine layout (as described in Chapter 4) were carried out from VP2 and VP3, with the aim of gathering supplementary information regarding golden eagle.

8.4.17 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.

8.4.18 All incidental records of target species (such as 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].

8.4.19 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 four height bands: (1) <25 m, (2) 25-50 m, (3) 50-200 m, (4) >200 m. These height bands are further referred to as height band 1, 2, 3, and 4.

Breeding raptor surveys

8.4.20 Breeding raptor surveys were undertaken within the Original Survey Area between March and July in 2018 and 2019. A combination of VP surveys and walkover surveys over suitable breeding habitat were 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

8.4.21 Breeding bird surveys were undertaken in the breeding seasons of 2018 within the Original Survey Area, in 2019 within the Additional Survey Area and in 2022 along the access track, covering all areas of open ground; and excluding forested habitats (as per NatureScot guidance[2]). Surveys used the standard methodology for assessing upland wader populations, as described by Brown and Shepherd (1993)[15]. This methodology was used to map the distribution and estimate the abundance of breeding birds within the Survey 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 the recording of moorland passerine species is generally not required. Moorland passerine species were recorded during the breeding bird surveys for the Proposed Development, however, no territory analysis was carried out for these species.

8.4.22 Four survey visits were carried out between April and July, as recommended by Calladine *et al*. (2009)[24] (the surveys in 2022 started in early May). After the last survey visit, wader species and red grouse 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

8.4.23 Surveys for lekking black grouse were carried out within the Original Survey Area between April and May of 2018, following the 'National Black Grouse Survey Instructions'[26] summarised in Gilbert *et al*. (1998)[14]. 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 on two further occasions, 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.

Collision risk modelling

8.4.24 Collision risk modelling (CRM) is 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 recognised 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.

8.4.25 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 and 3, only flights within these height bands were considered at potential collision risk.

8.4.26 Estimates were produced per season: breeding or non-breeding. Breeding season was defined as March to August (inclusive) and the non-breeding season was defined as September to February (inclusive). For golden eagle, CRM was carried out only on data collected during dedicated surveys between May 2022 and August 2022 inclusive (with no golden eagle activity having been recorded during the original two years of baseline surveys). For the other target species, the CRM was run using the VP data collected during the original two years of flight activity surveys: September 2017 to August 2018 and March 2019 to February 2020.

[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.

8.4.27 In the interests of proportionality, species rarely present, for which significant collision impacts due to the Proposed Development are highly unlikely, were excluded. 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. At the Proposed Development, four target species fulfilled this criterion: golden eagle, goshawk, curlew and golden plover (Table A8.18 in Technical Appendix 8.1).

8.4.28 All four species included within this analysis are expected to spend time travelling within the airspace at the Proposed Development Area ('non-directional flight') rather than commuting directly through ("directional flight"). For species exhibiting this type of flight, 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.

8.4.29 Although data in 2017/2018 and 2019/20 were collected from VPs overseeing different survey areas, the data were combined into a single model since the data do not provide sufficient information to distinguish annual and spatial variation in flight activity at this site. This analysis makes the assumption that levels of flight activity were similar among the years during which the surveys were carried out.

8.4.30 The CRM runs as a two-stage process. Firstly, the risk is calculated making the assumption that flight patterns are unaffected by the presence of the wind turbines, i.e. that no avoidance action is taken. This probability is then multiplied by the estimated numbers of bird movements through the wind farm rotors at risk height in order to estimate the theoretical numbers at risk of collision if they take no avoiding action. The second stage incorporates the probability that the birds, rather than flying heedlessly into the turbines, will actually take a degree of avoiding action. NatureScot has recommended using species-specific avoidance rates[9], where available; or using a precautionary value of 98%, as a general default avoidance rate, where species-specific values are not available. Therefore, a parameter representing avoidance behaviour is applied to the estimated collision mortality.

8.4.31 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 8.1.

Survey limitations

Inclement weather

8.4.32 Flight activity surveys scheduled for April 2019 and September 2019 could not be completed within that calendar month due to prolonged periods of unfavourable weather when conditions did not meet survey guidance. This missing survey effort was realised in May 2019 and October 2019 respectively. It is considered that this did not compromise the effectiveness of the surveys as no key time periods were missed and the full complement of survey effort per season was realised. Therefore, the data can be regarded as providing a reliable and realistic depiction of baseline conditions.

Changes to the Proposed Development

8.4.33 The boundary parameters of the Proposed Development have changed several times during the period in which baseline surveys were conducted. The major changes were the addition of turbines on Seathope Rig and the removal of the three southernmost turbines south of Scawd Law. This required another year of baseline surveys to be conducted to cover the Additional Survey Area. Consequently, data were collected for the two adjacent survey areas over two consecutive 12-month periods, however this was considered acceptable (see Section 8.5) as the two survey areas are relatively small in size with similar habitat types, holding the same assemblage of bird species. It is important to note that the baseline information for the Proposed Development still comprises one year of data overall. The final iteration of the design saw the removal of turbines on Seathope Rig and the addition of one turbine to the north of Seathope Rig at Windlestraw Law. This additional turbine is located within the Additional Survey Area. As the final 8-turbine layout is contained within the original turbine envelope, the baseline information collected for both the Original Survey Area and the Additional Survey Area is adequate to describe the baseline conditions of the Proposed Development.

8.4.34 Furthermore, at the time when the baseline ornithological survey work was being undertaken (2017-2020) the assumed access to the Proposed Development was from the south. However, access from the south was later deemed unfeasible and a new route was proposed in 2021 entering the Proposed Development from the west.

Access restrictions

8.4.35 Due to land ownership restrictions it was not possible for surveyors to access survey buffers outwith the Proposed Development Area. As such, the recommended buffers of infrastructure for raptors and black grouse were not accessed by surveyors where they fell outwith the Proposed Development Area. 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 Proposed Development Area 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.

Approach to impact assessment

8.4.36 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 the identified impact is considered to have a likely significant effect on the identified ornithological feature. The approach to the EcIA adopted within this assessment follows the CIEEM guidelines[1]. 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

8.4.37 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 8.1. 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 8.1: 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; and found in numbers that are crucial to the integrity of the designated site.
	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 Zone of Influence (ZoI) of the development.

[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.

Level of value	Example of IOF
	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 listed as a qualifying feature (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]).

8.4.38 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.

8.4.39 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.

8.4.40 In line with the principles of proportionate EIA, embedded mitigation (i.e. mitigation which has been embedded within the project design) 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

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

8.4.42 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 8.2 below.

Table 8.2: 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.

8.4.43 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.

8.4.44 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 Border Hills NHZ (NHZ 20) and regional impacts are assessed within this area as far as is practicable; and
- Effects on non-breeding bird populations are assessed in a regional (south-east Scotland) context.

8.4.45 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 8.3 below.

Table 8.3: Criteria used in this EcIA for describing duration of impact

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 more than 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)

[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.

Duration	Definition
	Short-term (up to 5 years)

8.4.46 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.

8.4.47 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 8.4 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 8.4: Behavioural sensitivity of birds

Sensitivity	Definition
High	Species or populations occupying habitats remote from human activities, or that exhibit strong and long-lasting (guide: more than 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.

8.4.48 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. However, tolerance is likely to increase as breeding progresses. 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 recreational activity and associated disturbance are likely to have a greater tolerance than those that occupy remote locations with little or no human disturbance).

Determining significance of likely ornithological effects

8.4.49 Having followed the process of identifying an IOF, determining its sensitivity, and characterising potential impacts, as set out above, the significance of the effect is then determined using professional judgement. 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 Section 8.7). 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 are short, medium, long-term, permanent, temporary, reversible, irreversible, positive and/or adverse. A finding of significance or non-significance is then made using this assessment.

8.4.50 Effects are more likely to be considered significant where the feature affected is of higher conservation importance or where the magnitude of the impact 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.

8.4.51 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".

8.4.52 Where likely effects 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.

8.4.53 The significance of residual effects on features, after the effects of implementation of mitigation measures have 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

8.4.54 In the absence of development, it is assumed that the land use within the Proposed Development Area and the surrounding locale would remain the same for the foreseeable future (the land is currently used for sheep farming, and the estate also release pheasant and red-legged partridge for game shooting). No major changes are expected to the character of the upland landscape, which comprises mostly a mix of heather moorland and rough, semi-improved grassland. No change in these habitats is anticipated in the short to medium term and consequently the bird community is likely to remain broadly similar. Similarly, the plantation forestry located to the south and west of the Proposed Development Area is also anticipated to remain unchanged in the short and medium term, at least; but in accordance with the rotational felling and replanting that is a part of this land management and which shall result in small-scale changes to the distribution of forest and forest-edge dwelling species.

8.4.55 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.

8.5 CONSULTATION

8.5.1 Throughout the baseline survey period ongoing consultations between Natural Power and NatureScot on the progress of the baseline surveying programme were taking place and these are summarised in Table 8.5.

Table 8.5: Summary of consultation between Natural Power and NatureScot during baseline survey period

Date	NatureScot guidance/response	Comment/action taken by Natural Power
12 October 2018	**Key points raised in email from NatureScot after receiving the method statement and 12-month summary report from the ornithology surveys**	
	NatureScot agreed with the conclusions drawn in the report that the 12 months of survey work carried out should be sufficient to describe the baseline conditions of the Proposed Development and are suitable for informing impact	Based on this response and on analysis of the survey findings and professional opinion, Natural Power decided that no second year of surveys was required at the Proposed Development.

[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
	assessment. However ultimately it is for Natural Power to make that final judgement.	
	NatureScot confirmed that the results of the surveys were typical of an upland site in south-east Scotland and were as expected for this site. The very low incidence of over-wintering grey geese in this area was also expected, based on NatureScot understanding of how they move around this part of Scotland between roosts and feeding areas.	No action required.
17 December 2019	**Key points raised in email from NatureScot in response to changes in turbine layout and conducting additional year of surveys over previously unsurveyed areas**	
	NatureScot tentatively agreed that the bird survey information gathered over two different years from the two separate areas of land that formed the Proposed Development could be used as the baseline for the impact assessment work. These areas are immediately adjacent to each other and relatively small in size with similar habitat types, so the bird species present are likely to be similar.	As a result of interim design iteration turbines were proposed on Seathope Rig ridge (the area not covered by baseline surveys in 2018-19) and additional surveys covering the Seathope Rig were conducted in 2019-20. Consequently, the baseline information collected over two consecutive years over two adjacent areas form the base of the assessment (each area was surveyed once over a 12-month period).
13 November 2020	**Key points raised in email from NatureScot in response to request from the SBC to include pink-footed goose in the EIAR**	
	NatureScot pointed out that based on information available in the public domain (which indicates that despite the Proposed Development being located within 20 km of Fala Flow and Gladhouse Reservoir SPAs), there is no connectivity between the Proposed Development and their pink-footed goose qualifying interests. The Proposed Development will have no impact on the pink-footed goose qualifying feature of either SPA, however, a Habitats Regulations Appraisal (HRA) is still required. The competent authority will need to carry out an HRA, even though available information indicates that the wind farm is not likely to have a significant effect on the SPAs. This would conclude that an appropriate assessment is not required. The EIAR will need to demonstrate that due consideration has been given to the pink-footed goose qualifying feature for each SPA.	Pink-footed goose has been included in the EIAR to inform an HRA (see Section 8.12)
13 October 2022	**Key points raised in email from NatureScot regarding the data available to assess the impacts on golden eagle**	
	Following the 2022 breeding season, Natural Power commissioned an analysis of golden eagle habitat loss using modelling and satellite tracking data, by a prominent eagle expert (Fielding, 2022[33]). This was provided to NatureScot for comment. It was stated that NatureScot were satisfied the contents of this report were sufficient to be able to assess this ornithological feature.	The impacts on golden eagle are fully assessed within the EIAR. The commissioned report is included within Appendix 8.2: Ornithology Confidential Appendix.

8.5.2 The 'Scawd Law Wind Farm Scoping Report' was submitted to the Scottish Government's Energy Consents Unit (ECU) on 28 July 2020. The formal scoping response issued from the ECU was received on 21 October 2020. Those responses considered relevant to this chapter are summarised in Table 8.6.

Table 8.6: Consultee scoping responses relating to ornithology

Consultee	Date	Issues raised and recommendations	Scoping response addressed
Scottish Borders Council (SBC)	October 2020	The SBC was largely satisfied with the submitted Scoping report stating that a comprehensive set of surveys has been carried out to inform an EIA. The Proposed Development lies within areas identified as low sensitivity with adjacent areas of medium sensitivity as identified in the RSPB/SNH Bird Sensitivity Map.	Noted
		The SBC advised that consideration should be given to the ongoing re-establishment of golden eagles in the region (the South of Scotland Golden Eagle Project). It is likely that released birds could occupy former home ranges and young birds are now foraging and commuting to certain areas within Scottish Borders. Further information may be available from the project team.	The SSGEP was contacted for information in February 2021 but due to the absence of golden eagles at the Proposed Development at that time it was concluded that the satellite tag data collected by the SSGEP would not be required to inform the baseline conditions and golden eagle would not be included within the EIAR. Subsequently, from late 2021 a pair of golden eagles settled in the vicinity and in 2022 a breeding attempt was

[33] Fielding, A. (2022) Scawd Law Wind Farm: an analysis of potential golden eagle habitat loss using the GET Model and satellite tracking data. A confidential report prepared for Natural Power Limited.

Consultee	Date	Issues raised and recommendations	Scoping response addressed
			made. At this point, the Applicant was made aware of this development. This delayed the submission of the EIAR and necessitated supplementary VP surveys in the remainder of the breeding season (May-August 2022). Consequently, golden eagle was added into the EIAR and the satellite tag data on golden eagle was obtained from SSGEP to conduct a habitat loss analysis.
		The SBC recommended that Lothian and Borders Raptor Study Group is consulted by the Applicant for records of Schedule 1 raptors. Any sensitive information on protected species should be contained within a confidential annex.	The raptor data were requested from the LBRSG in January 2021 to inform this EIA.
		Pink-footed geese should not be scoped out of the EIAR as the assessment of impacts will be required to inform a HRA.	To enable the assessment of impacts to inform a HRA, pink-footed goose was scoped back into the EIAR.
		The preliminary results of the South-east Scotland Bird Atlas indicate that there are possible or probable breeding records of snipe (tetrad NT34R, NT34K, NT34Q, NT34V); lapwing (NT34V); curlew (NT34R, NT34K, NT34Q, NT34V, NT33Z) and oystercatcher (NT34V, NT33Z). The Scottish Ornithologists' Club (SOC) data shows that the local area is moderately important for breeding waders within Scottish Borders. SOC and TWIC should be contacted for further information.	Data held by SOC for the area of the Proposed Development are not at a resolution suitable to further inform the baseline conditions of the Proposed Development. Data on ornithological interests from within 10 km of the Proposed Development were requested from TWIC, although this information is useful only for general context as it can only indicate the species' presence in the wider area.
		The SBC recommended that snipe (which may be displaced from areas adjacent to turbines) should be scoped into the EIAR.	Snipe was scoped back into the EIAR.
		The SBC recommended that cumulative effects on birds should be considered with regard to wind farm proposals within the Border Hills NHZ (NHZ 20) for consented wind farm applications and wind farm applications being considered under Planning.	Noted, cumulative impact assessment has been carried out for IOFs for which greater than negligible magnitude residual effects are predicted (see Section 8.10).
NatureScot 27 August 2020		NatureScot agreed that appropriate features and impacts have been identified for the assessment in the EIAR.	Noted

Consultee	Date	Issues raised and recommendations	Scoping response addressed
		NatureScot does not consider that the development is likely to have a significant effect on the wintering pink footed geese interests associated with the nearby Fala Flow SPA/SSSI, despite the proximity of the Proposed Development. There is sufficient information already available about how the geese move between their roost at Fala Flow and their feeding areas to the north and north-west of the SPA/SSSI to enable NatureScot to make that judgement. Impacts of the wind farm on this SPA/SSSI can be scoped out of any assessment.	Noted. However, pink-footed goose has been scoped back in following scoping responses from SBC and RSPB.
		NatureScot stated that Gladhouse Reservoir SPA/SSSI for many years has held insufficient numbers of wintering pink-footed geese to be of any concern to wind farm proposals and this SPA/SSSI can be scoped out of any assessment.	Noted
RSPB 28 August 2020		The RSPB agreed that the EcIA should only concentrate on those features which may be subject to significant effects from the proposed development providing this is based on results of thorough assessment of impact to all scoped-in receptors in the EIAR.	All scoped in ornithological features are assessed in Section 8.7 of this EIAR, following the CIEEM guidelines[1].
		The RSPB do not agree that black grouse should be scoped-out of assessment in the EIA. Given the continued decline of the Southern Scotland black grouse population and the location of the Proposed Development to local populations RSPB advised that black grouse was included for assessment in the EIA and that a data search is made with SUP to further inform this assessment.	Black grouse data were requested from the SUP in January 2021 and are included in this assessment. Black grouse was scoped back into the EIAR.
		The RSPB questioned the scoping out of pink-footed goose based on the fact that they have been recorded through survey work and are a designated feature of the Gladhouse Reservoir SPA, and the scoping report has not ruled out potential connectivity to this site. They advised that	Natural Power acknowledges that pink-footed geese were recorded during baseline surveys however on only four occasions. Also, as per NatureScot advice, the small population of pink-footed geese associated with Gladhouse Reservoir

Consultee	Date	Issues raised and recommendations	Scoping response addressed
		pink-footed geese remained scoped into the EIA in context of its status as designated feature of this SPA.	SPA is of no concern to wind farm proposals. No suitable habitat for roosting and foraging occurs within and around the Proposed Development Area and based on the limited numbers of pink-footed geese recorded during baseline surveys no connectivity between the Proposed Development Area and the Gladhouse Reservoir SPA can be ascertained. However, as the assessment of impacts was required to inform a HRA, this species was scoped back into the EIAR.
		Apart from black grouse and pink-footed goose the RSPB agreed with all other ornithological receptors proposed to be scoped into the EIA.	Noted.
Energy Consents Unit	21 October 2020	Scottish Ministers are generally satisfied with the approach to the scope of the EIA set out at Section 5 of the scoping report. However, Scottish Ministers agree with the comments of RSPB and SBC regarding black grouse. Both consultees highlight that the site and local area lie within a core area for black grouse. Scottish Ministers would request therefore that black grouse is included for assessment in the EIA.	Black grouse was scoped back into the EIA.

8.6 BASELINE CONDITIONS

Desk study

Existing records

8.6.1 The LBRSG, SUP, RSPB and TWIC provided data on bird species recorded within a 10 km radius of the Survey Area (data from the LBRSG on breeding raptors were obtained from within a 5 km radius). Excluding passerines, a total of 65 protected bird species and/or birds of conservation concern were recorded between 2010-2020. This included 11 Schedule 1 raptor species and 14 species of wader, some of which breed within the Survey Area (these records are summarised below). These species represent a typical bird assemblage associated with open moorland habitat in this region of Scotland. A complete list, including number of records and conservation designations is provided in Technical Appendix 8.1.

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

- Osprey recorded sporadically;
- Golden eagle recorded twice;
- White-tailed eagle recorded once;
- Goshawk recorded sporadically;
- Marsh harrier recorded once;
- Hen harrier recorded sporadically;
- Red kite recorded sporadically;
- Barn owl recorded sporadically;
- Merlin recorded sporadically;
- Hobby recorded once; and
- Peregrine recorded sporadically.

8.6.3 Wader species recorded within 10 km of the Survey Area (in bold are species found breeding within the Survey Area) comprise:

- Oystercatcher recorded frequently;
- Lapwing recorded frequently;
- **Golden plover** recorded sporadically;
- Dotterel recorded once;
- **Curlew** recorded frequently;
- Whimbrel recorded twice;
- Dunlin recorded once;
- Woodcock recorded sporadically;
- **Snipe** recorded frequently;
- Jack snipe recorded sporadically;
- Common sandpiper recorded frequently;
- Green sandpiper recorded sporadically;
- Greenshank recorded once; and
- Redshank recorded sporadically.

8.6.4 As a result of the change in golden eagle status in 2022, following the establishment of a territory that overlaps with the Proposed Development Area, the data search was extended and satellite tag data were requested and obtained from SSGEP in August 2022, to update the baseline conditions for this species.

8.6.5 The satellite data provides tracks of the golden eagle pair since territory occupation began. The male settled in the territory from July 2021 and the female from December 2021. The data shows that the male and female have similar range use and that this largely avoids the majority of the turbine locations within the Proposed Development. Liaison with the SSGEP confirmed that the 2022 breeding attempt was unsuccessful. A second pair of eagles that were initially flagged as being in the vicinity of the Proposed Development, were shown to be located at a distance of approximately 20 km; a distance at which no impacts would result from the Proposed Development.

8.6.6 Relevant black grouse records provided by the SUP are shown in Confidential Figure A8.2.2.

Designated sites

Table 8.7 lists the protected areas within the vicinity of the Proposed Development, based upon the search criteria described in Section 8.4. These designated sites are shown on Figure 8.3.

Table 8.7: Summary of protected sites designated for their ornithological interest, within 10 km of the Proposed Development (within 25 km for geese)

Site name	Designation	Designated feature	Distance and direction from proposed site
Moorfoot Hills	SSSI	Golden plover (breeding) Breeding bird assemblage	<0.5 km to north
Gladhouse Reservoir	SPA/ Ramsar/ SSSI	Pink-footed goose (non-breeding)	12.5 km to north-west
Fala Flow	SPA/ Ramsar/ SSSI	Pink-footed goose (non-breeding)	16.5 km to north-east

Baseline surveys

VP surveys

8.6.7 The breeding season surveys in 2018 and 2019 (between March and August inclusive) recorded flight lines from a total of 11 target species, most of which were raptors. Table 8.8 summarises levels of flight activity for each species and the amount of that flight activity which was in the CRZ at PCH (i.e. potential for collisions). Goshawk and curlew were the most frequently recorded species. The associated flight lines are shown in Figures 8.4b and 8.4c. In bold are species for which CRM was carried out.

Table 8.8: Results of the breeding season flight activity surveys in 2018 and 2019, including flights and individuals recorded in the CRZ at PCH. Species for which CRM was carried out are in bold.

Species	No. of flights (individuals)	No. of flights (individuals) in the CRZ at PCH
Greylag goose	1 (2)	1 (2)
Osprey	1 (1)	0 (0)
Hen harrier	4 (4)	1 (1)
Red kite	1 (1)	0 (0)
White-tailed eagle	2 (2)	0 (0)
Goshawk	**10 (10)**	**3 (3)**
Golden plover	**3 (22)**	**3 (22)**
Curlew	**21 (46)**	**3 (11)**
Short-eared owl	1 (1)	0 (0)
Merlin	4 (4)	0 (0)
Peregrine	2 (2)	0 (0)

8.6.8 A total of five target species were recorded during non-breeding season VP surveys between September 2017 and February 2018, and October 2019 and February 2020 (inclusive). Four of those species were also recorded during the breeding season, the only target species not recorded during breeding seasons was pink-footed goose. Table 8.9 summarises levels of flight activity for each species and the amount of that flight activity recorded in the CRZ at PCH. Goshawk was the most frequently recorded species, however golden plover were recorded in greater numbers. The flight lines for the non-breeding season target species are shown in Figures 8.4a and 8.4d. Two species (goshawk and golden plover) met the required criteria for conducting CRM.

Table 8.9: Results of the non-breeding season flight activity surveys in 2017/18 and 2019/20, including flights and individuals recorded in the CRZ at PCH. Species for which CRM was carried out are in bold

Species	No. of flights (individuals)	No. of flights (individuals) in the CRZ at PCH
Pink-footed goose	1 (52)	0 (0)
Unidentified goose	1 (50)	0 (0)
Goshawk	**26 (28)**	**8 (9)**
Golden plover	**7 (287)**	**4 (166)**
Merlin	4 (4)	0 (0)
Peregrine	1 (1)	1 (1)

8.6.9 Supplementary golden eagle targeted VP surveys, carried out between May and August 2022, recorded seven flights of golden eagle, of which four were in the CRZ at PCH. Seven other target species were recorded (Table 8.10), however no CRM was conducted for these. The associated golden eagle flight lines are shown in Confidential Figure A8.2.3.

Table 8.10: Results of the flight activity surveys in May-August 2022, including flights and individuals recorded in the CRZ at PCH. Species for which CRM was carried out are in bold

Species	No. of flights (individuals)	No. of flights (individuals) in the CRZ at PCH
Greylag goose	1 (8)	1 (8)
Red kite	5 (5)	2 (2)
Golden eagle	**7 (7)**	**4 (4)**
Lapwing	1 (7)	0 (0)
Golden plover	1 (2)	1 (2)
Curlew	22 (22)	3 (3)
Snipe	1 (1)	1 (1)
Peregrine	1 (1)	0 (0)

8.6.10 Incidental records of target species and records of secondary species recorded during VP surveys are summarised in Technical Appendix 8.1.

Breeding raptor surveys

8.6.11 No target raptor species were recorded breeding within the Survey Area in either survey year. However, in 2018 an active goshawk nest was located outwith the Proposed Development Area, approximately 2.5 km from the nearest turbine. In 2019 this nest site was not occupied. Target species records from raptor surveys in 2018 and 2019 are shown in Confidential Figure A8.2.1.

8.6.12 Flight activity data recorded in the non-breeding season 2017/2018 suggested that there could be another goshawk territory outside of the Proposed Development Area but no evidence of breeding was found during the breeding season surveys in 2018 and 2019.

8.6.13 Several raptor nests were found within the shelter-belts of mature coniferous trees in the valley to the east of Scawd Law, one of which was occupied by buzzard in 2018. The small size of each woodland block suggests that these are unsuitable breeding areas for goshawk (also, these woodland blocks are used for rearing and releasing of game birds, therefore are subjected to high level of disturbance) and it is considered that the inactive nests are

all likely to belong to buzzards. The LBRSG records show the nearest known active goshawk territories to be beyond 5 km of the Proposed Development Area.

8.6.14 Peregrine and merlin were occasionally recorded during baseline surveys but they showed no evidence of breeding within the Survey Area or within its immediate vicinity (neither species was recorded during the core breeding period between April and July). Based on the LBRSG data, there was a historical peregrine breeding site 2 km from the Proposed Development however the last breeding attempt there was recorded in 1999. Another known peregrine nest lies 4 km from of the Proposed Development, with nesting recorded in 2018 and 2019, however the productivity at this site is very poor due to sustained persecution. Historically the Moorfoot Hills grouse managed moorland was considered quite an important merlin breeding area, however over the last two decades a declining number of breeding attempts were discovered by the LBRSG. No recent breeding attempts of merlin have been recorded in the vicinity of the Proposed Development.

8.6.15 In 2018, a male hen harrier was observed twice in April and once in May but it was not recorded later in the breeding season. There were no records of females. Therefore, the evidence suggests that hen harrier was also a non-breeder. According to the LBRSG, in the last decade there have been a total of 19 hen harriers seen across the Moorfoot Hills (mostly to the north and east of the Proposed Development) during the breeding season but no proven or even suspected successful breeding. Since the vast majority of these sightings were early in the breeding season, persecution has been suggested as the reason for the lack of hen harrier breeding records in this area.

8.6.16 No short-eared owl was recorded during the raptor surveys however one was recorded during flight activity surveys in April 2018. The crepuscular behaviour of this species means that it could have been under-recorded but it is considered that a successful breeding attempt would not have gone undetected within the Survey Area. Consultation with LBRSG confirmed that the nearest breeding short-eared owls are over 4 km and 6 km from the Proposed Development (both sites produced fledglings in 2018).

Breeding bird surveys

8.6.17 A total of 37 bird species were recorded during the breeding bird surveys 2018-2019 and 2022 within the Survey Area, of which 20 species were considered to have held breeding territories. Territory mapping analyses were conducted only for six target species (excluding passerines), and the results are shown on Figures 8.5a and 8.5b. Of wader species, five were recorded as breeding: lapwing, curlew, snipe, golden plover and oystercatcher. Table 8.11 summarises the number of territories of target species recorded during each survey year within the corresponding survey areas. A full list of species recorded during breeding bird surveys is provided in Technical Appendix 8.1.

Table 8.11: Abundance estimates for species breeding at the Proposed Development recorded during breeding bird survey 2018, 2019 and 2022

Species	Estimated number of territories in the Original Survey Area (2018)	Estimated number of territories in the Additional Survey Area (2019)	Estimated total number of territories within 500 m buffer of turbines	Estimated number of territories along the Proposed Access (2022)
Red grouse	5	-	5	1
Lapwing	-	-	-	1
Golden plover	1	1	2	-
Curlew	1	3	3 - 4	2
Snipe	1	1	2	3
Oystercatcher	-	-	-	2

Black grouse surveys

8.6.18 No black grouse were recorded within the Survey Area. However, lekking birds were recorded outwith the Survey Area to the west and northwest of the Proposed Development. In 2018 two males were seen attending the lek near Colquhar, and five males were recorded at two leks near Blackhopebyre. In total, a minimum of seven black grouse males were recorded lekking in this area.

8.6.19 The information returned by the SUP confirmed the same three locations as regular leks. The lek near Colquhar (Woolhope Hill) was attended by two males in 2018, 2019 and 2020. Also, the lekking sites near Blackhopebyre (including Glentress Hills, Blackhopebyre and Kitty Cleuch) were attended by a total of five males in 2018, 2019 and 2020. Another lek near Blackhopebyre (Lee Pan) was attended by a single male in 2020.

8.6.20 In addition, two lekking sites east of the Proposed Development were identified by the SUP. In 2018 the Caddonhead lek, located 3.0 km from the nearest proposed turbine (T5), was attended by three males. Also in the same year three males were recorded at the Scroff lek located 2.9 km from the nearest proposed turbine (T8). These leks were not counted in 2019 and 2020. As these leks are 2.3 km apart it can be assumed that up to six lekking males were present to the east of the Proposed Development in 2018.

8.6.21 A summary of black grouse leks in the vicinity of the Proposed Development is given in Table 8.12. The Confidential Figure A8.2.2 provides a graphic representation of the most relevant leks.

Table 8.12: Active black grouse leks in proximity of the Proposed Development (in bold are data collected by Natural Power)

Years	Lek	Lekking males (max count)	Distance to nearest wind farm/access track	Distance to nearest turbine
2018-2020	**Woolhope Hill**	**2**	1.1 km	3.1 km
2018-2020	**Blackhopebyre (various leks)**	**5**	1.4 km 2.2 km	2.0 km
2018	Scroff	3	2.9 km	2.9 km
2018	Caddonhead	3	3.0 km	3.0 km
2020	Lee Pen	1	1.2 km (site entrance)	3.7 km

Source: Baseline information collected by Natural Power in 2018 was complemented by the records provided by the SUP

Collision risk modelling

8.6.22 Four target species fulfilled criterion for CRM. During the breeding season these were: golden eagle, goshawk, golden plover and curlew. During the non-breeding season these were: goshawk and golden plover. The risk of collision for each species, calculated with avoidance factors of 95%, 98%, 99%, 99.5% and 99.8%, are presented in Table 8.13.

Table 8.13: Estimated number of collisions during the breeding/summer season (March to August) and non-breeding/wintering season (September to February). Estimated number of collisions for golden eagle is based on a period of four months in the breeding season (May to August). Shaded cells represent NatureScot recommended avoidance rates. Annual estimates are sums of breeding and non-breeding seasons estimates.

		Estimated mortality assuming avoidance of:				
Species	Period/Season	95%	98%	99%	99.5%	99.8%
Golden eagle	May-August	0.10	0.04	**0.02**	0.01	0.00
Goshawk	Breeding	0.14	**0.06**	0.03	0.01	0.01
	Non-breeding	0.28	**0.11**	0.06	0.03	0.01

Species	Period/Season	Estimated mortality assuming avoidance of: 95%	98%	99%	99.5%	99.8%
	Annual	0.42	**0.17**	0.09	0.04	0.02
Golden plover	Breeding	1.40	**0.56**	0.28	0.14	0.06
	Non-breeding	4.35	**1.74**	0.87	0.44	0.17
	Annual	5.75	**2.30**	1.15	0.58	0.23
Curlew	Breeding	0.29	**0.12**	0.06	0.03	0.01
	Non-breeding	-	**-**	-	-	-
	Annual	0.29	**0.12**	0.06	0.03	0.01

8.7 IMPACT ASSESSMENT

8.7.1 This section assesses the potential impacts and the significance of effect 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 3: Site Selection and Design Evolution, for further details). Consequently, ornithological constraints have been considered during the scheme evolution. Likely significant effects are assessed against the final design as described in Chapter 4.

8.7.2 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.

8.7.3 In addition to effects which are directly related to the development, there may be other effects which arise as a result of the combined impacts 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, but may be more important and significant in the cumulative context.

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

Potential effects during construction

Habitat loss

8.7.5 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

8.7.6 The construction stage of wind farm developments can have potential impacts caused by 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.

8.7.7 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.

8.7.8 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[34].

8.7.9 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

8.7.10 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.

8.7.11 Studies have shown that, in general, species are not disturbed beyond 500 to 800 m from turbines[35, 36] and in some cases, birds do not appear to have been disturbed at all[37, 38, 39, 40]. However, this may depend on the sensitivity of the species in question; specific disturbance impacts are discussed in the feature assessment below.

8.7.12 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.

8.7.13 Pearce-Higgins *et al.* (2009)[36], 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

[34] 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.

[35] 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.

[36] 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.

[37] 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.

[38] 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.

[39] 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.

[40] 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.

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, stonechat distribution. A more recent study of displacement impacts of wind farms on 10 species of upland breeding birds, by the same lead author[41] 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 study by Sansom *et al.* (2016)[42] 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[43] and curlew[38], 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 Proposed Development Area such as skylark and meadow pipit[20].

8.7.14 In terms of non-breeding population densities, Hötker *et al.* (2006)[35] 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)[37] found no effect on four species groups (seed-eaters, corvids, gamebirds and skylarks); the only exception was pheasant.

8.7.15 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.

8.7.16 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

8.7.17 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.

8.7.18 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[44, 20]. Birds may also be more susceptible if the wind farm is located in an area of high prey density.

8.7.19 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.

8.7.20 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.

Potential effects during decommissioning

8.7.21 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. These are therefore not discussed separately within this assessment

Embedded mitigation

8.7.22 Embedded mitigation is built into the Proposed Development 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

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

Environmental Clerk of Works (ECoW)

8.7.24 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.

8.7.25 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.

8.7.26 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.

[41] 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.

[42] 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.

[43] 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.

[44] 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.

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 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

8.7.27 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 (e.g. golden eagle));
- 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.

8.7.28 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)

8.7.29 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 (including golden eagle), black grouse and upland waders, particularly in the vicinity of historic nest sites or suitable nesting habitat. It is proposed that this is 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 nesting 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 for the Proposed Access during the breeding season.

8.7.30 Measures to prevent disturbance to lekking black grouse (if any are found within 750 m from the construction works) 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.

8.7.31 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

8.7.32 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.

Decommissioning

8.7.33 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.

Features brought forward for assessment

8.7.34 Based on the results of the scoping process, the features and impacts identified for the EcIA are shown in Table 8.14.

Table 8.14: Features and impacts to be assessed within the EcIA

Features	Impact	Assessment
Pink-footed goose	Connectivity with an SPA	Screening for AA*
Black grouse	Disturbance/displacement	EcIA
Golden eagle	Collision and disturbance/displacement	CRM & EcIA
Goshawk	Collision and disturbance/displacement	CRM & EcIA
Golden plover	Collision and disturbance/displacement	CRM & EcIA
Curlew	Collision and disturbance/displacement	CRM & EcIA
Snipe	Disturbance/displacement	EcIA
Fala Flow SPA/SSSI	Adverse effects on site integrity (wintering pink-footed goose)	Screening for AA
Gladhouse Reservoir SPA/SSSI	Adverse effects on site integrity (wintering pink-footed goose)	Screening for AA

**AA – Appropriate Assessment (see Section 8.12)*

8.7.35 On the basis of the baseline survey results outlined in Section 8.6, the ornithological features of relevance to the Proposed Development have been assigned assessment values in Table 8.15 below. Based on this, they have been assessed as either as an IOF, or not an IOF, in the context of the Proposed Development. Regional population and Scottish context estimates are given in the context of NHZ 20 (Border Hills).

Table 8.15: Determination of Ornithological Features occurring within the Proposed Development

Species	Conservation designation*	Value	Population estimate[30, 45, 13]	Scottish context[45] (unless referenced within)	Baseline	IOF	Justification
Pink-footed goose	Amber	Regional	GB/UK: 510,000 wintering individuals. NHZ 20: 47,407 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 2019, a total of 500,928 pink-footed geese were counted in the UK (current population estimate). In the Borders 33,219 birds were counted in October 2018, and 10,311 in November 2018[46].	There was a single flight (52 individuals) recorded during VP surveys in the non-breeding season, and one incidental flight (110 individuals) recorded outside of the VP viewshed. No flights were recorded in the CRZ at PCH therefore no CRM was undertaken.	No	This species is of medium conservation concern (species on the UK BoCC Amber List). It is a qualifying feature of two internationally designated sites within the ZoI of the Proposed Development (within 25 km of the Survey Area). However, only one flight of pink-footed geese was recorded during baseline surveys and this did not pass through the CRZ. The absence of pink-footed geese passing over the Proposed Development suggests negligible collision risk and there is no route to disturbance/displacement effects. Therefore, this species is not considered to be an IOF. However, as a qualifying feature of the Fala Flow and Gladhouse Reservoir SPAs, pink-footed goose is included in the screening for Appropriate Assessment (Section 8.12).
Black grouse	Red; SBL; LBAP	Regional	GB/UK: 4,850 males (breeding season). Scotland: 3,344 displaying males. NHZ 20: 89 displaying males.	Two thirds of the UK birds are now found in Scotland and here numbers declined by 29% between 1995/96 and 2005[47]. Trends varied between regions, but there was a significant decline of 69% in south-east Scotland. Scottish population size is estimated at 3,550-5,750 lekking males with 7,500-19,000 winter population. An estimated 257 males remain in south-east Scotland[48].	No lekking males or any other black grouse records were made within the Survey Area during baseline surveys. However, several lek sites were identified outside of the Proposed Development (the nearest was 2 km from a turbine), which in 2018 supported up to 11 lekking males in total.	**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 outside of the Proposed Development Area, this species is considered to be an IOF and is taken forward for a full EcIA.
Golden eagle	Ann I, Sch 1.1 (A1,1A), SBL	Local	GB/UK: 510 pairs Scotland: 508 pairs NHZ 20: 3 occupied territories (2015).	Golden eagle is widely distributed in the Scottish Highlands and on most Hebridean Islands. In south-east Scotland it is a very rare resident, with one occupied territory[49]. Since 2018, immature golden eagles have been released in the Moffat Hills as part of the SSGEP to boost the local population.	No golden eagles were recorded during the baseline surveys in 2017-2020. In April 2022 a breeding attempt by golden eagles released as part of the SSGEP occurred within the Proposed Development Area. Golden eagle targeted VP surveys conducted between May and August 2022 recorded seven golden eagle flights (four in the CRZ at PCH). Predicted collision	**Yes**	This species is of regional value as a target species of high conservation concern (Annex I, Schedule 1 and SBL) 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 golden eagle, the recent conservation efforts to boost the local golden eagle population (SSGEP) and the facts that a pair of golden eagles set up a territory and built a nest within the Proposed Development Area, this species is considered to be an IOF and is taken forward for a full EcIA.

[45] 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.

[46] Brides, K., C. Mitchell & S.N.V. Auhage (2020) Status and distribution of Icelandic breeding geese: results of the 2019 international census. Wildfowl & Wetlands Trust Report, Slimbridge.19pp.

[47] 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.

[48] Warren, P. (2016) Black grouse conservation in southern Scotland – Phase 2 Development of a regional strategic conservation plan. The Game & Wildlife Conservation Trust, Durham. Available at: https://www.gwct.org.uk/media/641731/black-grouse-in-southern-Scotland.pdf.

[49] Murray, R.D., Andrews, I.J. & Holling, M. (2019) Birds in South-east Scotland 2007-13: a tetrad atlas of the birds in Lothian and Borders. The Scottish Ornithologists' Club, Aberlady.

Species	Conservation designation*	Value	Population estimate[30, 45, 13]	Scottish context[45] (unless referenced within)	Baseline	IOF	Justification
					mortality for golden eagle during this period was calculated at 0.02 birds.		
Goshawk	Sch 1.1	Regional	GB/UK: 620 pairs in the breeding season (minimum – underreporting considered likely). NHZ 20: 13 breeding pairs.	The Scottish goshawk population was estimated at 130 pairs between 2000 and 2004; the most recent estimations (2019) are for 165 pairs, of which 41 occupied home ranges were found in the Scottish Borders[50].	Goshawk was recorded both in the breeding and non-breeding seasons (10 and 26 records respectively), however all but one record were made during the 2017/18 survey period when an active goshawk territory was confirmed outwith the Proposed Development Area, approximately 2.5 km from the nearest turbine. Predicted collision mortality for goshawk is 0.06 birds per breeding season and 0.11 birds per non-breeding season, which gives an annual estimate of 0.17 birds.	**Yes**	This species is not a qualifying feature of any statutory sites within 10 km of the Survey Area, but is afforded special protection (Schedule 1). Although it was recorded irregularly during baseline surveys, it can be considered to be of importance in a regional context. Given its conservation status, small size of the regional population and predicted collision mortality at the Proposed Development goshawk is considered to be an IOF and is taken forward for a full EcIA.
Golden plover	Ann I, SBL, LBAP	Regional	GB/UK 33,500 – 50,500 breeding pairs. UK: 410,000 wintering individuals. Scotland: 15,000 breeding pairs. NHZ 20: 1,058 breeding pairs.	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 Outer Hebrides[51]. 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 the Scottish breeding population of golden plover is steady although slightly declining (by 7% between 1995 and 2018[52]). In Borders golden plover is a moderately common breeding species on the grass and heather-covered hills that surround the Tweed basin, with numbers highly variable during the winter[53].	A total of 10 golden plover flights were recorded during baseline surveys (three in the breeding season and seven in the non-breeding season), all totalling 309 individuals. Of these, seven flights (188 individuals) were in the CRZ at PCH. CRM was therefore conducted for this species and this would result in 0.56 mortalities during the breeding season and 1.74 mortalities in the non-breeding season. The combined annual collision risk estimate for golden plover is therefore 2.30 birds. Two breeding territories were identified within the Survey Area.	**Yes**	A regularly occurring target species of high conservation concern (Annex I, SBL and LBAP species) that is a qualifying feature of a nationally designated site (SSSI) within the ZoI of the Proposed Development. Given the high conservation status of golden plover, the predicted mortality rates at the Proposed Development and the presence of breeding birds within the Proposed Development Area, golden plover is considered to be an IOF and is taken forward for a full EcIA.
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.	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[52]. In Borders curlew is a common	There were 21 flights (46 individuals) recorded during VP surveys during breeding seasons in years 2018-2019, of which three flights (11 individuals) were recorded in the CRZ at PCH. No curlews were recorded in the non-breeding seasons. Predicted collision mortality for curlew is 0.12 birds per breeding season.	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. Predicted collision mortality at the Proposed Development for curlew (0.12 birds per year) represents 0.004% of the of the NHZ 20 breeding population (2,800 breeding individuals). This level of mortality is unlikely to be detectable against background annual mortality

[50] Challis, A., Wilson, M.W., Schönberg, N., Eaton, M.A., Stevenson, A. & Stirling-Aird, P. (2020) Scottish Raptor Monitoring Scheme Report 2019. BTO Scotland, Stirling.

[51] 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.

[52] 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.

[53] Brewis, T. (ed.) (2019) Borders Bird Report (No. 36). Scottish Ornithologist's Club Borders Branch

Species	Conservation designation*	Value	Population estimate[30, 45, 13]	Scottish context[45] (unless referenced within)	Baseline	IOF	Justification
			NHZ 20: 1,400 breeding pairs.	but declining breeding species (scarce in winter)[53].	Up to four breeding territories were estimated within the Survey Area.		(17.9%[54]). Furthermore, curlew collisions with turbines are relatively rare events, only 13 curlew collisions have been reported at European wind farms[55] (mostly in the Netherlands). Although it is possible that low numbers of breeding birds may be displaced during construction and/or operation of the Proposed Development, there is alternative breeding habitat within the Proposed Development 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 curlew 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 20: 908 breeding pairs (likely underestimated).	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 open areas except the most heavily farmed land. A 22% increase in the Scottish breeding population was recorded between 1995 and 2018[52]. In Borders snipe is a local breeding species, mostly in hilly areas[53].	No snipe flight activity was recorded during VP surveys during baseline surveys. Two breeding territories were found within the Survey 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 low numbers but is not a qualifying feature of any statutory sites within 10 km of the Survey Area. There was no flight activity recorded however breeding snipe were found within the Survey Area (two pairs). Given the size of breeding population in NHZ 20 (908 pairs), any theoretical collision rate would be undetectable against background annual mortality (*c.* 50%[56]), resulting in negligible collision risk. Although small numbers of snipe may be displaced by the Proposed Development there is alternative breeding habitat within the Proposed Development Area and in the surrounding locale. 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.

Designated site	Notified feature	Importance	Assessed condition	IOF	Justification
Gladhouse Reservoir SPA/SSSI	Non-breeding pink-footed goose	International	Unfavourable declining	**Yes**	The Gladhouse Reservoir SPA lies about 12.5 km northwest of the Proposed Development, i.e. within the foraging distance for the pink-footed geese (core range of 15-20 km)[11], therefore connectivity between the SPA and the Proposed Development can be assumed.
Fala Flow SPA/SSSI	Non-breeding pink-footed goose	International	Favourable maintained	**Yes**	The Fala Flow SPA lies about 16.5 km northeast of the Proposed Development, i.e. within the foraging distance for the pink-footed geese (core range of 15-20 km)[11], therefore connectivity between the SPA and the Proposed Development can be assumed.

** 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 (Scottish Borders) priority species; Red = UK Birds of Conservation Concern (BoCC) Red-listed species; Amber = UK BoCC Amber-listed species*

[54] Berg, A. (1994) Maintenance of populations and causes of population changes of curlews *Numenius arquata* breeding on farmland. Biol. Conservation. 67: 233–238.

[55] 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 May 2021.

[56] 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.

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

- Black grouse;
- Golden eagle;
- Goshawk; and
- Golden plover.

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

Black grouse

Introduction

8.7.38 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[47] (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[48]. The RSPB reported that numbers of lekking males have increased in more recent years, for example, 390 lekking males were recorded in the Scottish Borders in 2011 by the SUP[57].The south-east Scotland population was estimated to be 35-370 lekking males in 2008-2013 (with a wintering population of 75-1110 birds)[49]. The population in NHZ 20 is estimated at 89 displaying black grouse males.

Baseline summary

8.7.39 No black grouse were recorded within the Proposed Development Area. However, up to 11 lekking males were recorded in the vicinity of the Proposed Development at various locations outside of the Survey Area. The distance of these leks to the nearest turbines ranges from 2 to 4 km.

Potential collision risk impacts

8.7.40 It is acknowledged that theoretical risk of collision with turbines does exist for black grouse (there have been seven collisions reported from Austria[55] and two from Scotland[58]), however grouse species are known to collide with turbine towers, rather than turbine blades. Black grouse may also be susceptible to collisions with fences and power lines. A study conducted at four black grouse lek sites in Scotland[59], 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 unmarked fences.

8.7.41 Given no black grouse flight activity was recorded within the Survey Area, and turbines are being proposed in high altitude open moorland away from forest edges (i.e. in habitat unlikely to be used by black grouse), it is considered that unmitigated collision effects with turbines will be of negligible magnitude and not significant. Black grouse from the local population could potentially utilise the areas of suitable habitat within the Proposed Development Area, therefore the risk of collision with other wind farm infrastructure such as fences or guy ropes needs to be considered. After the implementation of embedded mitigation measures, however, potential effects will be **negligible** and **not significant** for black grouse at the local population level.

Potential disturbance/displacement impacts

8.7.42 No lekking black grouse males were recorded within the Survey Area. The nearest leks were located beyond disturbance distance from any infrastructure (1.1 km from a track and 2 km from the nearest turbine). NatureScot currently recommends that no construction work takes place within 750 m of lekking black grouse, therefore given the locations of leks no disturbance impacts from construction activities to lekking black grouse are predicted.

8.7.43 However, female black grouse nest generally 600 m from the local lek (range 129–2464 m)[60] and both sexes may be feeding in some proximity to the Proposed Development Area. With several leks being located 2-3 km from the proposed turbines, some black grouse can potentially nest within the areas affected by construction activities. As such, construction activity for the Proposed Development has the potential to disturb nesting black grouse. Also, in theory, without adequate mitigation, construction activity around turbines located in proximity to the leks (Turbines 6 and 7) could potentially damage or destroy ground nests of black grouse should these nests have been established before the construction activities commence. However, as no suitable nesting black grouse habitat exist in the close proximity to the aforementioned turbines, and no black grouse were recorded within the Survey Area during the baseline surveys, disturbance and/or displacement impacts on nesting black grouse are highly unlikely to occur.

8.7.44 With application of protection measures via embedded mitigation (timing of construction works, pre-construction surveys during the bird breeding season and an appropriate exclusion zone implemented around any nests) 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. As such, construction phase disturbance/displacement effect on this species is predicted to be of no more than short-term, **low negative magnitude** and **not significant**.

8.7.45 As most of the Proposed Development Area is not considered to be favourable black grouse breeding habitat, direct habitat loss to components of the Proposed Development is likely to be relatively small. Any indirect loss of foraging habitat is considered to be of small scale and of low significance, as it is unlikely it would have any significant impact on the local black grouse population. As such, **no disturbance or displacement impacts are predicted** for black grouse during operation of the Proposed Development.

8.7.46 Habitat fragmentation through agricultural intensification[61] and/or commercial afforestation[62] is one of the factors linked to the decline of black grouse population in southern Scotland (and elsewhere). 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[64]. In southern Scotland, the Moorfoot Hills and Tweedsmuir Hills support 62% of all lekking males (581)[48]. Information provided by the SUP identified several leks outside of the Proposed Development, however given the abundance and distribution of other leks in the Moorfoot Hills and Tweedsmuir Hills, the location of the Proposed Development does not seem to fragment any local black grouse population. Retaining connectivity between various sub-populations appears to be more crucial for the areas located outside of the Tweedsmuir Hills and Moorfoot Hills stronghold (for example, in the

[57] http://www.rspb.org.uk/news/308115-black-grouse-numbers-on-the-rise-in-scotland. Last accessed: 28 April 2021.

[58] 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.

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

[60] Warren, P., Baines, D. & Richardson, M. (2012) Black grouse Tetrao tetrix nest-site habitats and fidelity to breeding areas in northern England. Bird Study, 59, 139-143.

[61] Fuller, R.J. & Gough, S.J. (1999) Changes in sheep numbers in Britain: implications for bird populations. *Biological Conservation*, 91 (1): 73-89.

[62] 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.

[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] 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.

Lammermuir Hills and Pentland Hills). The main conservation target for the black grouse population in southeast Scotland is to increase breeding productivity and over-winter survival through habitat enhancement and targeted predator management.

8.7.47 There may 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.

Golden eagle

Introduction

8.7.48 In the UK, golden eagle is confined almost exclusively to the Scottish Highlands and Islands, with very few pairs nesting regularly further south. Although historically more home ranges were occupied, in south-east Scotland just one territory was regularly occupied[49] during the period 2007-2013. As a result, the SSGEP was set up to boost the population of golden eagles in southern Scotland through reintroductions. A report on golden eagles in southern Scotland concluded that the area (including Dumfries and Galloway) could potentially hold 14-16 pairs[65]. The study showed that local to the Proposed Development, the Moorfoot Hills had the capacity to support up to one pair of golden eagles and further south-west the Tweedsmuir Hills could hold up to four pairs. However, it was concluded that, taking into account habitat, disturbance and potential persecution incidents, the Moorfoot Hills were most likely to become important for non-breeding eagles rather than supporting a new range.

Baseline summary

8.7.49 No golden eagles were recorded during the two years of baseline surveys in 2017-2020, however in 2021 as a result of the golden eagle translocation programme a pair of golden eagles established a territory within the Proposed Development Area and attempted to breed in spring 2022. As a result of this breeding attempt, golden eagle targeted VP surveys were completed in May-August 2022 and these recorded seven flights over the Proposed Development Area (three off-effort records were also made). The flight activity concentrated in the north-east part of the Survey Area (Seathope Rig and Windlestraw Law). To avoid disturbance no surveys other than VP surveys were carried out, and the nest site was not visited. Note that the 2022 nesting attempt was unsuccessful, and the male bird has since died (A.H. Fielding, *pers. comm*.).

8.7.50 As the golden eagle pair were both satellite-tagged, robust data regarding the movements of these birds within their territory could be obtained. The flight data was used to determine the range boundary for the pair, and the Proposed Development Area is located within this range. However, the pattern of flights shows that the majority of the area in which the proposed turbines are to be located, is not well used by the pair. Flights were more frequent in the vicinity of T7 and T8 (the most northerly turbines), but overall, out of a total of 3,321 tag records for the pair, only 84 (2.5% of the total) were recorded within 300 m of the proposed turbine locations. The core areas in the territory lie to the east and north-west of the proposed turbines. Note that the tag data does not provide information regarding flight heights. The tracks of the tagged eagles are shown in the golden eagle analysis (Fielding, 2022[33]) included in Appendix 8.2: Ornithology Confidential Appendix.

Potential collision impacts

8.7.51 The VP survey data from the period May to August 2022 were used to calculate the collision risk for golden eagle. This estimate is based on four months of flight activity data, totalling 36 hours of survey effort at each VP location, and this produced an estimate of 0.02 bird collisions (for this four-month period). As eagles are resident, an extrapolated collision estimate for a full year is estimated at 0.06 birds per annum. However this assumes flight activity remains relatively constant during the year and it is likely that the number and duration of flights will be less during the months when the weather is poorer (assuming no change to the number of birds through the year). This annual estimate represents 1.00 % of the NHZ 20 breeding adult population, using the stated estimate for this region (three pairs), However, this regional estimate is now outdated given it does not take into account the presence of re-introduced birds, with immature birds expected to come into maturity and increase the regional population year on year.

8.7.52 There is evidence that collisions with turbines are actually rare for golden eagles in Scotland due to the high level of avoidance they have been found to exhibit[66,67]. Extensive analysis of satellite tagged birds shows that golden eagles very rarely approach turbines, and it is considered by expert opinion that the population impacts of a wind farm should not be based on additional mortality as a result of collision (but rather based on displacement impacts). Therefore, the collision estimate for golden eagles in relation to the Proposed Development is considered unlikely to come to pass. Based on this evidence, collision impacts are predicted to be of low negative magnitude and not significant.

Potential displacement impacts

8.7.53 As golden eagles show a strong avoidance of wind farms, the avoidance of the outer turbines in an array effectively results in the abandonment of land within the interior of the wind farm[67]. The authors of this research suggest that when assessing the impact of a wind farm in Scotland, all habitat within a buffer around the outer-most turbines of a wind farm should be considered 'lost' to eagles. Based on the available evidence, a buffer of 300 m around the turbines is considered appropriate, although this in itself is deemed a conservative approach[33]. Using this value of a 300 m buffer around the turbines, the Proposed Development is calculated to result in an area of 287 ha from which the territorial eagles will be displaced.

8.7.54 The analysis of golden eagle habitat loss[33] at the Proposed Development included an assessment of habitat suitability using the Golden Eagle Topography (GET) Model. This is the model currently recommended in guidance for interpreting impacts on golden eagles in Scotland and replaces the PAT (Predicting Aquila Territories) Model that was previously widely used. The GET model produces a 'score' for every 50 m pixel of an area using topography data to assess the suitability for golden eagles. The habitat suitability was further assessed by taking into account forest cover, with closed canopy forested areas not generally utilised by golden eagles, as well as other wind farm developments in the wider area. From this, the area (in hectares) of good eagle habitat within various radii of the Proposed Development were calculated. Inclusion of the satellite tagging data allowed for further analysis to determine habitat suitability within the home range. Full details of the analysis can be found included in Appendix 8.2: Ornithology Confidential Appendix.

8.7.55 The golden eagles that are present in the vicinity of the Proposed Development have a home range that is considered relatively large (7,786 ha) and it is considered to have an extremely high percentage of good eagle habitat within it, when compared to other territories that have been investigated in Scotland (95.2% of all open area within the range). The loss of 287 ha from the home range would result in a 4.4% loss, which is below the 5% threshold of 'acceptable loss' that is used in the GET Model. As described above, only 2.5% of tagged flight records for the pair were recorded within the Proposed Development Area and surrounding 300 m buffer, which shows that this area is utilised less than would be expected based purely on its proportion of the overall range size (despite the habitat within the turbine area being good eagle habitat).

8.7.56 The assessment of habitat loss at the Proposed Development[33] also looked into the impact on dispersing immature golden eagles, in addition to the impacts upon the resident pair. It was concluded that the Proposed Development would result in a negligible loss of habitat for dispersing birds, partly due to the area already being within an existing

[65] Fielding, A.H. and Haworth, P.F. (2014) Golden eagles in the south of Scotland: an overview. Scottish Natural Heritage Commissioned Report No. 626.

[66] Fielding, A.H., Anderson, D., Benn, S., Dennis, R., Geary, M., Weston, E. and Whitfield, D.P. (2021) Responses of dispersing GPS_tagged golden eagles (*Aqila chrysaetos*) to multiple wind farms across Scotland. *Ibis* 164,(1), 102-117.

[67] Fielding, A.H., Anderson, D., Benn, S., Dennis, R., Geary, M., Weston, E. and Whitfield, D.P. (2021) Non-territorial GPS-tagged golden eagles *Aquila chrysaetos* at two Scottish wind farms: Avoidance influenced by preferred habitat distribution, wind speed and blade motion status. *PLoS ONE* 16(8): e0254159.

territory and so likely avoided by young birds, and partly due to the very small percentage area of good eagle habitat that will be lost from the wider area.

8.7.57 Based upon the robust analysis of habitat loss undertaken specifically for the Proposed Development, it is predicted that displacement impacts will be no more than **moderately negative magnitude** and **not significant**.

Potential disturbance impacts

8.7.58 The nest site used in 2022 is in excess of the distance at which disturbance is expected to take place (recommended disturbance distance buffer of 750-1000 m (breeding season)[12]). More detail is included within Appendix 8.2: Ornithology Confidential Appendix. Therefore, construction works will not result in disturbance to birds at the nest. Construction works will, however, take place within the home range of the territorial eagle(s), but these will be temporary and will only affect a small area of the total range (7,786 ha). For these reasons, disturbance impacts are predicted to be of **low negative magnitude** and **not significant**.

Goshawk

Introduction

8.7.59 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 most recent Raptor Study Group (RSG) report states that in 2019 Scottish raptor workers located 165 occupied goshawk territories, of which 41 were located in the Borders[68]. These totals are related to observer effort rather than actual population size, however, with the number of monitored nests estimated as being 10-50% of the true figure.

Baseline summary

8.7.60 All but one record of goshawk came from the survey period during which an active nest was found in the vicinity of the Proposed Development (2017/2018). During flight activity surveys there were 26 records in the non-breeding season 2017/18, nine records in the breeding season 2018 and a single record in the breeding season 2019. The flight activity was evenly distributed across the Survey Area, with no dominant direction of travel. Both sexes were recorded, twice an adult female was seen flying together with a juvenile bird. These, and most of the other records, came from the non-breeding season 2017/18 which may suggest that goshawk bred near the Proposed Development in 2017 (the baseline survey recording started in September 2017). No displaying flights were recorded in the breeding season 2018, however an active nest was found outwith the Proposed Development Area. In the breeding season 2019 there was only a single flight recorded and the nest which was occupied in the previous year was found to be inactive. LBRSG do not have records of goshawk breeding within 5 km of the Proposed Development Area.

Potential collision risk impacts

8.7.61 Three flights from the breeding season and eight flights from the non-breeding season were used to calculate the collision risk for goshawk in the respective seasons, producing seasonal estimates of 0.06 birds and 0.11 birds. The predicted collision mortality for goshawk is therefore 0.17 bird per year (5.95 birds over the lifespan of the Proposed Development), representing 0.65% of the total NHZ 20 population estimate, and 0.27% of the Scottish Borders goshawk population (based on its most recent estimation[68]).

8.7.62 Raptors are susceptible to collision with turbines due to their morphology (i.e. heavy wing loading) and foraging behaviour (i.e. focussing on distant prey)[69]. Goshawk is a species which is generally at low risk of collision due to their foraging behaviour being at low level and mostly being within and adjacent to woodland cover. The turbines are all located in open upland habitat although given the seasonal abundance of potential prey (pheasant and red-legged partridge released for game shooting by the estate) the Proposed Development area is likely to periodically attract goshawk. However, goshawks are more likely to fly at PCH during their display period rather than when foraging for food since foraging flights are low-level and below PCH. Soaring flights are more likely to take a bird into the CRZ, but such flights are likely to be most frequent in the vicinity of the nest. It is expected that goshawks will more likely avoid the turbine envelope once the Proposed Development has been constructed. Indeed, studies suggest that raptors are likely to decline in general abundance in a given area due to avoidance of the wind farm[70]. Such avoidance means that flight activity within the Proposed Development is likely to be lower after construction than during baseline conditions, and it follows that the likelihood of collision will also be lower than estimated by CRM.

8.7.63 Predicted mortality estimate (0.17 bird per year) is based mostly on a period when goshawks were breeding in the vicinity of the Proposed Development (the nest site was used in one of the two survey years), and the survey work indicates that breeding does not take place every year, these collision rates are unlikely to be realised. As such, the potential effect as a result of collision risk is considered to be of **low negative magnitude** and **not significant** for goshawk.

Potential disturbance/displacement impacts

8.7.64 Goshawks are particularly vulnerable to disturbance in the early part of the breeding season during the nest building and early incubation stages (mid-March to mid-May). Some pairs are prone to desert, particularly if they are first-time breeders or in years when prey availability is low[71,12]. The type of disturbance most likely to affect goshawks is when a sudden change occurs in the nesting environment, such as commencement of harvesting operations or a sudden increase in traffic volume[71]. Thus, there is potential for breeding birds to be disturbed, particularly during construction activities. However, goshawks can become conditioned to some types of regular disturbance, such as road traffic, if the disturbance is present from the start of nesting[71]. It is considered unlikely that goshawks will be disturbed by turbine operation, although some operational wind farm activities (e.g. track maintenance, cable repairs, etc.) have the potential to disturb breeding goshawks.

8.7.65 In 2018 an occupied goshawk nest was found outside the Proposed Development Area, 2.5 km from the nearest turbine. This nest was found inactive in 2019 however goshawks can have up to four different nesting areas within their range and may move up to 2.5 km to another nest site[45]. Evidence suggests that goshawks can be disturbed up to a distance of 500 m[45, 72] and although no construction work will be undertaken in such proximity to the nest, details of embedded mitigation measures to prevent or minimise any disturbance to breeding goshawks 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, as well as monitoring for disturbance and controlling the construction traffic. In addition, large forestry stands exist within 5-10 km of the Proposed Development (Elibank and Traquair Forest, and Glentress Forest) providing topographical variety and habitat richness that attracts goshawk (there are two known goshawk territories in these forests). With extensive

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

[69] Kikuchi, R. (2008) *Adverse impacts of wind power generation on collision behaviour of birds and anti-predator behaviour of squirrels*. Journal for Nature Conservation 16: 44-55.

[70] Garvin, J. C., Jennelle, C. S., Drake, D. and Grodsky, S. M. (2011). *Response of raptors to a windfarm*. Journal of Applied Ecology, 48: 199-209.

[71] Petty, S.J. (1996) *Reducing disturbance to goshawks during the breeding season*. Forestry Commission Research Information Note 267.

[72] 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.

alternative breeding habitat present in the surrounding area any potential effects on goshawk as a result of the Proposed Development should be considered within this context (habitat suitability for goshawk within commercial conifer plantations is subject to constant change due to the nature of rotational harvesting).

8.7.66 Given the large distance from the areas where construction activities will occur as well as from the Proposed Access, construction phase disturbance/displacement effect on this species is predicted to be of no more than short-term, **low negative magnitude** and **not significant**. **No disturbance or displacement impacts are predicted** for this species during operation phase of the Proposed Development.

Golden plover

Introduction

8.7.67 Golden plover is a widespread resident breeder in upland areas; found in lowland farmland and near coasts in winter. Numbers increase during passage and in winter by birds from northern Europe and Iceland/ Greenland. It is an Annex I, SBL and LBAP species. Breeding golden plover is a qualifying feature of the neighbouring Moorfoot Hills SSSI where it has been recorded at densities of 5.4 pairs/km^2 on the blanket bog.

8.7.68 Most recently, the UK golden plover breeding population is estimated to be 32,500-50,500 pairs[30] although Forrester *et al.*[45] give a Scottish breeding population estimate of 15,000 pairs, stating that this represents 80% of the British breeding population. Forrester *et al.*[45] give a Scottish wintering population of 25,000-35,000 individuals. The NHZ 20 breeding population was estimated to be 1,058 (range 979-1,136) pairs in 2005[13]. No estimate of the non-breeding population is given for the NHZ. The non-breeding season population of golden plover consists of different birds to the Scottish breeding population, with migratory birds arriving from Iceland, Greenland and Fennoscandia[45]. The wintering population is likely to be highly transitory and to occur in fluxes, both temporally and geographically. The average golden plover population in south-east Scotland in winter is estimated at 4,524 birds (varying from 3,000 to 6,500 birds between years)**Error! Bookmark not defined.**. The British Trust for Ornithology (BTO) BirdTrends website[73] states that since 1995 the golden plover population shows stability in Scotland and in the UK as a whole.

Baseline summary

8.7.69 A total of 10 golden plover flights were recorded during baseline surveys. Three flights in the breeding season totalled 22 individuals (all recorded on the same day in March 2018), and seven flights in the non-breeding season totalled 287 individuals. All flights in the non-breeding season were recorded in the month of October which suggests that they were migrant birds (golden plover numbers in south-east Scotland peak in October when migrants are moving through**Error! Bookmark not defined.**). Single breeding territories were identified within the Survey Area in close proximity to Turbines 6 and 8 (in 2018 and 2019 respectively) and, given the distance between them (1.3 km), it can be assumed that Proposed Development Area held two breeding territories of golden plover.

Potential collision risk impacts

8.7.70 Seven flights (188 individuals) were recorded in the CRZ at PCH. CRM was therefore conducted for golden plover and this would result in 0.56 mortalities during the breeding season and 1.74 mortalities in the non-breeding season. The combined annual collision risk estimate for golden plover is therefore 2.30 birds.

8.7.71 The predicted mortality during the breeding season would equal 19.6 collisions throughout the lifespan of the Proposed Development, representing 0.03% of the NHZ 20 breeding population (2,116 breeding individuals). The predicted mortality during the non-breeding season would equal 60.9 collisions throughout the lifespan of the Proposed Development, which represents 0.04% of the wintering population in south-east Scotland**Error! Bookmark not defined.**. In the Scottish Borders the numbers of golden plover are highly variable during the winter[53], and according to NatureScot guidance[6] biogeographical zone assessments are best applied where species have relatively stable distributions (such as during the breeding season) or where species occupy a habitat in the non-breeding season that is consistent and predictable. As no winter population estimates are given for golden plover at the NHZ level, the mortality estimates from the non-breeding season are assessed against the size of the wintering population in south-east Scotland, which is considered to be a suitable alternative regional scale for the assessment.

8.7.72 Collision risk for waders is generally deemed to be low, due to a relatively low cursory flight path, coupled with high flight manoeuvrability. The relatively high mortality rates predicted for golden plover derive from a very low number of flights comprising a high number of individuals (the same flock recorded several times). In the unlikely event of these rates being realised, accounting for the size of the NHZ 20 breeding population and the wintering population in south-east Scotland, a measurable effect on the regional golden plover population is considered to be unlikely. As such, the potential collision effects on golden plover during the operational phase are considered to be of **low negative magnitude** and **not significant.**

Potential disturbance/displacement impacts

8.7.73 Two breeding territories (Table 8.10) were identified on the higher grounds within the Proposed Development Area in close proximity to turbines, therefore disturbance to breeding golden plover during construction is likely. Waders are most susceptible to disturbance at the chick-rearing stage[74] and should the disturbance level be sufficient, this could lead to displacement of the two pairs of golden plover from the Proposed Development Area. This would represent 0.19% of the NHZ 20 breeding population. As golden plover 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, any displacement is likely to be localised. In light of this, displacement of golden plover due to disturbance during the construction phase is likely to be of a **moderately negative magnitude**, but **not significant**.

8.7.74 Golden plover are relatively well studied in relation to disturbance/displacement on wind farm sites and it has been shown that, in most cases, no redistribution of birds away from tracks and infrastructure occurs post-construction[75]. Also, it has been shown that disturbance to waders at an operational wind farm is lower than during the construction phase, as shown by Pearce-Higgins *et al*. (2009)[36]. A study of displacement impacts of wind farms on 10 species of upland breeding birds found that there was little change in the densities of breeding golden plover[41]. Moreover, golden plover was not identified as being particularly sensitive to wind farm developments during the wintering period[73]. A review of 29 other studies suggests golden plover will approach wind turbines to an average distance of 175 m in the non-breeding season[35]. Most golden plover records during baseline surveys came from the month of October and related to flocks rather than individuals or pairs, which suggests that these were birds during the autumn passage and they did not utilise the Proposed Development Area for foraging. Although up to two breeding golden plover pairs may be affected by the operation of the Proposed Development, given the relative abundance of alternative habitat to the north of the Proposed Development (within the Moorfoot Hills SSSI) the effect of the loss of nesting or foraging habitat for golden plover within the Proposed Development Area will be negligible. In light of this, the effect of the displacement of golden plover due to disturbance during the operation phase is likely to be **low negative magnitude**, and therefore **not significant**.

8.7.75 There is no evidence to suggest that the Proposed Development lies on a migratory/ regular commuting route for the species therefore barrier effect is not anticipated.

[73] Woodward, I.D., Massimino, D., Hammond, M.J., Barber, L., Barimore, C., Harris, S.J., Leech, D.I., Noble, D.G., Walker, R.H., Baillie, S.R. & Robinson, R.A. (2020) BirdTrends 2020: trends in numbers, breeding success and survival for UK breeding birds. Research Report 732. BTO, Thetford. www.bto.org/birdtrends

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

[75] Douglas, D.J.T., Bellamy, P.E. & Pearce-Higgins, J.W. (2011) Changes in the abundance and distribution of upland breeding birds at an operational wind farm. *Bird Study* 58 (1).

8.8 MITIGATION AND RESIDUAL EFFECTS

8.8.1 The Proposed Development is predicted to have moderately, low or negligible impacts, and no significant effects, on all of the IOFs recorded. Although no species-specific mitigation is required, various embedded measures (described in Section 8.7) will be implemented to ensure compliance with legislation, and to follow good practice guidance with regard to breeding birds. No requirements for further mitigation were identified.

8.8.2 No significant effects on any IOFs during any phase of the Proposed Development life cycle are predicted.

8.9 SUMMARY OF EFFECTS

8.9.1 The magnitude of pre-mitigation and residual impacts and the significance of residual effects on each IOF during the construction and operation phases is detailed in Table 8.15 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.

Table 8.15: Summary of pre-mitigation impacts and residual impacts on each IOF, and the residual significance of effect

IOF	Conservation importance	Nature of potential pre-mitigation impact	Magnitude of pre-mitigation impact	Significance of pre-mitigation effect	Specific mitigation/ enhancement measure	Magnitude of residual impact	Residual significance	Level of certainty/comments
Construction/Decommissioning								
Black grouse	Regional	Disturbance and/or displacement	Low negative	Not significant	No specific mitigation required (after implementation of embedded mitigation).	Low negative	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: high.
Golden eagle	Regional	Disturbance and/or displacement	Low negative	Not significant	No specific mitigation required (after implementation of embedded mitigation).	Low negative	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: high.
Goshawk	Regional	Disturbance and/or displacement	Low negative	Not significant	No specific mitigation required (after implementation of embedded mitigation).	Low negative	Not significant	Confidence in the prediction: high.
Golden plover	Regional	Disturbance and/or displacement	Moderately negative	Not significant	No specific mitigation required (after implementation of embedded mitigation).	Moderately negative	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	Negligible	Not significant	No specific mitigation required (to reduce risk of collision any fencing required for the wind farm areas to be marked).	Negligible	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: high.
		Disturbance and/or displacement	No impacts are predicted	-	No specific mitigation required.	No impacts are predicted	-	Confidence in the prediction: high.
Golden eagle	Regional	Collision risk	Low negative	Not significant	No specific mitigation required.	Low negative	Not significant	A measurable effect on the regional population is considered to be unlikely. Confidence in the prediction: moderate-high.
		Displacement	Moderately negative	Not significant	No specific mitigation required.	Moderately negative	Not significant	A measurable effect on the regional population is considered to be unlikely. Confidence in the prediction: moderate-high.
		Disturbance	Low negative	Not significant	No specific mitigation required.	Low negative	Not significant	A measurable effect on the regional population is considered to be highly

IOF	Conservation importance	Nature of potential pre-mitigation impact	Magnitude of pre-mitigation impact	Significance of pre-mitigation effect	Specific mitigation/ enhancement measure	Magnitude of residual impact	Residual significance	Level of certainty/comments
								unlikely. Confidence in the prediction: high.
Goshawk	Regional	Collision risk	Low negative	Not significant	No specific mitigation required.	Low negative	Not significant	A measurable effect on the regional population is considered to be highly unlikely. Confidence in the prediction: moderate.
		Disturbance and/or displacement	No impacts are predicted	-	No specific mitigation required.	No impacts are predicted	-	Confidence in the prediction: high.
Golden plover	Regional	Collision risk	Low negative	Not significant	No specific mitigation required.	Low negative	Not significant	A measurable effect on the local population is considered to be highly unlikely. Confidence in the prediction: high.
		Disturbance and/or displacement	Low negative	Not significant	No specific mitigation required.	Low negative	Not significant	A measurable effect on the local population is considered to be highly unlikely. Confidence in the prediction: high.

8.10 CUMULATIVE EFFECTS

8.10.1 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].

8.10.2 In line with this guidance, any wind farm developments of fewer than three turbines (small scale wind energy proposals[76]) were excluded from the cumulative impact assessment (CIA), 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 CIA, 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 three developments for inclusion in the CIA which comprise:

- Bowbeat Wind Farm (operational) – this is a 24-turbine operational site, located approx. 8 km to the north-west of the Proposed Development Area;
- Greystone Knowe (submitted) – this is a proposed 15-turbine site, located to the north of the Proposed Development Area approx. 5.5 km; and
- Longpark Wind Farm (operational) – this is a 19-turbine operational site, located approx. 8 km to the east of the Proposed Development Area.

8.10.3 It should be noted that cumulative assessments may be complicated by availability of EIAR/Environmental Statement (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 for the three wind farm projects identified.

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

- Black grouse: disturbance/displacement effects;
- Golden eagle: disturbance/displacement and collision effects;
- Goshawk: disturbance/displacement and collision effects; and
- Golden plover: disturbance/displacement and collision effects.

8.10.5 The residual effect of the individual operational, constructed, consented and submitted developments 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 8.16 below.

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

Table 8.16: 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	Scawd Law	Bowbeat	Longpark	Greystone Knowe	Cumulative residual effects
Site status	8 turbines	24 turbines Operational since 2002.	29 turbines (including extension) Operational since 2009.	15 turbines In planning.	76 turbines

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

Site	Scawd Law	Bowbeat	Longpark	Greystone Knowe	Cumulative residual effects
			Original ES could not be accessed but ES for the 10-turbine extension (2014) was used for information.	Baseline ornithology surveys undertaken 2017-2019.	
Black grouse	No lekking males were found within the Survey Area during baseline surveys. Several lek sites, supporting up to 11 males, were identified in 2018 to the west, northwest and east of the Proposed Development.	ES mentions black grouse within the vicinity of Toxide Moss near Tweedale Burn but no mention of indicative numbers. Mitigation measures included moving the cable route further north to 1 km away from areas identified as important to black grouse which would minimise any potential collision risk. CRM not undertaken.	Longpark Wind Farm Extension ES (2014) mentions black grouse in reference to desk study data only: the Moorfoot Hills SAC/SSSI is a stronghold for lek sites. However, the species was determined to utilise the agricultural periphery of the site only. No baseline data could be found for this species within the ES.	No black grouse were recorded during the dedicated baseline surveys (site plus 1.5 m buffer) and the project area was considered to have no value for this species.	No black grouse were recorded within the survey areas on any of the developments, however some leks and black grouse habitats are present at the peripheries. Embedded mitigation to prevent disturbance to this species (e.g. restrictions on location and timing of works during the lekking period; see Section 8.7) 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[62]. **The cumulative disturbance/displacement effect is predicted to be not significant.**
Golden eagle	Not recorded during the initial two years of baseline surveys, a pair set up territory in late 2021 and had an unsuccessful breeding attempt in 2022. CRM (based on May to August 2022 data) gives an annual estimate of 0.06 birds.	Golden eagle not recorded during baseline surveys.	Golden eagle not recorded during baseline surveys.	Golden eagle not recorded during baseline surveys.	Golden eagles were not recorded during the baseline surveys for the other projects, but the change in status of golden eagles since 2021 means that the existing data is no longer representative. However, the commissioned report (Fielding, 2022)[33] into impacts of the Proposed Development on golden eagles factored in habitat loss as a result of other wind farm projects (existing and consented) within a 20 km radius of the nest and so the results presented in this chapter include cumulative impacts. Greystone Knowe was not included in the analysis but lies outside the northern edge of the eagles' home range. Therefore, **the cumulative disturbance/displacement effect is predicted to be not significant.** Fielding (2022)[33] also showed that the other wind farm projects are located outside the home range of the eagles, so despite the lack of contemporary flight activity data from these other projects, the **cumulative collision effect is predicted to be not significant**.
Goshawk	Goshawk was recorded both in the breeding and non-breeding seasons (10 and 26 records respectively), mainly during the 2017/18 survey period when an active goshawk territory was confirmed within 2.5 km of the nearest turbine. Predicted collision mortality for goshawk is 0.06 birds per breeding season and 0.11 birds per non-breeding season, which gives an annual estimate of 0.17 birds.	No records of goshawk in ES.	Goshawk records showed during desk study data analysis only. No records of this species were collected during baseline surveys in 2011 and 2013.	Goshawk was recorded on 21 occasions during baseline surveys and so qualified for CRM. The resultant estimate predicted 0.050 individuals per annum.	In addition to the Proposed Development one other project undertook CRM for goshawk. The total estimated collision rate is of 0.22 individuals per year, which is equivalent to 0.85% of the breeding population estimate of NHZ 20, and 0.27% of the Scottish Borders goshawk population (based on its most recent estimation[68]). Collision mortality is not predicted to be significant at the regional population level, **therefore no significant cumulative effect is predicted.**
Golden plover	A total of 10 golden plover flights were recorded during baseline surveys (three in the breeding season and seven in the non-	Golden plover was not mentioned as an ecological sensitivity in the ES but were mentioned as a "low risk of collision" species.	No breeding birds were recorded within the study areas during baseline surveys. Two passage flights were recorded but collision	Golden plover was recorded on 145 occasions (October to May only). The CRM estimated 150.24 birds per year.	The only breeding birds were recorded at the Proposed Development. Displacement of two pairs would represent 0.19% of the NHZ 20 breeding population and is not predicted to be significant at the

Site	Scawd Law	Bowbeat	Longpark	Greystone Knowe	Cumulative residual effects
	breeding season), all totalling 309 individuals. Of these, seven flights (188 individuals) were in the CRZ at PCH. CRM estimated 0.56 mortalities during the breeding season and 1.74 mortalities in the non-breeding season (the combined annual collision risk estimate is 2.30 birds). Two breeding territories were identified within the Survey Area.		impacts were considered unlikely due to their minimal presence over the site in total and no CRM was undertaken.	Golden plovers were observed during walkover surveys but were not recorded as breeding. The bird population (as a whole) found within the project area was considered to only face minor disturbance impacts and no significant effect.	regional population level. Therefore no significant cumulative effect is predicted. In addition to the Proposed Development one other project undertook CRM for golden plover. The cumulative CRM annual estimate is of 152.54 birds per year, of which Greystone Knowe accounts for 150.24 (98.5%) of this total. It should be noted that the impact of the Proposed Development to the cumulative total can be considered negligible. As the Greystone Knowe birds were recorded in the period October to May, this suggests non-breeding birds and so the NHZ 20 (breeding) population is not relevant. Using the wintering population estimates, the cumulative CRM total is equivalent to 3.49% of the wintering population of south-east Scotland**Error! Bookmark not defined.** and 0.4%-0.6% of the full Scottish wintering population[45], though given the movements of golden plover through the year, the source population should probably be considered to be the full UK wintering population[30] (the CRM estimate being 0.04% of this total). The integrity of the golden plover population will not be affected at this level and so **cumulative collision effects are predicted to be not significant**.

8.11 STATEMENT OF SIGNIFICANCE

8.11.1 An assessment has been made of the predicted significance of effects of the Proposed Development on ornithological interests. By applying 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.

8.12 SCREENING FOR APPROPRIATE ASSESSMENT

8.12.1 Under the Conservation (Natural Habitats, *&c.*) Regulations 1994, as amended (the Habitats Regulations) any development that may have a likely significant effect (LSE) on an SPA, SAC or Ramsar site, either alone or in combination with other projects, requires an Appropriate Assessment (AA) to be carried out by the relevant competent authority, to determine whether or not the development would have an adverse effect on the integrity of the SPA, SAC or Ramsar site.

8.12.2 Before an AA is initiated, a screening process is undertaken to determine whether any of the predicted impacts of the development would result in a LSE. This screening assessment is presented here to provide information to the competent authority to allow them to reach a decision on whether or not the development would have a LSE on any SPA or SAC and therefore whether an AA is required.

8.12.3 There are two statutory sites of international importance within 25 km of the Proposed Development designated for ornithological features of which geese are a named feature: Gladhouse Reservoir SPA/Ramsar site and Fala Flow SPA/Ramsar site. Both are designated for their non-breeding populations of pink-footed geese.

8.12.4 For the purposes of this screening assessment, reasoned argument and professional judgement of biological significance are used to determine whether a conclusion of no adverse effect on the integrity of the SPA can be reached..

8.12.5 The SPAs have the following conservation objectives:

- To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
- To ensure for the qualifying species that the following are maintained in the long term:
- Population of the species as a viable component of the site;
- Distribution of the species within the site;
- Distribution and extent of habitats supporting the species;
- Structure, function and supporting processes of habitats supporting the species; and
- No significant disturbance of the species.

8.12.6 Due to the distance between the Proposed Development and the Gladhouse Reservoir SPA and Fala Flow SPA (12.5 km and 16.5 km respectively), there would be no direct effect on the habitats contained within either SPA. Furthermore, there would be no disturbance during the construction, operation or decommissioning of the Proposed Development and therefore no impact on the distribution of qualifying species within the SPA.

8.12.7 Therefore, it is the maintenance of the population of the qualifying species as viable components of the SPA that must be considered to determine whether or not the Proposed Development will have a LSE (either on its own or in combination with other similar projects) on either SPA.

8.12.8 Gladhouse Reservoir SPA lies in the Moorfoot Hills, south of Edinburgh and 12.5 km northwest of the Proposed Development. It is a public water-supply reservoir, with limited aquatic and emergent vegetation. The reservoir is the largest freshwater body in the Lothians and is surrounded by both coniferous and mixed woodland and grassland. At the time of designation, the Gladhouse Reservoir SPA held internationally important numbers of wintering pink-footed geese (10,500 individuals representing over 10% of the Eastern Greenland/Iceland/UK biogeographic population). However, the latest assessed condition (2009) of this SPA is unfavourable declining

and the numbers of pink-footed geese are estimated at 2,625 individuals[77], which means that the Gladhouse Reservoir SPA is no longer holding internationally important numbers.

8.12.9 Fala Flow SPA is in the Lammermuir Hills to the south-east of Edinburgh and 16.5 km northeast from the Proposed Development. It is a blanket mire, with some pools that support an internationally important pink-footed goose winter roost. At the time of designation, the Fala Flow SPA held 6,719 individuals, representing an average of 2.7% of the population (5-year peak mean 1991/92-1995/96). Later counts (2006/07 to 2010/11) estimated the SPA population as 4,031 individuals (1.6% of the population). The latest assessed condition is favourable maintained (2009).

8.12.10 Pink-footed goose is the qualifying interest at both of these SPAs. Pink-footed geese are known to travel up to 20 km between roosting and feeding sites[78] (a range of 20 km is also generally considered to be the maximum distance at which connectivity to a goose SPA can be assumed). They use stubble fields in autumn gleaning the spilt grain, with grassland predominating after autumn. The predominantly moorland nature of the habitats present within the Proposed Development and immediate vicinity are unlikely to be of any importance to aggregations of foraging wintering or roosting geese. Maps of the pink-footed goose feeding areas associated with both Gladhouse Reservoir and Fala Flow SPAs have been published[77] and they show that within 20 km of each SPA there are no feeding areas located between an SPA and the Proposed Development. **Therefore, there is no evidence of connectivity between both SPAs and the Proposed Development.**

8.12.11 During baseline surveys for the Proposed Development pink-footed geese were recorded overflying the Survey Area on one occasion – a flock of 52 individuals was observed on 8 November 2017. This flight occurred outside of the CRZ, therefore CRM could not be carried out. NatureScot guidance[9] states that in light of the robust population and high avoidance rate of 99.8%, CRM is no longer required for applications in the wider countryside but it would be still expected in support of applications where there is connectivity with designated areas for which pink-footed goose is a qualifying interest. However, as no collision risk can be associated with the Proposed Development, the number of in-combination collision mortalities from other developments located within a 20 km radius of the Proposed Development, attributable to both the Gladhouse Reservoir and Fala Flow SPAs, would remain unchanged.

8.12.12 In conclusion, the Proposed Development is not expected to impact upon the qualifying interest of either SPAs and therefore **no likely significant effect** on either SPA can be concluded. An appropriate assessment is therefore not required.

[77] Mitchell, C. (2012) *Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland*. Wildfowl & Wetlands Trust / Scottish Natural Heritage Report, Slimbridge. 108pp.

[78] Patterson, I.J. (2011) Geese distribution in relation to SPAs in Grampian. Report to Scottish Natural Heritage.