Chapter 8 Ornithology

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List of Abbreviations

Abbreviation	Description
AA	Appropriate Assessment
BoCC	Birds of Conservation Concern
BSI	The British Standards Institution
BTO	British Trust for Ornithology
CEMP	Construction Environment Management Plan
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CRM	Collision Risk Modelling
CRZ	Collision Risk Zone
DTM	Digital Terrain Model
ECoW	Environmental Clerk of Works
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment

EIAR	Environmental Impact Assessment Report
ES	Environmental Statement
FORL	Fred. Olsen Renewables Limited
GET	Golden Eagle Topographical
GPS	Global Positioning System
ha	hectare
IBA	Important Bird Area
IOF	Important Ornithological Feature
Km	Kilometre
LBRSG	Lothian and Borders Raptor Study Group
LBAP	Local Biodiversity Action Plan
LNCS	Local Nature Conservation Site
LNR	Local Nature Reserve
LSE	Likely Significant Effect
LWS	Local Wildlife Site
m	metre
MAGIC	Multi-Agency Geographic Information for the Countryside
MBBS	Moorland Breeding Bird Survey
NNR	National Nature Reserve
OEMP	Operational Environmental Management Plan
PCH	Potential Collision Height
RSH	Rotor Swept Height
RSPB	Royal Society for the Protection of Birds
SBC	Scottish Borders Council
SBL	Scottish Biodiversity List
SCM	Site Condition Monitoring
SINC	Site of Important Nature Conservation
SPA	Special Protection Area
SPI	Standardised Preference Index
SPP	Species Protection Plan

SSGEP	South of Scotland Golden Eagle Project
SSSI	Site of Special Scientific Interest
SUP	Southern Uplands Partnership
SWT	Scottish Wildlife Trust
TWIC	The Wildlife Information Centre
VP	Vantage Point
WCA	The Wildlife and Conservation Act 1981
ZoI	Zone of Influence

Glossary

Term	Definition
The Applicant	Fred. Olsen Renewables Limited
Baseline	The existing conditions that prevail against which the effects of the Proposed Development are compared.
Birds of Conservation Concern (BoCC)	A five-yearly assessment of ornithological conservation priorities, provided by a review of the population status of birds regularly found in the UK, Channel Islands and the Isle of Man conducted by the UK's leading bird conservation organisations.
Collision Risk Zone (CRZ)	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.
EIA Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.
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 of 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
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.
Proposed Development	The proposed Lees Hill Renewable Energy Park as described in Chapter 4, Volume 2 of this EIAR.
Proposed Development Site	The project development area within the site boundary as shown in Figure 1.2, Volume 3a.

Ramsar site	A Ramsar Site is a wetland site of international importance designated under the Ramsar Convention, where waterfowl or waterfowl habitat are described as ecological features.
Site boundary	Proposed application boundary for the Proposed Development Site.
Site of Special Scientific Interest (SSSI)	Sites of Special Scientific Interest are protected areas that represent the UK's most important wildlife and/or geological sites.
Special Protection Area (SPA)	Special Protection Areas are sites of international importance that have been adopted by the European Commission and formally designated by the UK government.
Survey Area	The area within which ornithological baseline surveys were carried out. This generally refers to the Proposed Development Site plus a surrounding buffer, the size of which is determined by the specific survey being described. Details of the area covered are described in the methodology provided for each field survey (.
Zone of Influence	This is "the area over which ecological features[1] may be subject to significant effects as a result of the proposed project or associated activities" (CIEEM)[2].

[1] *Ornithological features are included under 'ecological features'.*

[2] *UK. CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Chartered Institute of Ecology and Environmental Management, Winchester.*

8. Ornithology

8.1. Introduction

Summary of Chapter

8.1.1. In order to inform the preparation of the Environmental Impact Assessment Report (EIAR), a desk study and baseline ornithology surveys were undertaken between March 2020 and February 2022. All surveys were undertaken following the most relevant industry guidelines and incorporated relevant scoping responses. The proposed Lees Hill Renewable Energy Park is not located within any statutory sites designated for ornithological interests.

8.1.2. An assessment has been made of the predicted significance of effects of the proposed Lees Hill Renewable Energy Park (hereafter referred to as the Proposed Development) on ornithological interests. Following survey and assessment, designated sites and species considered to be IOFs in the context of the Proposed Development and subject to further impact assessment, following guidance, were Greenlaw Moor Special Protection Area (SPA), Ramsar site and Site of Special Scientific Interest (SSSI), Outer Firth of Forth and St Andrews Bay Complex SPA, barnacle goose, greylag goose, pink-footed goose, red grouse, black grouse, oystercatcher, lapwing, golden plover, curlew, snipe, redshank, short-eared owl, peregrine, skylark, meadow pipit and reed bunting. Following such further assessment (including collision risk modelling for appropriate species), no significant effects are anticipated upon any IOFs.

8.1.3. Controls will be put in place during construction through creation of a site-specific Construction Environment Management Plan (CEMP), Species Protection Plan (SPP) and appointing an Environmental Clerk of Works (ECoW) to monitor adherence to such plans. Additional mitigation measures for golden plover are detailed in Section 8.7.

Contents of Chapter

8.1.4. This ornithological chapter of the EIAR has been prepared by Natural Power Consultants Ltd (Natural Power) on behalf of Fred. Olsen Renewables Limited (FORL) (hereby referred to as the 'Applicant') in respect of the Proposed Development. The Proposed Development comprises wind, solar and battery storage, and associated infrastructure, located approximately 5 km west of Duns in the Scottish Borders (see Figure 1.1: Site Location, Volume 3a of the EIAR). The Proposed Development lies within the Scottish Borders Council (SBC) administrative area.

8.1.5. This chapter provides details of the baseline ornithological conditions within the Proposed Development Site and the immediate surrounding environment. Baseline ornithological conditions have been established for avian fauna through a programme of rigorous ornithological field surveys, in addition to a desk-based review to obtain additional relevant ornithological data. The identified species comprising the ornithological baseline are described and assessed using recognised criteria, in accordance with industry guidelines (e.g. that produced by the Chartered Institute of Ecology and Environment Management: CIEEM, 2018[2]).

8.1.6. This chapter has been prepared following a scoping process which led to a scoping report issued to consultees in April 2022 and the issue of the Scoping Opinion by Scottish Minsters in July 2022.

8.1.7. In line with the principles of proportionate EIA, embedded mitigation is considered at the outset of the assessment (see Section 1.8.6, Paragraphs 8.6.3 to 8.6.13). 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 IOFs and are taken forward for a full Ecological Impact Assessment (EcIA).

8.1.8. This Ornithology chapter should be read alongside Chapter 7: Ecology, Volume 2 of the EIAR.

8.1.9. All Latin names for species mentioned in this chapter are listed in Technical Appendix 8.1: Ornithology, Volume 4 of the EIAR. Summaries of survey times and dates are also given in Technical Appendix 8.1: Ornithology, Volume 4 of the EIAR. Full survey data, including details of survey dates, times and weather conditions, plus results data, can be provided on request.

8.2. Legislation, Policy and Guidance

8.2.1. The ornithological baseline surveys and subsequent assessment have been carried out with reference to a number of national policy documents, as addressed in Chapter 5: Planning and Legal Context and Chapter 7: Ecology, Volume 2 of the EIAR.

8.2.2. Legislative and guidance documents with specific relevance to ornithology are:

Legislation

- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposes the Habitats Directive into UK law[3];
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2012[4];
- The Conservation of Habitats and Species (Amendment) Regulations 2017, relating to reserved matters in Scotland[5];
- Wildlife and Countryside Act (WCA) 1981 (as amended)[6];
- Directive 2009/147/EC on the Conservation of Wild Birds (the Birds Directive)[7].
- The Nature Conservation (Scotland) Act 2004[8];
- The Wildlife and Natural Environment (Scotland) Act 2011[9];
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, which transpose the EIA Directive into the Scottish planning system[10].

Policy and Guidance

- National Planning Policy Framework 4 (NPF4) – particularly Policy 3;
- Planning Advice Note (PAN) 51: Planning, Environmental Protection and Regulation[11];
- Planning Advice Note (PAN) 60: Planning for Natural Heritage (Scottish Government 2000)[12];

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[3] *UK. The Conservation (Natural Habitats, &c.) Regulations (1994). Available from - https://www.legislation.gov.uk/uksi/1994/2716/contents/made [Accessed: 19/05/2023]*

[4] *Scotland. The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations (2012). Available from - https://www.legislation.gov.uk/ssi/2012/228/contents/made [Accessed: 03/10/2023]*

[5] *UK. The Conservation of Habitats and Species Regulations (2017). Available from - https://www.legislation.gov.uk/uksi/2017/1012 [Accessed: 03/10/2023]*

[6] *UK. Wildlife and Countryside Act (1981). Available from - https://www.legislation.gov.uk/ukpga/1981/69 [Accessed: 03/10/2023]*

[7] *UK. Directive 2009/147/EC of the European Parliament and of the Council (2009). Available from - https://www.legislation.gov.uk/eudr/2009/147/contents [Accessed: 03/10/2023]*

[8] *Scotland. Nature Conservation (Scotland) Act (2004). Available from - https://www.legislation.gov.uk/asp/2004/6/contents [Accessed: 03/10/2023]*

[9] *Scotland. The Wildlife and Natural Environment (Scotland) Act (2011). Available from - https://www.legislation.gov.uk/asp/2011/6/contents/enacted [Accessed: 03/10/2023]*

[10] *Scotland. The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations (2017). Available from - https://www.legislation.gov.uk/ssi/2017/101/contents/made [Accessed: 03/10/2023]*

[11] *Scotland. Scottish Government (2006). PAN 51. Planning, Environmental Protection and Regulation. Scottish Government, Edinburgh.*

[12] *Scotland. Scottish Government (2000). PAN 60: Planning for Natural Heritage. Scottish Government, Edinburgh.*

- PAN 1/2013 – Environmental Impact Assessment[13];
- Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives: Scottish Executive Circular 6/1995 as amended[14].
- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2018)[2];
- Recommended bird survey methods to inform impact assessment of onshore wind farms[15];
- Birds and Wind Farms: Risk Assessment and Mitigation[16];
- Developing field and analytical methods to assess avian collision risk at wind farms[17];
- Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action[18];
- Assessing the significance of impacts on bird populations from onshore wind farms that do not affect protected areas[19];
- Monitoring the impacts of onshore wind farms on birds[20];
- Guidance on methods for monitoring bird populations at onshore wind farms[21];
- Avoidance rates for the onshore SNH wind farm collision risk model[22];
- Assessing the cumulative impact of onshore wind farms on birds[23];
- General pre-application and scoping advice for solar farms[24];
- Natural Capital Best Practice Guidance[25];
- Solar farms and songbirds: Could skylarks benefit from ground mounted solar?[26];
- Solar Habitat: Ecological trends on solar farms in the UK[27];
- Are Skylarks Being Overlooked in Impact Assessment?[28];

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[13] *Scotland. Scottish Government. (2013 (updated 2017)). PAN 1/2013 – Environmental Impact Assessment. Scottish Government, Edinburgh.*

[14] *Scotland. Scottish Executive (1995 (updated 2000)). Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives. Scottish Executive, Rural Affairs Department, Edinburgh.*

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

[16] *De Lucas, M., Janss, G. & Ferrer, M. (eds.) (2007). Birds and Wind Power. Quercus, Madrid.*

[17] *Band, W., Madders, M., Whitfield, D. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. Scottish Natural Heritage, Natural Research Ltd.*

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

[19] *SNH (2018). Assessing the significance of impacts on bird populations from onshore wind farms that do not affect protected areas. Scottish Natural Heritage (now NatureScot), Inverness.*

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

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

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

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

[24] *NatureScot (2022). General pre-application and scoping advice for solar farms. Available from - https://www.nature.scot/doc/general-pre-application-and-scoping-advice-solar-farms*

[25] *Solar Energy UK (2022). Natural Capital Best Practice Guidance. Solar Energy UK, London.*

[26] *Solar Energy UK (n.d.). Solar farms and songbirds: could skylarks benefit from ground mounted solar? Available from - https://solarenergyuk.org/solar-farms-and-songbirds-could-skylarks-benefit-from-ground-mounted-solar/ [Accessed: 03/10/2023]*

[27] *Solar Energy UK (2023). Solar Habitat: Ecological trends on solar farms in the UK. Solar Energy UK, London.*

[28] *Fox, H (2022). Blithe Spirit: Are Skylarks Being Overlooked in Impact Assessment? CIEEM, Romsey.*

- Evidence review of the impact of solar farms on birds, bats and general ecology (NEER012)[29];
- Assessing connectivity with Special Protection Areas (SPAs)[30];
- A Review of Disturbance Distances in Selected Bird Species[31];
- Good Practice during Wind Farm Construction[32];
- British Standard 42020:2013 Biodiversity – code of practice for planning and development[33];
- Natural Heritage Zone (NHZ) bird population estimates. Scottish Windfarm Bird Steering Group (SWBSG). Commissioned report number 1504[34];
- Bird Monitoring Methods[35];
- A method for censusing upland breeding waders[36];
- Raptors: A Field Guide to Survey and Monitoring[37];
- Birds of Conservation Concern 5: The population status of birds in the United Kingdom, Channel Islands and the Isle of Man[38];
- Scottish Biodiversity List (SBL)[39]; and
- Scottish Borders Local Biodiversity Action Plan (Scottish Borders LBAP) 2018-2028[40].

8.3. Method of Assessment

Data Collection

Desk Study

8.3.1. A desk study was undertaken to collate relevant existing ornithological survey data, public domain survey data, and to obtain historical records of protected and relevant species from within the Proposed Development Site and the surrounding environment. This provided

[29] *Natural England (2017). Evidence review of the impact of solar farms on birds, bats and general ecology 2016 (NEER012). Natural England, Worcester.*

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

[31] *Goodship, N.M. & Furness, R.W. (MacArthur Green) (2022). Disturbance Distances Review: an updated literature review of disturbance distances of selected bird species. NatureScot Research Report 1283. Available from - https://www.nature.scot/doc/naturescot-research-report-1283-disturbance-distances-review-updated-literature-review-disturbance [Accessed: 03/10/2023]*

[32] *Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland and Historic Environment Scotland (2015). Good practice during windfarm construction. Available from - https://www.nature.scot/sites/default/files/2018-08/Guidance%20-%20Good%20Practice%20during%20wind%20farm%20construction.pdf [Accessed 03/10/2023]*

[33] *The British Standards Institution (BSI) (2013). Biodiversity – Code of practice for planning and development. BSI Standards Limited, London.*

[34] *Wilson, M.W., Austin, G.E., Gillings, S. & Wernham, C.V. (2015). Natural Heritage Zone bird population estimates. SWBSG commissioned report number 1504. pp72.*

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

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

[37] *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.*

[38] *Stanbury, A., 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.*

[39] *Scottish Government (2020). Scottish Biodiversity List. Available from - https://www.nature.scot/doc/scottish-biodiversity-list [Accessed 03/10/2023]*

[40] *Scottish Borders Council (2018). Supplementary Guidance Scottish Borders Local Biodiversity Action Plan (2018-2028). Scottish Borders Council, Melrose.*

background information on the ornithological features that are potentially present to help inform and guide the baseline ornithological field surveys, and it also provides context to the results of those surveys. Combined with the results of the ornithological field surveys, this information has been utilised to provide a comprehensive baseline on which to base the EcIA.

Existing Historic Records

8.3.2. Historical data was provided by the Applicant in November 2020. This data includes the following surveys undertaken within the Proposed Development Site between 2012 and 2013;

- Breeding bird surveys;
- Vantage point (VP) surveys;
- Raptor walkovers; and
- Winter bird walkovers.

Statutory, National and Locally Designated Sites of Nature Conservation

8.3.3. A web-based search was undertaken to identify and provide information on statutory designated sites of nature conservation, with avian species as listed features. The search was carried out using the Multi-Agency Geographic Information for the Countryside (MAGIC) Map application tool[41] and the NatureScot SiteLink website[42]. The search focussed on identifying the following sites:

- SPAs – within 10 km of the Proposed Development (within 25 km for sites designated for geese);
- Ramsar sites (Ramsar Convention on Wetlands of International Importance) where waterfowl or waterfowl habitat are described as ecological features – within 10 km of the Proposed Development;
- SSSIs – within 5 km of the Proposed Development;
- Important Bird Areas (IBAs) – within 5 km of the Proposed Development;
- Local Nature Conservation Sites (LNCS) such as Sites of Important Nature Conservation (SINCs) and Local Wildlife Sites (LWS) – within 5 km of the Proposed Development; and
- Local and National Nature Reserves (LNRs/NNRs; including Royal Society for the Protection of Birds (RSPB) and the Scottish Wildlife Trust (SWT) reserves) – within 5 km of the Proposed Development.

8.3.4. LNRs and SINCs (which are non-statutory sites that are predominantly designated for their habitat or overall biodiversity assemblage and not specifically for their ornithological interest) were searched for indications of ornithological use. However, since these sites are non-statutory and numerous in the vicinity of the Proposed Development, sites that overlap with the Proposed Development Site and a precautionary 5 km search radius around the Proposed Development were focussed on during the search.

Ornithological Features of Conservation Concern

8.3.5. A data search from The Wildlife Information Centre (TWIC) requested all ornithological records held within the Proposed Development Site and a 10 km buffer for all Schedule 1[6], Annex I[7], BoCC Red List and Amber List[38], and SBL[39]-listed species since 2012. The data search was extended to within 25 km of the Proposed Development Site for goose and gull species.

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[41] *Multi-Agency Geopgraphic Information for the Countryside (MAGIC) (2022). Available from - https://magic.defra.gov.uk/MagicMap.aspx [Accessed 03/10/2023]*

[42] *NatureScot SiteLink (n.d.) Available from - https://sitelink.nature.scot/home [Accessed 03/10/2023]*

8.3.6. The RSPB was also approached to request any ornithological data on Schedule 1[6], Annex I[7], BoCC Red List and Amber List[38], and SBL[39]-listed species they hold for the Proposed Development Site and a 10 km radius (25 km radius for geese and gulls) between 2012-2023.

8.3.7. Further records of Schedule 1[6] and/or Annex I[7] nesting and roosting raptors within 10 km of the Proposed Development Site since 2012 were requested from the Lothian and Borders Raptor Study Group (LBRSG).

8.3.8. Additionally, ornithology chapters from EIARs of other developments in the vicinity of the Proposed Development were consulted for any relevant information.

Baseline Surveys

8.3.9. A summary of the baseline ornithology surveys undertaken in line with NatureScot guidance[15] at the Proposed Development (dates and extent of the area surveyed) is provided in Table 8.1 below. Details of survey extents can be found in Figures 8.1: Vantage Points and Viewsheds, Volume 3a and 8.2: Ornithology Survey Areas, Volume 3a. A summary of each of the baseline ornithology survey methods is provided. Further survey method details, along with dates of survey visits and analysis methods are given in Technical Appendix 8.1: Ornithology, Volume 4 of the EIAR. Full survey details including survey timings and weather conditions can be provided on request.

Table 8.1: Summary of baseline ornithological surveys undertaken at the Proposed Development

Survey	Dates	Notes
Breeding season Vantage Point (VP) surveys	Mar-Aug 2020 and 2021	Details on VP surveys provided below
Non-breeding season VP surveys	Sep 2020/2021-Feb 2021/2022	Details on VP surveys provided below
Migration VP surveys	Mar-May 2020 and Sep-Nov 2020/2021	Details on VP surveys provided below
Moorland breeding bird surveys (MBBS)	Apr-Jul 2020 and May-Jul 2021	Previous proposed turbine locations plus 500 m buffer
Breeding raptor surveys	Mar-Aug 2020	Previous proposed turbine locations plus 2 km buffer
Barn owl survey	Jan 2021	Previous proposed turbine locations plus 1 km buffer
Black grouse surveys	Mar-May 2020 and May 2021	Previous proposed turbine locations plus 1.5 km buffer

Target Species

Wind Developments

8.3.10. NatureScot guidance[15] suggests that assessment of the effects of wind farms on birds should, in most circumstances, be limited to those protected species and other species of conservation concern that, as a result of their flight patterns or response behaviour, are likely to be affected by, or subject to, significant and adverse impacts from wind farms. The guidance states that there are three overarching lists describing protected species and species of conservation concern:

1. Species listed in Annex I of the Council Directive 2009/147/EC on the Conservation of Wild Birds (Annex I species)[7];

2. Species protected under Schedule 1 of the Wildlife & Countryside Act 1981 (as amended) (Schedule 1 species)[6]; and
3. Red-listed Birds of Conservation Concern as identified in BoCC (Red listed species)[38].

8.3.11. In addition, consideration should be given to Local Biodiversity Action Plan (LBAP)[40] species and any other species for which a site hosts a particular concentration.

8.3.12. 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' and are recorded in detail during flight activity surveys.

8.3.13. In accordance with NatureScot guidance[15], surveys focused on the following target species:

- All raptors and owls listed in Schedule 1 and 1A of the WCA 1981 (as amended)[6] and/or Annex I of the EC Birds Directive[7];
- All species of wildfowl (with the exception of widespread species Canada goose and mallard);
- Black grouse; and
- All wader species.

8.3.14. Secondary species[43] (species of lesser conservation concern) which were surveyed are:

- All other raptor species (including buzzard, sparrowhawk and kestrel);
- All gull species;
- Grey heron;
- Red grouse;
- Raven;
- Schedule 1 passerines (e.g. crossbill); and
- Any large aggregations of red-listed passerines.

8.3.15. Proposed developments may differ considerably in their ornithological sensitivity; NatureScot guidance therefore recommends that survey programmes and the level of survey effort should be tailored to an individual site's needs.

Solar Developments

8.3.16. NatureScot recommends that methods outlined within guidance for wind developments[15] should be consulted to inform survey methodology used for proposed solar developments[24], in proportion to size and location. This includes the identification of 'target species' to be recorded during surveys. As the permanent (>25 years) footprint of habitat change (see Chapter 7: Ecology, Volume 2 of the EIAR) of the solar PV area of the Proposed Development (69.77 ha) is greater than the habitat loss associated with the proposed turbines and associated infrastructure (9.28 ha), all Schedule 1[6], Annex I[7] and BoCC Red or Amber-listed[38] ground-nesting species were included as target species within 50 m of the solar PV area during the MBBS. This included species regarded as secondary species such as red grouse and passerines.

[43] *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. These species are recorded during flight activity surveys but in less detail than target species (for example their flights are not mapped and so collision risk modelling cannot be undertaken for secondary species).*

Vantage Point Surveys (flight activity survey)

8.3.17. The flight activity survey focuses on identifying flight lines and flight heights of target species and allows any regular patterns of flight lines to be identified, allowing turbine locations to be designed to minimise collision risk to birds, if necessary. The data generated can also be used to estimate the theoretical collision risk of a particular species. This is achieved by noting the flight heights at which the birds are recorded during the period of observation. The time and duration of the flight were recorded, and the altitude of the target bird(s) was recorded at the start of the observation and at 15 second intervals thereafter into one of five height bands (subsequently referred to as height bands 1, 2, 3, 4 and 5);

- Height band 1: 0 - 24 m;
- Height band 2: 24 - 30 m;
- Height band 3: 30 - 150 m;
- Height band 4: 150 - 180 m; and
- Height band 5: > 180 m.

8.3.18. The ornithological features recorded during the VP surveys (classed as 'target' species) are described in the baseline survey results sections. 'Secondary' species were also recorded in accordance with NatureScot guidance[15].

8.3.19. All incidental records of target species (i.e., birds that were not in flight, birds that were heard but not seen, birds that were observed well beyond the survey area and records outside of the formal VP surveys) were also recorded to provide context, although these records do not contribute to Collision Risk Modelling (CRM).

8.3.20. As the Proposed Development is within 25 km of Greenlaw Moor SPA, Ramsar site and SSSI, additional VP surveys were completed during the migration period (September to November and March to May), in line with NatureScot guidance[15].

Collision Risk Modelling

8.3.21. CRM uses data collected during flight activity surveys to predict the number of individuals per target species that have the potential to collide with the wind turbine rotors. This is undertaken when sufficient flight activity occurs within the Collision Risk Zone (CRZ) at Potential Collision Height (PCH) (i.e. the height at which rotor blades sweep), as per the Band *et al*. (2007)[17] collision risk model recommended by NatureScot[18]. For the purposes of this assessment, sufficient flight activity was defined as three or more flights, or more than 10 individuals, at PCH in the CRZ within a season. Thus, species that rarely pass through the study area and which are not considered to be at risk of significant effects did not undergo CRM.

8.3.22. For the purposes of this EIA, flights which pass through or touch a 281 m buffer of the proposed turbine locations are considered to be in the CRZ, based upon a blade length of 81 m plus a precautionary 200 m buffer.

8.3.23. CRM was run based on a layout of six turbines of 200 m height (to blade tip), with blade lengths of 81 m and a hub height of 119 m. Therefore, for the purposes of the EcIA, the turbine swept height shall be between 31 m and 200 m altitude. Using the height bands recorded during the VP surveys, all flights in height bands 3 (30 m - 150 m), 4 (150 m - 180 m) and 5 (over 180 m) were included in the CRM, although this will be a precautionary approach as some flights at the lower end of height band 3 and the majority of flights recorded in height band 5 will lie outside the actual PCH. Flights recorded in height bands 1 and 2 are below PCH. Only records at PCH within the CRZ (blade width plus 200 m buffer) are used within the CRM. For comparison, and to provide context for the assessment of collision risk on IOFs, CRM excluding height band 5 was also undertaken.

8.3.24. For species that usually fly in approximately straight lines ('directional approach'), such as migrating geese, flights observed were extrapolated up in order to estimate the number of individuals likely to pass through the CRZ at PCH per season or year. For species that generally fly non-directionally ('random approach'), such as foraging raptors, the observed time spent flying within the risk area is calculated and similarly extrapolated up per season or year across the whole risk area. During random approach modelling, average flight activity per unit effort (measured in minutes of survey time and hectares of area surveyed) is calculated. This metric is then used to extrapolate flight activity across time and across the entirety of the CRZ to estimate the total flight activity across the site per year (or season). The underlying assumption behind this is that the surveys provide a representative sample of flight activity over time and in space.

8.3.25. The number of flights or flight activity are then used to estimate the number of birds expected to pass through the rotor swept area or volume respectively and, combined with the probability of a bird colliding with a blade if it does pass through the rotor swept area, to give a predicted number of collisions in the absence of avoidance behaviour. This is then combined with a parameter representing avoidance behaviour likely to be displayed by birds flying towards turbine blades. Collision estimates were calculated based on a range of avoidance rates including recommended species-specific avoidance rates (SNH, 2018[22]).

8.3.26. 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: Ornithology, Volume 4 of the EIAR.

Golden Eagle Topography (GET) Model

8.3.27. 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 across Scotland, in south-east Scotland just one territory was regularly occupied[44] during the period 2007-2013. As a result, the South of Scotland Golden Eagle Project (SSGEP)[45] was launched in 2018 to boost the population of golden eagles in southern Scotland through reintroductions. A report published in September 2023 revealed that the population within the south of Scotland had since grown to 46 individuals[46].

8.3.28. A previous report on golden eagles in southern Scotland concluded that the south of Scotland (including Dumfries and Galloway) could potentially hold 14-16 pairs[47]. The study indicated that the Lammermuir Hills, local to the Proposed Development, had the capacity to support a single pair of golden eagles or provide suitable habitat for non-breeding golden eagles during dispersal of juvenile birds. As such, a Golden Eagle Topography (GET) Model was carried out to assess

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[44] 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.

[45] South of Scotland Golden Eagle Project. Available from - https://www.goldeneaglessouthofscotland.co.uk/ [Accessed 04/10/2023]

[46] NatureScot (2023). Pioneering conservation project reveals new record number of golden eagles in southern Scottish skies and confirms love is in the air for established pair. Available from - https://www.nature.scot/pioneering-conservation-project-reveals-new-record-number-golden-eagles-southern-scottish-skies-and [Accessed 04/10/2023]

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

the suitability of habitat for golden eagles within the Proposed Development and surrounding 300 m buffer, as per NatureScot guidance[48].

8.3.29. The GET Model is a simple model that has been developed to predict golden eagle habitat usage within a site based on the topographical characteristics of that site[49]. The model is based around the assumption that golden eagles will use ridges and rugged topography to exploit the vertical lift generated by such features. It has been developed and validated using Global Positioning System (GPS) telemetry records from juvenile golden eagles in Scotland.

8.3.30. The model is based on three underlying topographical variables: altitude, slope and distance to the nearest ridge, measured at a 50 m resolution. A Standardised Preference Index (SPI) is calculated for each variable for each 50 m grid cell based on criteria provided in Fielding e*t al*., 2020[49]. These are then summed to give a predicted usage score between 1 and 10 for each grid cell, with 1 predicting lowest usage and 10, highest usage.

8.3.31. The model was run using the R software environment for statistical computing[50] using a script modified from that provided with Fielding *et al*., 2020[49]. Ordnance Survey Open Data Digital Terrain Model (DTM) Data at a 50 m resolution were used for the altitude input, and the slope and distance to the nearest ridge data were derived from that and used to calculate SPIs and the final preference index.

Survey Limitations

8.3.32. There were limiting factors to survey methodologies, the details of which are provided in this section. As a whole, it is not considered that these limitations have resulted an impact on the assessment provided within this Chapter, and the reasoning for this in relation to each limitation is provided on a case-by-case basis below.

Weather Conditions

8.3.33. Weather conditions during the VP surveys were not always optimal, with occasional periods of heavy rain and strong winds reported. However, it is not always possible to avoid poor weather conditions and surveying in a range of weather conditions is considered give an accurate representation of the environment within and surrounding the Proposed Development. It is therefore considered that occasional periods of poor weather is not a significant limitation to the dataset obtained.

Access

8.3.34. Permission to access land for ornithology surveys outside of the Proposed Development Site was not granted. Therefore, the survey areas which fell outside of the Proposed Development Site, comprising a 500 m buffer for MBBS, 1.5 km buffer for black grouse surveys and 2 km buffer for breeding raptor and owl surveys, were surveyed via short VPs from locations within the Proposed Development Site. As far as possible, these VPs overlooked visible suitable habitat, including woodland and moorland habitat, within the relevant survey buffers.

8.3.35. Existing historic data was provided by the Applicant, within 10 km of the Proposed Development, as a result of comprehensive survey work including vantage point surveys, breeding bird surveys, breeding raptor surveys and winter walkovers, that had been completed previously

[48] *NatureScot (2021). NatureScot statement on modelling to support the assessment of forestry and wind farm impacts on golden eagles. Available from - https://www.nature.scot/doc/naturescot-statement-modelling-support-assessment-forestry-and-wind-farm-impacts-golden-eagles [Accessed 04/10/2023]*

[49] *Fielding, A.H., Haworth, P.F., Anderson, D., Benn, S., Dennis, R., Weston, E., & Whitfield, D.P. (2020). A simple topographical model to predict Golden Eagle Aquila chrysaetos space use during dispersal. Ibis, 162, 400-415.*

[50] *R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.*

(2012-2014). Site conditions have not been subject to any significant change since. As such, the inclusion of this concise dataset in combination with additional historic records provided by TWIC, the RSPB and the LBRSG, allowed for a robust assessment of effects.

Changes to the Proposed Development

8.3.36. In November 2019, the initial layout of the Proposed Development comprised seven turbines. The ornithology survey areas used during the breeding raptor survey, barn owl survey and black grouse survey were based on this initial layout. In February 2021, the turbine layout changed, with an additional turbine also included. The black grouse survey area was not amended to reflect the change in turbine layout following consultation with NatureScot, with 22.5% of a 1.5 km buffer surrounding the updated turbine layout to the south and east not surveyed during the black grouse surveys in 2021.

8.3.37. Similarly, 22% of the 1.5 km buffer of the final turbine layout of the Proposed Development, comprising six proposed turbines, was not surveyed for black grouse. However, the majority of habitat within the 22% of the 1.5 km buffer that was not surveyed comprises cultivated arable land and woodland, with a small portion of heather moorland present within the buffer to the northeast, and to the south within Greenlaw Moor SSSI. As there is little suitable habitat for black grouse within much of the 1.5 km buffer area not surveyed during the 2021 black grouse surveys, it is not considered to be a significant limitation to the assessment.

VP Survey Effort

8.3.38. During the 2020-2021 non-breeding season, 32 and 33 hours were completed at VPs 1 and 2, respectively. However, four hours were completed at VP1, and three hours at VP2 on 1 March 2021. Similarly, 30 hours of VP survey were completed at VP1 during the 2021-2022 non-breeding season, with no survey completed in January 2022. However, six hours of survey were completed at VP1 on 3 March 2022 to account for this. As these survey hours were completed only a few days outside of the non-breeding season, this is not considered to be a significant limitation to the dataset.

8.3.39. Additional VP surveys were completed during the autumn migration period (September to November) in 2020 and 2021, and the spring migration period (March to May) in 2021. During the 2021-2022 non-breeding season VP surveys, only three hours of migration VP were completed in October and November 2021. Six hours of migration VP were completed on 3 December 2021 to account for this. As these survey hours were completed only a few days outside of the non-breeding season, this is not considered to be a significant limitation to the dataset.

8.3.40. Details of the full survey effort is provided in Table 8.1.5, Technical Appendix 8.1: Ornithology, Volume 4.

CRM

8.3.41. At the time of writing and the completion of CRM, the turbine model for the Proposed Development had not been selected. However, the CRM was completed to include a lowest rotor swept height of 31 m and a maximum rotor swept height of 200 m to include a range of turbine models. The height bands used during the VP surveys assumed a maximum rotor swept height of 180 m (height band 5 >180 m). Height band 5 was therefore included in CRM to capture flights that occurred between 180-200 m in height. As height band 5 included all flights that were above 180 m, and thus above a maximum rotor swept height of 200 m, many flights recorded at height band 5 may not have been at PCH (31-200 m). However, as all flights at height band 5 were included, this accounts for a worst-case scenario in which all flights at height band 5 were at PCH. It is expected that at worst this would result in an overestimate in collision risk. It is therefore not a significant limitation to the results of the CRM or impact assessment of IOFs at risk of collision impacts.

MBBS – Meadow Pipit Records

8.3.42. Meadow pipit was only recorded during the first year of MBBS. Although only a single year of MBBS results was used in the assessment for meadow pipit, this species is a common, abundant and widespread breeding species in Scotland, with suitable breeding habitat widely available within and surrounding the Proposed Development Site. Therefore, it is considered that the absence of a second year of MBBS data for meadow pipit would not result in any significant changes to the outcome of the assessment, and thus is not a significant limitation.

Approach to Impact Assessment

8.3.43. This section presents the approach taken to the EIA and provides an overview of how the potential for impact has been determined and the method by which significance of effect has been ascertained. The approach to the EIA adopted within this assessment follows the CIEEM guideline[2], and in line with these guidelines professional judgement has been applied where appropriate. The criteria used and the underlying rationale are described further within the following sections.

Determining Important Ornithological Features (IOFs)

8.3.44. The assessment process involves identifying IOFs, in accordance with CIEEM guidelines[2]. These ornithological features and their values are determined by the criteria defined in Table 8.2.

Table 8.2: 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 Zone of Influence (ZoI) of the Proposed 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[51].
National	A regularly occurring species listed as a qualifying feature of a nationally designated site (e.g. SSSI) within the ZoI of the Proposed Development. Species populations present with sufficient conservation importance to meet criteria for SSSI selection[52, 53, 54].

[51] *An area that is used regularly by 1% or more of the Great Britain 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 that is used regularly by over 20,000 waterfowl (waterfowl as defined by the Ramsar Convention) or 20,000 seabirds in any season.*

[52] *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.*

[53] *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).*

[54] *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.*

Regional	A species occurring within SPAs, Ramsar sites and SSSIs, but not crucial to the integrity of the site. Species populations present falling short of SSSI selection criteria but with sufficient conservation importance to likely meet criteria for selection as a local site[52].
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 or Welsh BoCC Red and Amber Lists[38].
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)[38].

8.3.45. The assessment of ornithological features recorded during the baseline surveys also considers the importance of the site 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.

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

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

Characterising Potential Effects on Ornithological Features

8.3.48. Impacts on IOFs are judged in terms of magnitude and duration. 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 8.3.

Table 8.3: Approach used to evaluate ornithological features by defined magnitude

Impact magnitude	Description
Very highly negative	Total or almost complete loss of an ornithological feature resulting in a permanent adverse effect on the integrity[55] of the feature. The conservation

[55] *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.*

	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.

8.3.49. In the case of designated sites, spatial magnitude is assessed in respect of the area within the designated site boundary or using a scale at which the designated features can be regarded as having potential connectivity with the Proposed Development. For non-designated sites, spatial magnitude is assessed at an appropriate scale depending on the feature's importance.

8.3.50. Impacts and spatial magnitude are assessed within an appropriate bio-geographic scale:

- Impacts on breeding bird populations are assessed in a regional context; and
- Impacts on non-breeding bird populations are assessed in a national context.

8.3.51. The assessment also considers whether the impact is positive or negative, short-term (for example only during construction) or long-term (throughout the lifetime of the Proposed Development), reversible or permanent. This is summarised in Table 8.4.

Table 8.4: Criteria for describing duration

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

8.3.52. 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.

8.3.53. 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 8.5. The judgement takes account of information available on the responses of birds to various stimuli (e.g. predators, noise and disturbance by humans).

Table 8.5: Criteria for describing behavioural sensitivity

Behavioural Sensitivity	**Definition**
High	Species or populations occupying habitats remote from human activities, or that exhibit strong and long-lasting (guide: > 20 minutes) reactions to disturbance events.
Moderate	Species or populations that appear to be warily tolerant of human activities, or that exhibit short-term reactions (guide: 5 minutes - 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.

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

Determining Significance of Potential Ornithological Effects

8.3.55. Only features for which there is considered to be the potential for significant effects are identified as IOFs and taken forward for EcIA. Having followed the process of identifying an IOF, determining its sensitivity, and characterising potential impacts, the significance of the effect is then determined. The CIEEM guidelines[2] use only two categories to classify effects: 'significant' or 'not significant'. In this EIA chapter, significance of effects is assessed following an assumption of the application of embedded mitigation measures (see Section 1.8.6, Paragraphs 1.8.6.3 to 1.8.6.13). The significance of an effect is determined by considering the importance of the feature, the magnitude of the impact and applying professional judgement as to whether the integrity of the feature will be affected. The assessment includes potential impacts on each IOF from all phases of the development, e.g. construction, operation and decommissioning, and considers direct, indirect, secondary and cumulative impacts and whether the impacts and their effects are short, medium, long-term, permanent, temporary, reversible, irreversible, positive and/or adverse.

8.3.56. In this assessment, an effect that threatens the integrity of a feature (i.e. maintenance of the conservation status of a species or designated site) is considered to be significant. It should be

noted that, alongside the criteria provided, professional judgement is applied in determining the significance of a potential effect.

8.3.57. Where appropriate, mitigation and/or compensation measures, including the design process, are identified in order to avoid and reduce potentially significant effects. It is also good practice to propose mitigation measures to reduce negative effects that are not significant. The significance of residual effects on features after the effects of mitigation have been considered can then be determined, along with any monitoring requirements[21].

Cumulative Impact Assessment and Residual Impacts

8.3.58. The Cumulative Impact Assessment (CIA) identifies any other projects which, in combination with effects from the Proposed Development could give rise to a significant cumulative impact on ecological features. Cumulative effects are particularly important as ornithological features may be already exposed to background levels of threat or pressure and may be close to critical thresholds where further impacts could cause irreversible decline. Cumulative effects can also make habitats and species more vulnerable or sensitive to change.

8.3.59. Cumulative effects can either be additive / incremental (i.e. multiple activities/projects may give rise to a significant effect due to their proximity in time and space) and connected (i.e. different aspects of the same project which may be authorised under different consent processes).

Trends and Predicted Future Baseline

8.3.60. Current habitat use within the Proposed Development Site is agricultural with the addition of a motocross track and quarry. In the absence of development, it is assumed that the habitat use at Proposed Development would remain the same for the foreseeable future.

8.3.61. It is more difficult to predict changes that may occur in the longer-term (i.e. over 25 years). Climate change and the shift in species and habitat distributions that this may cause, as well as potential land management changes that this may bring about, cannot be reliably predicted at this time. Baseline surveys carried out for the Proposed Development represent a snapshot of the ecology community present at the time and cannot be extrapolated to predict future population trends in the event of climate change, or a future change in land use at the Proposed Development.

8.4. Consultation

8.4.1. An initial consultation letter was submitted to NatureScot in April 2020, with a response also received in April 2020. It was agreed that a review of ornithology results following the first year of baseline ornithology surveys should be completed. As such, a summary report comprising the results of the 2020 breeding season ornithology surveys was submitted to NatureScot in January 2021. Following this, NatureScot were in agreement that a second year of breeding raptor surveys, black grouse surveys and spring migration VPs was not necessary.

8.4.2. On completion of two years of baseline ornithology surveys, a Scoping Report[56] (Technical Appendix 1.1: Scoping Report, Volume 4) was issued to Scottish Ministers and consultees in July 2022. This document contained details of the proposed assessment methodology and ornithological features proposed for the preparation of the EIAR and those to be scoped out of the EIA, following one year of baseline surveys. Most features were proposed to be scoped out on the basis that construction and operation of the Proposed Development would not be likely to result in significant effects. Following consultee responses including as contained in the

[56] *Natural Power (2022). Lees Hill Energy Park Scoping Report. The Natural Power Consultants on behalf of Fred. Olsen Renewables, Kirkcudbrightshire.*

Scoping Opinion, the following ornithological features were scoped out and are not considered any further in this assessment:

- Whooper swan;
- Goldeneye;
- Woodcock;
- Marsh harrier;
- Hen harrier;
- Red kite;
- White-tailed eagle;
- Barn owl; and
- Merlin.

8.4.3. All consultation relevant to this chapter is summarised in Table 8.6. The table does not repeat scoping responses listed in Table 7.6 in Chapter 7: Ecology, Volume 2 of the EIAR.

Table 8.6: Consultee scoping responses relating to ornithology

Consultee	Comments/issues raised/recommendations	Addressed responses/outcomes
NatureScot Response to consultation letter outlining the proposed ornithology survey programme, submitted on 06 April 2020.	10 April 2020 Agreed with including historic survey data provided by the Applicant to inform the survey programme and assessment. Agreed with proposed survey programme and advised reviewing the survey programme following one year of surveys.	Historic survey data provided by the Applicant (see Section 1.8.5, Paragraphs 1.8.5.2 to 1.8.5.3) was used to inform the assessment.
NatureScot Response to summary report comprising the results of the 2020 breeding season bird surveys and proposal not to include breeding raptor surveys, black grouse surveys, or spring migration VP surveys during a second year of ornithology surveys, submitted on 19 February 2021.	18 March 2021 Agreed with the conclusions and recommendations in the Scoping Report, including the proposed survey programme for the second year of surveys: MBBS and additional migration VPs for pink-footed geese during autumn passage (September to November). Agreed that a second year of breeding raptor surveys and black grouse surveys were not required.	Additional migration VPs to record migrating pink-footed goose were completed during the spring passage period in 2020 (March to May) and the autumn passage periods in 2020 and 2021 (September to November) to inform the assessment (see Section 1.8.3, Table 8.1).
NatureScot Response to consultation letter outlining the changes in survey methodology to reflect the amended design of the Proposed Development, which accompanied the 2020 summary report, submitted on 19 February 2021.	18 March 2021 Agreed with proposed changes to VP viewsheds to account for the changes in turbine layout and additional turbine.	This is addressed in Survey Limitations, in Section 1.8.3, Paragraphs 1.8.3.36 to 1.8.3.37.
NatureScot	Advised that Greenlaw Moor SPA undergo Habitats Regulations Appraisal and the	Greenlaw Moor SPA and Ramsar site are included in the

September 2022 Response to Scoping Report.	Greenlaw Moor SSSI be included in the impact assessment.	Screening for Appropriate Assessment in Section 1.8.10. Greenlaw Moor SSSI has been scoped into the assessment as an IOF in Section 1.8.6, Paragraphs 1.8.6.19 to 1.8.6.28.
	Advised that the Firth of Forth and St Andrews Bay Complex SPA undergo Habitats Regulations Appraisal	The Outer Firth of Forth and St Andrews Bay Complex SPA has been included in the Screening for Appropriate Assessment in Section 1.8.10.
	Recommended that the Proposed Development would not affect the integrity of Din Moss – Hoselaw Loch SPA and SSSI and that these designated sites would not need to be included in the assessment (including a HRA for the SPA).	Din Moss – Hoselaw Loch SPA and SSSI were scoped out of the assessment.
	Agreed with the ornithological features scoped in and scoped out of the EIA Report, as detailed in Table 11.13 in the Scoping Report.	See the Scoping Report[56].
Scottish Borders Council **September 2022** Response to Scoping Report.	Satisfied that the survey programme was sufficient to provide a robust impact assessment.	Survey programme detailed in Section 1.8.3.
	Recommended that a Golden Eagle Topography Model be undertaken to assess habitat suitability for golden eagles within the Proposed Development Site following re-establishment of golden eagles via the South of Scotland Golden Eagle Project.	A GET model was carried out to assess the suitability of habitat within the Proposed Development Site for golden eagles. The methods are presented in Section 1.8.3, Paragraphs 1.8.3.27 to 1.8.3.31, and the results are presented in Section 1.8.5, Paragraphs 1.8.5.25 to 0.
	Advised that an Appropriate Assessment be carried out for Greenlaw Moor Ramsar site.	Greenlaw Moor Ramsar site is included in the Screening for Appropriate Assessment in Section 1.8.10.
	Recommended that red grouse and short-eared owl were scoped into the EIA Report due to inclusion of both species as notified features of the Greenlaw Moor SSSI breeding bird assemblage.	Red grouse and short-eared owl were scoped into the assessment (see Section 1.8.6).
The RSPB **August 2022**	Expressed concerns regarding access restrictions within the ornithology survey areas and possible under-recording of	This is addressed in Survey Limitations, in Section 1.8.3, Paragraphs 1.8.3.34 to 1.8.3.35.

Response to Scoping Report.	sensitive species such as black grouse and breeding waders.	
	Expressed concern regarding the change to turbine layout and implications for areas not surveyed within the relevant survey buffers of the updated design.	This is addressed in Survey Limitations, in Section 1.8.3, Paragraphs 1.8.3.36 to 1.8.3.37.
	Recommended that black grouse was scoped into the EIA Report due to the proximity of the access road to a recorded lek site and inclusion of black grouse as a notified feature of the Greenlaw Moor SSSI breeding bird assemblage.	Black grouse was scoped into the assessment (see Section 1.8.6).
	Advised contacting the Game & Wildlife Conservation Trust (GWCT) and Southern Uplands Partnership (SUP) to request recent data on grouse species within the Proposed Development and surrounding area.	The GWCT and SUP were contacted but no response has been received at the time of writing.
	Agreed that the assessment should focus on species for which impacts may be significant.	Only species for which there was a possible significant impact were taken forward for full EcIA.

8.5. Baseline

8.5.1. This section presents the baseline environment for desk-based review and field surveys in relation to the Proposed Development.

Desk Study

Existing Historic Records

8.5.2. Historic records of target species provided by the Applicant within 10 km of the Proposed Development included:

- Black grouse;
- Lapwing;
- Golden plover;
- Dotterel;
- Goshawk;
- Marsh harrier;
- Barn owl;
- Merlin; and
- Skylark.

8.5.3. A full list of species records provided is detailed in Technical Appendix 8.1: Ornithology, Volume 4 of the EIAR.

Statutory, National and Locally Designated Sites of Nature Conservation

8.5.4. A list of designated sites with an ornithological interest that are located within the search area around the Proposed Development (5 km for LNRs/NNRs, SINCs and SSSIs, and 10 km for SPAs and Ramsar sites (up to 25 km for geese)) is provided in Table 8.7. There are two sites of international importance for their ornithological interests within the search area, one with multiple designations: Greenlaw Moor SPA[57], Ramsar site[58] and SSSI[59]; and Outer Firth of Forth and St Andrews Bay Complex SPA[60].

8.5.5. The locations of these sites can be found on Figure 8.3: Designated Sites within 10 km (25 km for Geese and Gulls) of the Proposed Development, Volume 3a of the EIAR.

[57] *Greenlaw Moor SPA (1996). SPA Citation. Available at - https://sitelink.nature.scot/site/8509 [Accessed: 03/10/2023]*

[58] *Greenlaw Moor Ramsar site (1996). Ramsar Site Citation. Available from - https://sitelink.nature.scot/site/8427 [Accessed 03/10/2023]*

[59] *Greenlaw Moor SSSI (1987). SSSI Citation. Available from - https://sitelink.nature.scot/site/743 [Accessed: 03/10/2023]*

[60] *Outer Firth of Forth and St Andrews Bay Complex SPA (2020). SPA Citation. Available from - https://sitelink.nature.scot/site/10478 [Accessed: 03/10/2023]*

Table 8.7: Designated sites with ornithological interests within 10 km of the Proposed Development Site (25 km for gulls and geese as designated features)

Site	Designation	Distance to Proposed Development Site	Designation criteria
Greenlaw Moor	SPA	1.7 km	Non-breeding pink-footed goose
	Ramsar	1.7 km	Non-breeding pink-footed goose
	SSSI	0.01 km	Breeding bird assemblage including: • Black grouse; • Red grouse; • Golden plover; and • Short-eared owl.
Outer Firth of Forth and St Andrews Bay Complex	SPA	18 km	Internationally important for non-breeding waterfowl and breeding and non-breeding seabirds. Non-breeding waterfowl assemblage including: • Eider; • Velvet scoter; • Common scoter; • Long-tailed duck; • Goldeneye; • Red-breasted merganser; • Slavonian grebe; and • Red-throated diver. Breeding seabird assemblage including: • Kittiwake; • Herring gull; • Common tern; • Arctic tern; • Common guillemot; • Puffin; • Manx shearwater; • Gannet; and • Shag. Non-breeding seabird assemblage including: • Kittiwake; • Black-headed gull; • Little gull; • Common gull; • Herring gull; • Common guillemot; • Razorbill; and • Shag.

Ornithological Features

8.5.6. The data search provided records of the target species shown in Table 8.8.

Table 8.8: Target species for which records were returned during the data search.

Geese, Swans, Ducks and Nightjar	Waders	Raptors	Passerines
• Brent goose; • Barnacle goose; • Greylag goose; • Taiga bean goose; • Pink-footed goose; • Mute swan; • Whooper swan; • Shelduck; • Shoveler; • Wigeon; • Pintail; • Teal; • Pochard; • Tufted duck; • Surf scoter; • Common scoter; • Long-tailed duck; • Goldeneye; • Smew; • Red grouse; and • Nightjar.	• Oystercatcher; • Lapwing; • Golden plover; • Ringed plover; • Whimbrel; • Curlew; • Black-tailed godwit; • Ruff; • Dunlin; • Woodcock; • Snipe; • Common sandpiper; • Green sandpiper; • Redshank; • Wood sandpiper; • Greenshank.	• Osprey; • Honey-buzzard; • Goshawk; • Marsh harrier; • Hen harrier; • Red kite; • Barn owl; • Short-eared owl; • Merlin; • Peregrine;	• Skylark; • Meadow pipit; and • Reed bunting.

8.5.7. A full list of species is provided in Technical Appendix 8.1: Ornithology, Tables 8.1.3 and 8.1.4 (with the exception of confidential records which are provided in the Confidential Technical Appendix 8.2: Ornithology), Volume 4 of the EIAR.

Baseline Surveys

Vantage Point Surveys

Breeding Season

8.5.8. The breeding season surveys (March to August) undertaken in 2020 and 2021 recorded flight lines from a total of 16 target species, all of which were goose, wader or raptor species. Table 8.9 summarises levels of flight activity for each species and the amount of that flight activity which was in the CRZ at PCH during each breeding season (i.e. potential for collisions). Those ornithological features for which CRM was undertaken are shown in bold text. Breeding season

flight activity within the CRZ at PCH excluding height band 5 is shown in Technical Appendix 8.1: Ornithology, Volume 4 of the EIAR.

8.5.9. Table 8.9 shows that waders were the most frequently recorded, with most flights recorded for lapwing, followed by curlew, during both breeding season VP survey years. The associated flight lines are shown in Figures 8.4-8.5 (2020 and 2021 breeding seasons: geese), Figures 8.6-8.7 (2020 and 2021 breeding seasons: waders), and Figures 8.8-8.9 (2020 and 2021 breeding season: raptors), Volume 3a of the EIAR.

Table 8.9: Results of the breeding season flight activity surveys in 2020 and 2021

Species	No. of flights (individuals) – 2020	No. of flights (individuals) in the CRZ at PCH – 2020	No. of flights (individuals) – 2021	No. of flights (individuals) in the CRZ at PCH – 2021
Barnacle goose	**2 (900)**	**1 (450)**	**-**	**-**
Greylag goose	**18 (36)**	**3 (5)**	**34 (122)**	**11 (39)**
Oystercatcher	**29 (41)**	**6 (7)**	**25 (33)**	**1 (1)**
Lapwing	**205 (699)**	**21 (144)**	**119 (474)**	**12 (12)**
Golden plover	**9 (438)**	**5 (240)**	**1 (150)**	**-**
Curlew	**183 (248)**	**44 (69)**	**68 (114)**	**14 (15)**
Woodcock	1 (1)	1 (1)	-	-
Snipe	**15 (19)**	**6 (10)**	**8 (18)**	**1 (1)**
Redshank	2 (2)	-	1 (1)	-
Marsh harrier	1 (1)	1 (1)	-	-
Hen harrier	1 (1)	1 (1)	-	-
Red kite	2 (2)	2 (2)	-	-
White-tailed eagle	-	-	2 (2)	1 (1)
Short-eared owl	1 (1)	-	5 (5)	-
Merlin	-	-	1 (1)	-
Peregrine	**7 (7)**	**1 (1)**	**-**	**-**

Non-breeding Season

8.5.10. A total of 14 target species, and unidentified grey goose, wader and raptor species, were recorded during non-breeding season VP surveys between September 2020 and February 2021 (inclusive) and September 2021 and February 2022 (inclusive). Ten of those species were also recorded during the breeding season, with the addition of pink-footed goose, whooper swan, goldeneye and black grouse. Table 8.10 summarises levels of flight activity for each species and the amount of that flight activity recorded in the CRZ at PCH. Those ornithological features for which CRM was undertaken are shown in bold text. Non-breeding season flight activity within

the CRZ at PCH excluding height band 5 is shown in Technical Appendix 8.1: Ornithology, Volume 4 of the EIAR.

8.5.11. Overall, pink-footed goose was the most frequently recorded species, followed by golden plover. The flight lines for the non-breeding season target species are shown in Figure 8.10 (2020-2021 non-breeding season: geese, swans and grouse), Figure 8.11 (2021-2022 non-breeding season: geese and ducks), Figures 8.12-8.13 (2020-2021 and 2021-2022 non-breeding season: waders), and Figures 8.14-8.15 (2020-2021 and 2021-2022 non-breeding season: raptors), Volume 3a of the EIAR.

Table 8.10: Results of the non-breeding season flight activity surveys in Sep 2020-Feb 2021 and Sep 2021-Feb 2022

Species	No. of flights (individuals) – Mar-Aug 2020	No. of flights (individuals) in the CRZ at PCH – Sep 2020-Feb 2021	No. of flights (individuals) – Mar-Aug 2021	No. of flights (individuals) in the CRZ at PCH – Sep 2021-Feb 2022
Greylag goose	**5 (13)**	**3 (5)**	**12 (73)**	**8 (53)**
Pink-footed goose	**12 (700)**	**8 (557)**	**26 (1343)**	**22 (1008)**
Unidentified grey goose	**4 (84)**	**1 (7)**	**1 (3)**	**1 (3)**
Whooper swan	1 (6)	1 (6)	-	-
Goldeneye	-	-	1 (5)	-
Black grouse	1 (1)	-	-	-
Oystercatcher	1 (3)	-	-	-
Lapwing	**11 (118)**	**1 (1)**	**11 (251)**	**6 (222)**
Golden plover	**16 (393)**	**6 (167)**	**16 (116)**	**8 (68)**
Curlew	**10 (13)**	**-**	**4 (4)**	**-**
Snipe	**2 (5)**	**-**	**1 (1)**	**1 (1)**
Unidentified wader	**2 (18)**	**1 (5)**	**-**	**-**
Hen harrier	2 (2)	-	4 (4)	1 (1)
Red kite	1 (1)	-	-	-
Merlin	-	-	1 (1)	-
Peregrine	**7 (7)**	**2 (2)**	**4 (4)**	**2 (2)**
Unidentified raptor	-	-	1 (1)	-

8.5.12. Records of secondary species and incidental records of target species recorded during the breeding and non-breeding season VP surveys are summarised in Technical Appendix 8.1: Ornithology, Volume 4 of the EIAR.

Moorland Breeding Bird Surveys

8.5.13. A total of 10 target species were recorded during the MBBS in 2020 and 2021. Breeding territories were identified for six wader species within the MBBS Area during 2020, namely oystercatcher, lapwing, golden plover, curlew, snipe and redshank. Breeding territories were identified for all of these wader species in 2021, with the exception of golden plover. Breeding territories for four other target ground-nesting species, namely red grouse, skylark, meadow pipit and reed bunting, were identified within 50 m of the solar PV area.

8.5.14. Table 8.11 summarises the number of breeding territories identified within the MBBS Area during the MBBS in 2020 and 2021 for all wader species. Breeding territories identified within 50 m of the solar PV area for other target ground-nesting species are also summarised. Breeding territories are shown in Figures 8.16-8.17 (MBBS Results 2020 and 2021), Volume 3a of the EIAR.

Table 8.11: Moorland breeding bird survey results

Species	2020		2021	
	Total no. of territories recorded	No. of territories within 500 m of proposed turbines and associated infrastructure/ 50 m of the solar PV area	Total no. of territories recorded	No. of territories within 500 m of proposed turbines and associated infrastructure/ 50 m of the solar PV area
Target wader species within the MBBS Area				
Oystercatcher	4	3	4	3
Lapwing	28	21	27	26
Golden plover	1	1	0	0
Curlew	8	7	6	5
Snipe	11	9	8	7
Redshank	1	1	1	1
Other target ground-nesting species				
Red grouse	0	0	1	1
Skylark	19	16	8	7
Meadow pipit	74*	18**	Not recorded (see Section 8.3, Paragraph 8.3.42)	-
Reed bunting	4	4	2	2

**Rather than mapping meadow pipit registrations, the total number of meadow pipits observed during each visit was recorded. The total number of meadow pipits recorded across all four survey visits was divided by four to give the average number of meadow pipits recorded during a single survey visit. This was then divided by two to represent the number of potential territories occupied by breeding pairs;*

***The solar PV area and surrounding 50 m buffer covers 24% of the area within the MBBS area. It is therefore assumed that if territories are spread evenly across the MBBS area that 24% of breeding territories recorded within the MBBS area are located within the solar PV area and surrounding 50 m buffer.*

Breeding Raptor Surveys

8.5.15. A total of four target species were recorded during the Breeding Raptor Surveys, namely red kite, barn owl, short-eared owl and peregrine.

8.5.16. There is suitable breeding habitat for red kite and short-eared owl within the Proposed Development Site, however, no evidence of breeding was recorded within the Breeding Raptor Survey Area during 2020. Similarly, although peregrine was recorded within the Breeding Raptor Survey Area, there was no evidence that peregrine bred within 2 km of the Proposed Development.

8.5.17. Results of the Breeding Raptor Surveys are shown in Figure 8.18: Breeding Raptor Survey Results 2020, Volume 3a of the EIAR.

Barn Owl Survey

8.5.18. A single barn owl roost was identified within the Barn Owl Survey Area. Details of the barn owl roost site are provided in the Confidential Appendix (Confidential Technical Appendix 8.2: Ornithology), Volume 4 of the EIAR.

Black Grouse Surveys

8.5.19. No black grouse were recorded during the Black Grouse Surveys completed between March and May 2020. However, a lek was recorded in May 2021. There were also incidental records of a single male black grouse recorded during the breeding raptor surveys in April 2020 and the VP surveys in March 2021. Details of these incidental records are provided in the Confidential Appendix (Confidential Technical Appendix 8.2: Ornithology), Volume 4 of the EIAR.

Collision Risk Modelling (CRM)

8.5.20. Nine target species fulfilled criterion for CRM: barnacle goose, greylag goose, pink-footed goose, oystercatcher, lapwing, golden plover, curlew, snipe and peregrine.

8.5.21. Barnacle goose, greylag goose and pink-footed goose were considered to have ‘directional’ flights and oystercatcher, lapwing, golden plover, curlew, snipe and peregrine were considered to have ‘non-directional’ flights (see Section 1.8.3, Paragraph 1.8.3.24).

8.5.22. Two flights (10 individuals), recorded at PCH within the CRZ during the non-breeding season were identified only as belonging to an unidentified goose species (Table 8.10). As a precautionary measure, these records were included in the collision risk calculations for both pink-footed goose and greylag goose as both of these species were recorded in the CRZ at PCH during the non-breeding season.

8.5.23. Similarly, a single flight (five individuals), recorded at PCH within the CRZ during the non-breeding season was identified only as belonging to an unidentified wader species (Table 8.10). As a precautionary measure, this record was included in the collision risk calculations for lapwing, golden plover and snipe as all of these wader species were recorded in the CRZ at PCH during the non-breeding season.

8.5.24. The risk of collision for each species that passes through the CRZ at PCH (height bands 3, 4 and 5), calculated with avoidance factors of 95%, 98%, 99%, 99.5% and 99.8% are presented in Table 8.12. The results in bold indicate the NatureScot recommended avoidance rate (SNH, 2018)[22] for each species. Full results which the avoidance rates have been calculated on are provided in Technical Appendix 8.1: Ornithology, Volume 4 of the EIAR. Estimated mortality rate

of each species included within the CRM excluding height band 5 is also shown in Technical Appendix 8.1: Ornithology, Volume 4 of the EIAR.

Table 8.12: Estimated number of collisions during the breeding season (defined as March to August) and non-breeding season (defined as September to February) for height bands 3, 4 and 5 – values in bold show collisions for the threshold avoidance rates recommended by NatureScot (SNH, 2018). Annual estimates are sums of breeding and non-breeding estimates.

Species	Model type	Season	Estimated mortality assuming avoidance rate of:				
			95%	98%	99%	99.5%	99.8%
Barnacle goose	Commuting	Breeding	22.18	8.87	4.44	2.22	**0.89**
		Non-breeding	0.00	0.00	0.00	0.00	**0.00**
		Annual	22.18	8.87	4.44	2.22	**0.89**
Greylag goose	Commuting	Breeding	2.27	0.91	0.45	0.23	**0.09**
		Non-breeding	1.80	0.72	0.36	0.18	**0.07**
		Annual	4.07	1.63	0.81	0.41	**0.16**
Pink-footed goose	Commuting	Breeding	0.00	0.00	0.00	0.00	**0.00**
		Non-breeding	35.44	14.18	7.09	3.54	**1.42**
		Annual	35.44	14.18	7.09	3.54	**1.42**
Oystercatcher	Non-directional	Breeding	0.07	**0.03**	0.01	0.01	0.00
		Non-breeding	0.00	**0.00**	0.00	0.00	0.00
		Annual	0.07	**0.03**	0.01	0.01	0.00
Lapwing	Non-directional	Breeding	1.03	**0.41**	0.21	0.10	0.04
		Non-breeding	2.39	**0.96**	0.48	0.24	0.10
		Annual	3.42	**1.37**	0.69	0.34	0.14
Golden plover	Non-directional	Breeding	13.97	**5.59**	2.79	1.40	0.56
		Non-breeding	11.91	**4.76**	2.38	1.19	0.48
		Annual	25.88	**10.35**	5.17	2.59	1.04
Curlew	Non-directional	Breeding	0.53	**0.21**	0.11	0.05	0.02
		Non-breeding	0.00	**0.00**	0.00	0.00	0.00
		Annual	0.53	**0.21**	0.11	0.05	0.02
Snipe		Breeding	0.54	**0.21**	0.11	0.05	0.02

Species	Model type	Season	Estimated mortality assuming avoidance rate of:				
			95%	98%	99%	99.5%	99.8%
	Non-directional	Non-breeding	0.01	**<0.01**	<0.01	<0.01	<0.01
		Annual	0.55	**0.21**	0.11	0.05	0.02
Peregrine	Non-directional	Breeding	0.02	**0.01**	<0.01	<0.01	<0.01
		Non-breeding	0.01	**0.01**	<0.01	<0.01	<0.01
		Annual	0.03	**0.02**	<0.01	<0.01	<0.01

Golden Eagle Topography (GET) Model

8.5.25. Predicted golden eagle usage in the vicinity of the Proposed Development is presented in Figure 5.1, below.

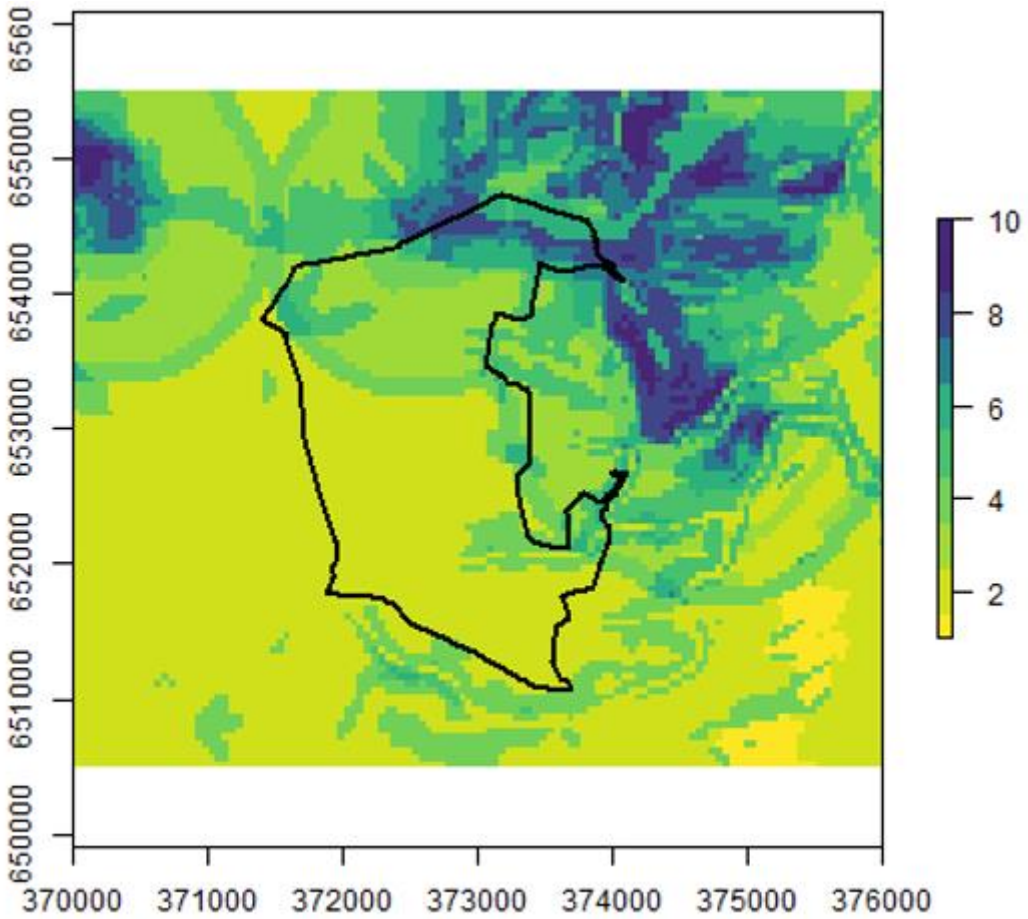

Figure 5.1: Predicted golden eagle usage scores for the area surrounding the Proposed Development (1 = lowest usage, 10 = highest usage). The black line indicates the Proposed Development Site

8.5.26. The CRZ for the Proposed Development was defined as a 281 m buffer of the proposed turbine locations representing half the rotor diameter of the maximum turbine specification proposed at the site plus a 200 m precautionary buffer zone (see Section 1.8.3, Paragraphs 1.8.3.21 to

1.8.3.26). The analysis predicts that no areas of high golden eagle usage (defined as grid cells with predicted usage scores of 6 and above) fall within the CRZ (Figure 5.2).

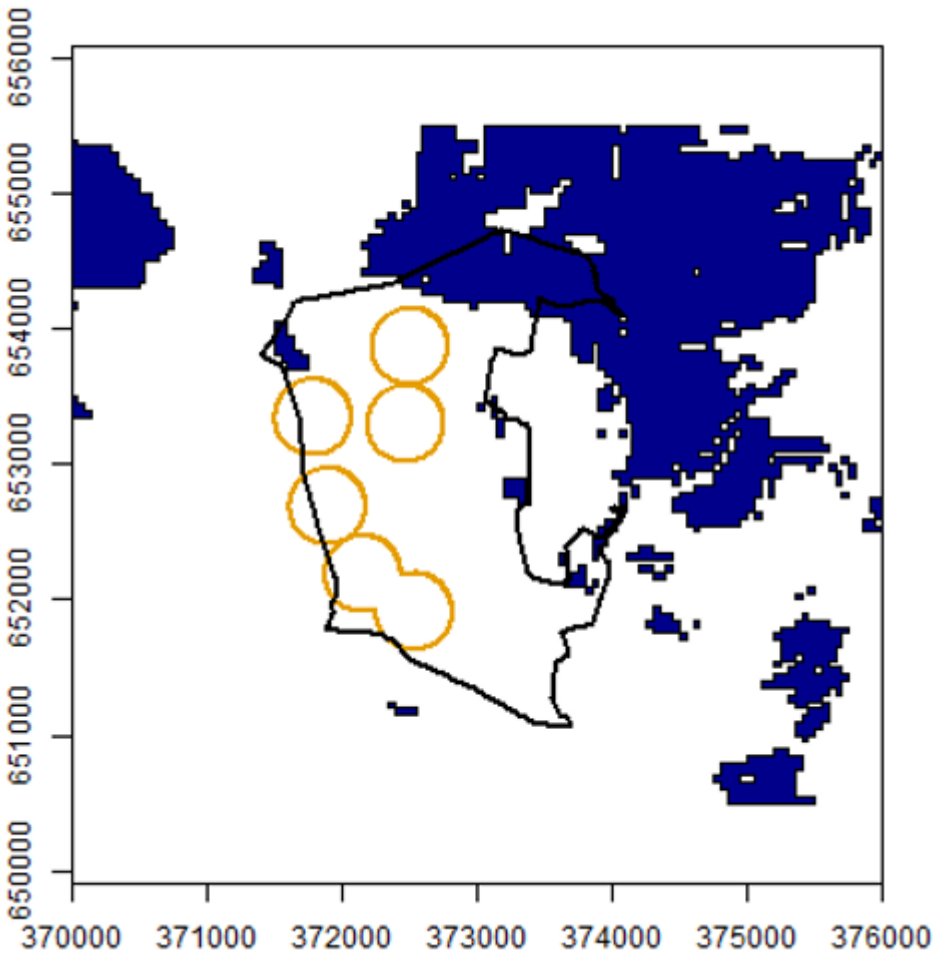

Figure 5.2: Areas of lower (usage scores <6, white) and higher (usage scores of ≥6) predicted golden eagle usage for the area surrounding the Proposed Development. The black line indicated the Proposed Development Site and the orange lines indicate the CRZ

8.6. Assessment of Potential Effects

General Impacts

8.6.1. The main ways in which a wind farm and solar farm may affect ornithological receptors are via:

- Habitat loss due to land-take: construction of turbine bases, a solar PV array, BESS, access tracks and other structures will lead to direct habitat loss. The effects of habitat loss will depend upon the extent of land-take and the type of habitat affected. Embedded mitigation measures will be put in place to prevent any associated damage to, or destruction of, nests, as discussed below.
- Disturbance and/or displacement: The construction stage of wind farm and solar 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 whilst the construction activities are taking place. 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. Disturbance impacts during the operational phase are likely to be less than during the construction phase, as disturbance due to human activities

will be considerably reduced, plus some species may become habituated to the activity. Displacement around turbines and a solar PV array following construction and lasting throughout the operational phase may result for some ornithological features. The extent of this depends on the sensitivity of the species, the season (breeding or non-breeding) as well as site-specific factors. In addition, during the operational phase turbines may act as a barrier to movement, where regularly having to fly around the wind farm could result in greater energy expenditure.

- Collision with turbines: collision of a bird with the turbine rotors or tower is likely to be fatal. The likelihood of collision depends on a number of factors, such as the ecology of the species (time spent flying, manoeuvrability, etc), the surrounding habitat, the layout of the turbines and weather conditions. Note that birds which avoid a wind farm due to disturbance, will clearly not also be subject to collision risk.

8.6.2. In line with the principles of proportionate EIA, embedded mitigation is considered from the outset. Features have only been taken on for further impact assessment if no significant effect cannot be concluded following the implementation of this embedded mitigation.

Embedded Mitigation

8.6.3. Embedded mitigation measures are proposed at the outset of the Proposed Development, to reduce impacts associated with construction, operation and decommissioning, and are outlined as follows.

Construction Phase

8.6.4. All relevant construction phase embedded mitigation measures, such as appointment of an EcoW, will be implemented through a CEMP, which will be agreed in advance with SBC in consultation with NatureScot.

Environmental Clerk of Works (EcoW)

8.6.5. In line with good practice, an independent EcoW will be appointed prior to the commencement of construction and will be present 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.

Toolbox Talks

8.6.6. Prior to the start of construction, contractors will be made aware of the ornithological sensitivities within the area of the Proposed Development (particularly with regard to the potential presence of Schedule 1[6] 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.

Pre-construction Surveys

8.6.7. 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 active nests. Any active nests found will be cordoned off to a suitable distance[31] 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 an appropriate planning condition.

Timing of Works

8.6.8. 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)

8.6.9. A SPP will be produced; this plan will detail embedded mitigation measures required prior to and during construction for protected bird species potentially breeding at the Proposed Development, particularly in the vicinity of historic nests or suitable nesting habitat.

Operational Phase

8.6.10. With the exception of the operation and general maintenance of the wind 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.

Operational Environmental Management Plan

8.6.11. Where potential effects exist, control measures will be incorporated into an Operational Environmental Management Plan (OEMP). The OEMP will detail mitigation measures required during the operational phase relating to bird species to ensure ongoing compliance with relevant environmental legislation. The OEMP will be implemented during the operational phase of the Proposed Development, which will include the following measures to benefit bird species:

- Restoration of marshy grassland and heathland habitats within the Proposed Development Site; and
- Enhancement of existing areas of wetland habitats within the Proposed Development Site to create a cluster of scrapes for waders.

8.6.12. An outline OEMP is provided in Technical Appendix 7.3: Operational Environmental Management Plan, Volume 4 of the EIAR.

Decommissioning

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

Feature Assessment

8.6.14. On the basis of the description of the ornithological baseline, together with the legislation and guidance, a summary of the ornithological features within the Proposed Development Site is provided in Table 8.13 below.

8.6.15. Where no significant effects are likely with the application of embedded mitigation as outlined in Section 1.8.6, Paragraphs 1.8.6.3 to 1.8.6.13, above this is specified, and the feature is not considered an IOF requiring EIA.

Table 8.13: Determination of Important Ornithological Features occurring within the Proposed Development Site

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
Greenlaw Moor	SPA	International	-	-	-	**Yes**	Greenlaw Moor SPA is designated for non-breeding pink-footed goose. The SPA lies 1.7 km south-west of the Proposed Development, within foraging range of pink-footed goose (15-20 km)[30], therefore connectivity between the SPA and the Proposed Development can be assumed.
	Ramsar	International	-	-	-	**Yes**	Greenlaw Moor Ramsar site is designated for non-breeding pink-footed goose. The Ramsar site lies 1.7 km south-west of the Proposed Development, within foraging range of pink-footed goose (15-20 km)[30], therefore connectivity between the Ramsar site and the Proposed Development can be assumed.
	SSSI	National	-	-	-	**Yes**	The breeding bird assemblage is a qualifying feature of Greenlaw Moor SSSI. The breeding

[61] *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.*

[62] *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.*

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
							assemblage includes red grouse, black grouse, golden plover and short-eared owl, three of which were recorded within the Proposed Development Site. The SSSI lies approximately 10 m to the south-west of the Proposed Development, therefore connectivity between the SSSI and the Proposed Development is highly likely.
Outer Firth of Forth and St Andrews Bay Complex	SPA	International	-	-	-	**Yes**	A non-breeding waterfowl assemblage is a qualifying feature of the Outer Firth of Forth and St Andrews Bay Complex SPA, of which goldeneye is a notified feature. The SPA lies approximately 18 km to the north-west of the Proposed Development.
Barnacle goose	Annex I, Amber, SBL	National	UK: 1550 breeding pairs; 105,000 wintering individuals Scotland: 70,000 wintering individuals	Barnacle goose is a common wintering species in Scotland, which supports 20% of the world's wintering population. Wintering birds from Greenland are widespread across the west coast of	Two flights of 900 birds in total were recorded at PCH within the Proposed Development Site during a VP survey in April 2020. As a single flight of >10 birds was recorded at PCH in the CRZ, barnacle	No	Barnacle goose is an Annex I-listed and UK BoCC Amber-listed species of international importance for the wintering population in the UK. There is suitable foraging habitat for barnacle goose within the Proposed Development Site. However, none were recorded using the site for roosting or foraging and therefore no impact of

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
			NHZ: 328 wintering individuals	Scotland, particularly the Outer and Inner Hebrides, with birds from Svalbard wintering largely along the Solway Firth.	goose qualified for CRM. Annual predicted collision mortality is 0.89 birds.		disturbance or displacement is predicted. A predicted annual 35ollisionn mortality of 0.89 birds represents 0.3% of the NHZ wintering population, 0.001% of the wintering population in Scotland, 0.0008% of the wintering population In the UK. Migrating barnacle geese may be at risk of collision with turbines, however the collision risk is considered to be of **negligible magnitude** and **not significant**. Therefore, barnacle goose is not considered to be an IOF.
Greylag goose	Amber	Local	UK: 47,000 breeding pairs; 230,000 wintering individuals Scotland: 20,000 breeding individuals; 85,000 wintering individuals No NHZ estimate	This is a common resident species breeding and wintering in Scotland, with a further wintering population arriving from Iceland (Scotland supports 95% of the Icelandic greylag goose population in winter). The breeding population in the south of Scotland is	A total of 52 flights of 158 birds were recorded across the breeding season VP surveys in 2020 and 2021, with 17 flights of 86 birds recorded during the non-breeding season VP surveys in 2020-2021 and 2021-2022. As 25 flights of 102 birds were recorded at PCH in the CRZ,	No	Greylag goose is a UK BoCC Amber-listed species for the wintering population in the UK. Greylag geese were observed using the Proposed Development Site for foraging. Although foraging greylag geese may be impacted by disturbance and displacement, the impact during construction and decommissioning would be temporary and it is expected that greylag geese would continue to use the foraging habitat within the Proposed Development Site during operation. Additionally, there is extensive foraging habitat available

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
				considered to be naturalised and feral and not of conservation importance. The non-breeding population which winters in the south of Scotland, however, largely comprises birds that breed in Iceland, and is of conservation importance.	greylag goose qualified for CRM. Non-breeding season predicted collision mortality is 0.07 birds.		within the surrounding area. The impact of disturbance and displacement is considered to be of **low negative magnitude** and **not significant**. A predicted non-breeding season collision mortality of 0.07 birds represents 0.00008% of the wintering population in Scotland and 0.00003% of the wintering population in the UK. The collision risk is considered to be of **negligible magnitude** and **not significant**. Therefore, greylag goose is not considered to be an IOF.
Pink-footed goose	Amber	Regional	UK: 510,000 wintering individuals Scotland: 100,000-150,000 wintering individuals, 200,000 migrating individuals in October NHZ: 47,407 wintering individuals	Pink-footed goose from Iceland and Greenland are a common wintering species across the east and south of Scotland, with 50% of the world's wintering population supported in winter, and approximately 66% of the world's migrating population in Autumn.	A total of 38 flights of approximately 2043 birds was recorded during the non-breeding season VP surveys in 2020-2021 and 2021-2022. As 30 flights of 1565 birds were recorded at PCH in the CRZ, pink-footed goose qualified for CRM.	No	Pink-footed goose is a UK BoCC Amber-listed species of international importance for the wintering population in the UK. There is suitable foraging habitat for pink-footed goose within the Proposed Development Site. However, no pink-footed geese were recorded using the site for roosting or foraging and therefore no impact of disturbance or displacement is predicted. A predicted annual collision mortality of 1.42 birds represents 0.003% of the NHZ wintering

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
					Annual predicted collision mortality is 1.42 birds.		population, 0.001% of the wintering population in Scotland, and 0.0003% of the wintering population in the UK. The collision risk is considered to be of **negligible magnitude** and **not significant**. Therefore, pink-footed goose is not considered to be an IOF. However, as non-breeding pink-footed goose is a designated feature of Greenlaw Moor SPA and Ramsar site, it has been considered as part of the Appropriate Assessment Screening for the SPA and the Ramsar site.
Red grouse	Amber, SBL	Local	UK: 265,000 breeding pairs Scotland: 100,000-150,000 breeding pairs; 200,000-300,000 wintering individuals No NHZ estimate	This is a common and widespread resident species within Scotland which holds approximately 40% of the *Lagopus lagopus scotica* population. Red grouse are abundant in open heather moorland habitat in the uplands across Scotland. Much of	A single breeding territory was identified within 50 m of the solar PV area during the MBBS in 2021.	No	Red grouse is a UK BoCC Amber List and SBL-listed species of conservation concern. It is listed as a notified feature of the designated breeding bird assemblage for Greenlaw Moor SSSI. Red grouse breed in heather moorland and are a common breeding resident in Scotland. It is expected that 4.05% of suitable breeding habitat (4.44 ha of a total of 109.59 ha of heather moorland and blanket bog habitat (see Table 7.11 in Chapter 7:

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
				the heather moorland habitat in Scotland is managed for the shooting of red grouse.			Ecology, Volume 2)) will be permanently lost within the Proposed Development Site and 37.95% (41.59 ha) will be permanently changed within the solar PV area. However, this represents 0.48% of the estimated available heathland habitat within NHZ 20 (46.03 ha of 9512.4 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2) that will be permanently lost or changed as a result of the Proposed Development. A maximum of one breeding territory recorded within 50 m of the solar PV area represents 0.001% of the breeding population in Scotland and 0.0004% of the breeding population in the UK. However, given that there is extensive suitable breeding habitat available within the surrounding area, particularly in Greenlaw Moor SSSI, it is considered that the impact of habitat loss, disturbance and displacement would be of **negligible magnitude** and **not significant**. Therefore, red grouse is not considered to be an IOF. However, as red grouse is listed as a notified feature of the Greenlaw

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
							Moor SSSI breeding bird assemblage, it is considered as part of the assessment of impacts on Greenlaw Moor SSSI.
Black grouse	Red, SBL, LBAP	Local	UK: 4850 lekking males Scotland: 3550-5750 lekking males; 7500-19,000 wintering individuals NHZ: 89 displaying males	This is a widespread resident species within Scotland which holds approximately 71% of the population in the UK. The highest concentrations of black grouse are within Perth and Kinross, North-east Scotland and Badenoch and Strathspey. This species is more sparsely distributed across Argyll, Ayrshire, Dumfries and Galloway and the Borders.	No black grouse were recorded within the black grouse survey area. Incidental records of lekking black grouse were recorded outside of the black grouse survey area during the VP surveys in May 2021. A single flight by a single bird was recorded during the breeding season VP surveys in 2021. As the single flight was by <10 birds, the flight did not qualify for CRM.	No	Black grouse is a UK BoCC Red List and SBL-listed species of conservation concern that is also listed on the Scottish Borders LBAP, due to significant decline in the UK breeding population. It is listed as a notified feature of the designated breeding bird assemblage for Greenlaw Moor SSSI. No black grouse or leks were recorded within 1.5 km of the Proposed Development Site and permanent loss of suitable breeding habitat within the Proposed Development Site is expected to be low (4.15% (1.92 ha of 46.23 ha) of dry heathland habitat will be permanently lost, with 9.45% (4.37 ha) permanently changed within the solar PV area (see Table 7.11 in Chapter 7: Ecology, Volume 2)). This represents 0.07% of the estimated dry heathland habitat within NHZ 20 (6.29 ha of 8514.9 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2) that will be permanently

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
							lost or changed as a result of the Proposed Development. Any potential for disturbance and displacement effects on black grouse, including the lek site recorded outside of the 1.5 km survey area will be avoided through implementation of embedded mitigation (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12). it is considered that the impact of habitat loss, disturbance and displacement would be of **negligible magnitude** and **not significant**. As only a single flight was recorded across all VP surveys and it was not at PCH, it is considered that collision risk for this species of **negligible magnitude** and not **significant**. Therefore, black grouse is not considered to be an IOF. However, as black grouse is listed as a notified feature of the Greenlaw Moor SSSI breeding bird assemblage, it is considered as part of the assessment of impacts on Greenlaw Moor SSSI.
Oystercatcher	Amber, LBAP	Local	UK: 95,500 breeding pairs;	This is a common and widespread	Four breeding territories were	No	Oystercatcher is a UK BoCC Amber-listed species of

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
			305,000 wintering individuals Scotland: 84,500-116,500 breeding pairs; 80,000-120,000 wintering individuals No NHZ estimate	breeding species in Scotland, which supports 71% of breeding population in the UK. The breeding population in Scotland migrate south to winter elsewhere in the UK and Ireland, with the wintering population comprising birds from Fennoscandia, Iceland and the Faeroe Islands.	identified within the Proposed Development Site during the MBBS in 2020 and in 2021. During both 2020 and 2021, three breeding territories were located within 500 m of the Proposed Development. A total of 54 flights by 74 birds was recorded during the breeding season VP surveys, with a single flight of three birds recorded during the non-breeding season VP surveys in 2020-2021. As seven flights of 8 birds were recorded at PCH in the CRZ, oystercatcher qualified for CRM. Annual predicted collision mortality is 0.03 birds.		conservation concern that is also listed on the Scottish Borders LBAP. It is expected that 1.93% of suitable breeding habitat (9.27 ha of 481.07 ha of grassland, heathland and cultivated arable land habitats combined (see Table 7.11 in Chapter 7: Ecology, Volume 2)) will be permanently lost within the Proposed Development Site and 14.29% (68.76 ha) will be permanently changed within the solar PV area. However, this represents 0.7% of the estimated available marshy grassland and heathland habitat within NHZ 20 (78.03 ha of 11109.3 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2) that will be permanently lost or changed as a result of the Proposed Development. There is extensive suitable breeding habitat for oystercatcher within the surrounding area, and suitable habitat within the Proposed Development Site will be restored and created with the implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12). A maximum of three breeding territories recorded within 500 m of the Proposed

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
							Development during both survey years represents 0.004% of the breeding population in Scotland, and 0.003% of the breeding population in the UK. It is therefore considered that the impact of habitat loss, disturbance and displacement would be of **low negative magnitude** and **not significant**. A predicted annual collision mortality of 0.03 birds represents 0.0002% of the breeding population in Scotland and 0.00002% in the UK, and 0.0003% and 0.00001% of the wintering population in Scotland and the UK, respectively. The impact of collision risk is therefore considered to be of **negligible magnitude** and **not significant**. Therefore, oystercatcher is not considered to be an IOF.
Lapwing	Red, SBL	Local	UK: 97,500 breeding pairs; 635,000 wintering individuals Scotland: 71,500-105,600 breeding pairs	This is a common and widespread breeding species within Scotland which holds approximately 52-66% of the breeding population in the UK. The	A total of 28 breeding territories were identified within the Proposed Development Site in 2020, with 27 identified in 2021. Of these breeding territories, 21 were	No	Lapwing is a UK BoCC Red List and SBL-listed species of conservation concern that has seen significant decline in the breeding population in Scotland in the past 26 years. It is expected that 1.93% of suitable breeding habitat (9.27 ha of 481.07 ha of grassland,

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
			No NHZ estimate	highest breeding densities are located within the Northern Isles, Inner and Outer Hebrides, and lowland agricultural areas of the south and east of Scotland. The breeding population of lapwing in Scotland has seen significant decline within the past 26 years of 62%[63].	located within 500 m of the Proposed Development in 2020, with 26 located within 500 m of the Proposed Development in 2021. A total of 324 flights by 1173 birds was recorded during the breeding season VP surveys, with 22 flights by 369 birds recorded during the non-breeding season VP surveys. As 40 flights of 379 birds were recorded at PCH in the CRZ, lapwing qualified for CRM. Breeding season and non-breeding season predicted collision mortality is		heathland and cultivated arable land habitats combined (see Table 7.11 in Chapter 7: Ecology, Volume 2)) will be permanently lost within the Proposed Development Site and 14.29% (68.76 ha) will be permanently changed within the solar PV area. However, this represents 0.7% of the estimated available marshy grassland and heathland habitat within NHZ 20 (78.03 ha of 11109.3 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2) that will be permanently lost or changed as a result of the Proposed Development. There is extensive suitable breeding habitat for lapwing within the surrounding area, and suitable habitat within the Proposed Development Site will be restored and created with the implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12). A maximum of 26 breeding territories recorded within 500 m of the Proposed Development represents 0.04% of the breeding population in

[63] *Heywood, J.J.N., Massimino, D., Balmer, D.E., Kelly, L., Noble, D.G., Pearce-Higgins, J.W., Woodcock, P., Wotton, S., Gillings, S. & Harris, S.J. 2023. The Breeding Bird Survey 2022. BTO Research Report 756. British Trust for Ornithology, Thetford.*

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
					0.41 and 0.96 birds, respectively.		Scotland and 0.03% in the UK. It is therefore considered that the impact of habitat loss, disturbance and displacement would be of **low negative magnitude** and **not significant**. A predicted breeding season collision mortality of 0.41 birds represents 0.0003% of the breeding population in Scotland and 0.0002% of the breeding population in the UK. A predicted non-breeding season collision mortality of 0.96 birds represents 0.0002% of the wintering population in the UK. The impact of collision risk is therefore considered to be of **negligible magnitude** and **not significant**. Therefore, lapwing is not considered to be an IOF.
Golden plover	Annex I, SBL, LBAP	Local	UK: 32,500-50,500 breeding pairs; 410,000 wintering individuals Scotland: 15,000 breeding pairs; 25,000-35,000 wintering	Golden plover is a widespread breeding bird in upland habitat in Scotland, supporting 80% of the breeding population in the UK. During winter, golden plover	A single breeding territory was identified within the Proposed Development Site in 2020. This breeding territory was located within 500 m of the Proposed Development.	**Yes**	Golden plover is an Annex I, SBL-listed species of conservation concern that is also listed on the Scottish Borders LBAP. It is listed as a notified feature of the designated breeding bird assemblage for Greenlaw Moor SSSI. Given the high conservation status of golden plover and predicted risk of collision, golden plover is

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
			individuals; 10,000-30,000 spring passage individuals; 20,000-60,000 autumn passage individuals NHZ: 1058 breeding pairs	occupy coastal areas around Scotland, joined by other wintering golden plover from Fennoscandia and Greenland.	A total of 10 flights by 588 birds was recorded during the breeding season VP surveys, with 32 flights by 509 birds recorded during the non-breeding season VP surveys. As 19 flights of 475 birds were recorded at PCH in the CRZ, golden plover qualified for CRM. Breeding season and non-breeding season predicted collision mortality is 5.59 and 4.76 birds, respectively.		considered to be an IOF and is taken forward for a full EcIA.
Curlew	Red, SBL, LBAP	Regional	UK: 58,500 breeding pairs; 125,000 wintering individuals Scotland: 58,800 breeding pairs; 85,700 wintering individuals	There is a widespread population of breeding curlew within Scotland in upland and agricultural areas, supporting approximately 16-27% of the European breeding population.	Eight breeding territories were identified within the Proposed Development Site in 2020, with six identified in 2021. Of these breeding territories, seven were located within 500 m of the Proposed	No	Curlew is a UK BoCC Red List and SBL-listed species of conservation concern also listed on the Scottish Borders LBAP. It is expected that 1.93% of suitable breeding habitat (9.27 ha of 481.07 ha of grassland, heathland and cultivated arable land habitats combined (see Table 7.11 in Chapter 7: Ecology, Volume 2)) will be permanently lost within the Proposed Development

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
			NHZ: 1,400 breeding pairs	There has been a significant decline (60%) in breeding curlew in Scotland within the past 26 years[63].	Development in 2020, with five in 2021. A total of 251 flights by 362 birds was recorded during the breeding season VP surveys, with 14 flights by 17 birds recorded during the non-breeding season VP surveys. As 58 flights of 84 birds were recorded at PCH in the CRZ, curlew qualified for CRM. Breeding season predicted collision mortality is 0.21 birds.		Site and 14.29% (68.76 ha) will be permanently changed within the solar PV area. However, this represents 0.7% of the estimated available marshy grassland and heathland habitat within NHZ 20 (78.03 ha of 11109.3 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2) that will be permanently lost or changed as a result of the Proposed Development. There is extensive suitable breeding habitat for curlew within the surrounding area, and suitable habitat within the Proposed Development Site will be restored and created with the implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12). A maximum of seven breeding territories recorded within 500 m of the Proposed Development represents 0.5% of the NHZ breeding population, 0.01% of the breeding population in Scotland and the UK. It is therefore considered that the impact of habitat loss, disturbance and displacement would be of **low negative magnitude** and **not significant**. A predicted breeding season collision mortality of 0.21 birds

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
							represents 0.008% of the NHZ breeding population, 0.0002% of the breeding population in Scotland, and the UK. The impact of collision risk is therefore considered to be of **negligible magnitude** and **not significant**. Therefore, curlew is not considered to be an IOF.
Snipe	Amber, LBAP	Regional	UK: 66,500 breeding pairs; 1,100,000 wintering individuals Scotland: 34,000-40,000 breeding pairs; 10,000-30,000 wintering individuals NHZ: 908 breeding pairs	Breeding snipe are widespread within Scotland, with 65% of the UK breeding population present in marshy grassland and wet bog habitat across lowland and upland areas. Although there has been an overall 17% increase in breeding snipe in Scotland within the past 26 years, a 10% decline was reported between 2021 and 2022[63].	Eleven breeding territories were identified within the Proposed Development Site in 2020, with eight identified in 2021. Of these breeding territories, nine were located within 500 m of the Proposed Development in 2020, with seven located within 500 m of the Proposed Development in 2021. A total of 23 flights by 37 birds was recorded during the breeding season VP surveys, with	**Yes**	Snipe is a UK BoCC Amber List-listed species of conservation concern also listed on the Scottish Borders LBAP. Given the conservation status of snipe and the maximum number of breeding territories present within 500 m of the Proposed Development, snipe is considered to be an IOF and is taken forward for a full EcIA.

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
					three flights by six birds recorded during the non-breeding season VP surveys. As eight flights of 12 birds were recorded at PCH and at CRZ, snipe qualified for CRM. Breeding season predicted collision mortality is 0.21 birds.		
Redshank	Amber, LBAP	Local	UK: 22,000 breeding pairs; 100,000 wintering individuals Scotland: 11,700-17,500 breeding pairs; 4000-25,000 wintering individuals No NHZ estimate	Redshank is a common and widespread resident and migrant bird in Scotland, with 40% of the breeding population in the UK supported. Redshank breed predominantly in wetland habitat and move to occupy coastal areas during winter.	A single breeding territory was recorded within the Proposed Development Site in 2020 and in 2021. Both were located within 500 m of the Proposed Development. Two flights by single birds were recorded during the breeding season VP surveys in 2020, with a single flight	No	Redshank is a UK BoCC Amber List-listed species of conservation concern due to significant long-term population decline. It is also listed on the Scottish Borders LBAP. It is expected that 1.74% of suitable breeding habitat (1.18 ha of 67.63 ha of marshy grassland habitat (see Table 7.11 in Chapter 7: Ecology, Volume 2)) will be permanently lost within the Proposed Development Site and 27.93% (18.89 ha) will be permanently changed within the solar PV area. However, this represents 1.26% of the estimated available marshy grassland habitat

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
					by a single bird recorded in 2021. As none of the flights were at PCH in the CRZ, redshank did not qualify for CRM.		within NHZ 20 (20.07 ha of 1596.9 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2) that will be permanently lost or changed as a result of the Proposed Development. There is extensive suitable breeding habitat for redshank within the surrounding area, and suitable habitat within the Proposed Development Site will be restored with the implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12). A maximum of one breeding territory recorded within 500 m of the Proposed Development represents 0.009% of the breeding population in Scotland and 0.005% of the breeding population in the UK. It is therefore considered that the impact of habitat loss, disturbance and displacement would be of **low negative magnitude** and **not significant**. As none of the flights were recorded at PCH in the CRZ, it is considered that collision risk would be of **negligible magnitude** and **not significant**. Therefore, redshank is not considered to be an IOF.

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
Golden eagle	Schedule 1, 1A and A1, Annex I, SBL	Negligible	UK: 510 breeding pairs Scotland: 508 breeding pairs NHZ: 3 occupied territories (based on results of the 2003 golden eagle survey)	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 known occupied territory between 2007 and 2013[44]. Since 2018, juvenile and immature golden eagles have been released in the Moffat Hills as part of the SSGEP to boost the local population. The most recent report produced by the SSGEP noted that since the start of the translocation project, there are 46 golden eagles within the south of Scotland population[46].	No golden eagles were recorded during baseline ornithology surveys and no records of golden eagle within 10 km of the Proposed Development were returned in the desk study. As the population of golden eagles is expanding as result of the SSGEP, it is likely that these birds, most of which are currently sub-adults, will seek to re-colonise historic territories within the south of Scotland. The Lammermuir Hills has potential suitable habitat for a single pair of golden eagles to occupy a breeding territory[47]. Therefore, a GET model[49] was carried out to assess the suitability of habitat	No	Golden eagle is a Schedule 1, 1A and A1, Annex I and SBL-listed species of conservation concern. The Lammermuir Hills in comparison with other upland sites in the south of Scotland, has less available suitable habitat, high disturbance due to public recreation and a high occurrence of potential persecution incidents[47]. Given that there were no records of golden eagle within the Proposed Development Site, no records within 10 km were returned during the desk study, and there is minimal suitable habitat for golden eagle within the Proposed Development Site, it is considered that there would be little potential for disturbance or displacement effects on this species. Therefore, golden eagle is not considered to be an IOF.

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
					within the Proposed Development and surrounding 300 m buffer, as per NatureScot guidance[48].		
Short-eared owl	Annex I, Amber, SBL	Local	UK: 620-2200 breeding pairs Scotland: 125-1250 breeding pairs; 300-3000 wintering individuals; 5-20 spring passage individuals; 20-100 autumn passage individuals NHZ: 35 breeding pairs	Short-eared owl are a resident breeding species in the uplands of Scotland, with 77% of the breeding population in the UK supported. During winter, short-eared owl occupy marshes and coastal grasslands.	A single flight by a single bird was recorded during the breeding season VP surveys in 2020, with five flights by single birds recorded in 2021. None of these flights were recorded at PCH in the CRZ and did not qualify for CRM.	No	Short-eared owl is an Annex I, UK BoCC Amber List and SBL-listed species of conservation concern. It is listed as a notified feature of the designated breeding bird assemblage for Greenlaw Moor SSSI. Suitable breeding habitat is present within the Proposed Development Site. Although there were no records of short-eared owl breeding or roosting. It is considered that disturbance or displacement effects on this species would be of negligible **magnitude** and not **significant**. No flights were recorded at PCH and in the CRZ, short-eared owl is a notified feature of the Greenlaw Moor SSSI breeding bird assemblage. collision risk would be of **negligible magnitude** and not **significant.** Therefore, short-eared owl is not considered to be an IOF.

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
							However, as short-eared owl is listed as a notified feature of the Greenlaw Moor SSSI breeding bird assemblage, it is considered as part of the assessment of impacts on Greenlaw Moor SSSI.
Peregrine	Schedule 1, Annex I, SBL, LBAP	Local	UK: 1750 (1600-1900) breeding pairs Scotland: 600 breeding pairs; 2000-2500 wintering individuals NHZ: 27 breeding pairs	Peregrine is a scarce but widespread resident species in Scotland, which supports 42% of the UK population and 6% of the European population. Peregrine breeds in various habitats, nesting on cliffs in uplands, coasts, quarries and even in cities.	Seven flights by single birds were recorded during the breeding season VP surveys in 2020, and during the 2020-2021 non-breeding season. Four flights by single birds were recorded during the 2021-2022 non-breeding season. As five flights of single birds were recorded at PCH in the CRZ, peregrine qualified for CRM. Both breeding season and non-breeding season predicted collision mortality is 0.01 birds.	No	Peregrine is a Schedule 1, Annex I, SBL-listed species of conservation concern, also listed on the Scottish Borders LBAP. A predicted breeding season collision mortality of 0.01 birds represents 0.02% of the NHZ breeding population, 0.008% of the breeding population in Scotland, and 0.0003% of the breeding population in the UK. A predicted non-breeding season collision mortality of 0.01 birds represents 0.0005% of the wintering population in Scotland. Collision risk is considered to be of **negligible magnitude** and **not significant**. Therefore, peregrine is not considered to be an IOF.

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
Skylark	Red, SBL	Local	UK: 1,550,000 breeding territories Scotland: 290,000-557,000 breeding pairs; 13,000-40,000 wintering individuals No NHZ estimate	Skylark is common and widespread within Scotland, with an estimated 290,000-557,000 breeding pairs, noted in Forrester et al. (2007). This species breeds in open habitats across Scotland and is commonly associated with open agricultural land and upland moorland, supporting up to 31% of the estimated UK breeding population. The breeding population of skylark in Scotland has increased by 16% since 2011 but has seen an overall 5% decrease since 1995.	Nineteen breeding territories were recorded in 2020, with eight recorded in 2021. Sixteen of the territories identified in 2020 were located within 50 m of the solar PV area, with seven located within 50 m in 2021.	No	Skylark is a UK BoCC Red List and SBL-listed species of conservation concern. Although skylark are common and widespread within Scotland. It is expected that 1.59% of suitable breeding habitat (5.57 ha of 350.08 ha of acid, neutral and improved grassland, dry heathland and cultivated arable land habitats combined (see Table 7.11 in Chapter 7: Ecology, Volume 2)) will be permanently lost within the Proposed Development Site and 3.61% (12.65 ha) will be permanently changed within the solar PV area. There is extensive suitable breeding habitat for skylark within the surrounding area, and suitable habitat within the Proposed Development Site will be restored and created with the implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12). A maximum of 16 breeding territories recorded within 50 m of the solar PV area represents 0.006% of the breeding population in Scotland and 0.001% of the breeding population in the UK. It is therefore considered that the impact of habitat loss,

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
							disturbance and displacement would be of **low negative magnitude** and **not significant**. Therefore, skylark is not considered to be an IOF.
Meadow pipit	Amber	Local	UK: 2,450,000 breeding pairs Scotland: 1,000,000-1,600,000 breeding pairs; 10,000-50,000 wintering individuals No NHZ estimate	Meadow pipit is one of the most abundant and widespread passerines within Scotland, which holds an estimated 51% of the UK breeding population. 14% decline in breeding population in Scotland in the past 26 years[63].	Approximately seventy-four breeding territories were identified within the MBBS area, of which 18 are estimated to have been present within 50 m of the solar PV area in 2020.	No	Meadow pipit is a species of conservation concern, listed on the UK BoCC Amber List. Although meadow pipit are abundant and widespread within Scotland. It is expected that 1.93% of suitable breeding habitat (9.27 ha of 481.07 ha of grassland, heathland and cultivated arable land habitats combined (see Table 7.11 in Chapter 7: Ecology, Volume 2)) will be permanently lost within the Proposed Development Site and 14.29% (68.76 ha) will be permanently changed within the solar PV area. However, this represents 0.7% of the estimated available marshy grassland and heathland habitat within NHZ 20 (78.03 ha of 11109.3 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2) that will be permanently lost or changed as a result of the Proposed Development. There is extensive suitable breeding habitat for meadow pipit within the surrounding area, and

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
							suitable habitat within the Proposed Development Site will be restored and created with the implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12). An approximate estimate of 18 breeding territories, recorded within 50 m of the solar PV area represents 0.002% of the breeding population in Scotland and 0.0007% of the breeding population in the UK. It is therefore considered that the impact of habitat loss, disturbance and displacement would be of **negligible magnitude** and **not significant**. Therefore, meadow pipit is not considered to be an IOF.
Reed bunting	Amber, SBL, LBAP	Local	UK: 275,000 breeding territories Scotland: 15,000-30,000 breeding pairs; 40,000-90,000 wintering individuals No NHZ estimate	This is a common resident in Scotland, breeding in a variety of wetland and riparian habitats across much of Scotland. A significant increase of 57% in breeding reed bunting since 1995[63].	Four breeding territories were identified within 50 m of the solar PV area in 2020, with two identified in 2021.	No	Reed bunting is a UK BoCC Amber List and SBL-listed species of conservation concern that is also listed on the Scottish Borders LBAP. It is expected that 2.13% of suitable breeding habitat (5.06 ha of 237.81 ha of marshy grassland, wet heathland, flush and cultivated arable land habitats combined (see Table 7.11 in Chapter 7: Ecology, Volume 2)) will be permanently lost within the Proposed Development

Feature	Covering legislation and guidance/ conservation designation	Geographical level of value	Population estimate[61,62,34]	Scottish context[62]	Baseline	IOF	Justification
							Site and 23.69% (56.34 ha) will be permanently changed within the solar PV area. However, this represents 3.08% of the estimated available wet heathland habitat within NHZ 20 (61.40 ha of 1995 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2) that will be permanently lost or changed as a result of the Proposed Development. There is extensive suitable breeding habitat for reed bunting within the surrounding area, and suitable habitat within the Proposed Development Site will be restored and created with the implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12). A maximum of four breeding territories recorded within 50 m of the solar PV area represents 0.03% of the breeding population in Scotland and 0.002% of the breeding population in the UK. It is therefore considered that the impact of disturbance and displacement would be of **negligible magnitude** and **not significant**. Therefore, reed bunting is not considered to be an IOF.

Impact Assessment

8.6.16. Six features have been identified as IOFs, requiring EIA following the application of embedded mitigation (see Section 1.8.6, Paragraphs 8.6.3 to 8.6.13). These are:

- Greenlaw Moor SPA;
- Greenlaw Moor Ramsar site;
- Greenlaw Moor SSSI;
- Outer Firth of Forth and St Andrews Bay Complex SPA;
- Golden plover; and
- Snipe.

8.6.17. An impact assessment for each of these ornithological features is provided below for the construction and operation periods. For all species, decommissioning effects are predicted to be of similar or lower magnitude to the effects during construction.

8.6.18. A Screening for Appropriate Assessment (AA) for Greenlaw Moor SPA and Ramsar site and the Outer Firth of Forth and St Andrews Bay Complex SPA is provided in Section 1.8.10.

Greenlaw Moor SSSI

8.6.19. Greenlaw Moor SSSI lies approximately 10 m south-west of the Proposed Development Site. The SSSI is designated for non-breeding pink-footed goose and its breeding bird assemblage which includes golden plover, red grouse, short-eared owl and black grouse as notified features. The most recent site condition assessment assessed the non-breeding pink-footed goose population as favourable maintained, but the breeding bird assemblage in Greenlaw Moor SSSI as unfavourable declining. As Greenlaw Moor SSSI comprises active raised bog, moorland and wetland habitat, the site is also of local importance for other passage and wintering wildfowl and waders.

8.6.20. The SSSI regularly supports approximately 3-6% of the wintering population of pink-footed goose in the UK (15,300-30,600 individuals). As a predicted annual mortality of 1.42 pink-footed geese through collision with the Proposed Development turbines is equivalent to 0.009% of the SSSI population, the Proposed Development is not considered to affect the integrity of the SSSI population.

8.6.21. The most recent Site Condition Monitoring (SCM) of the breeding bird assemblage at Greenlaw Moor SSSI[64], undertaken by NatureScot in 2017, revealed that golden plover and red grouse bred within the SSSI, but short-eared owl and black grouse were absent. Further target species included within the breeding bird assemblage (not included in the SSSI citation but in the Site Management Statement), that were recorded within the Proposed Development Site were oystercatcher, lapwing, curlew, redshank, snipe, peregrine, skylark, meadow pipit and reed bunting.

8.6.22. During the SCM, a total of five golden plover breeding territories (three probable and two possible) were identified within the SSSI. As the Proposed Development is in close proximity to the SSSI, it is possible that golden plover breeding within the SSSI would pass through the Proposed Development Site to forage (3-11 km foraging range during the breeding season). The predicted collision mortality of golden plover per breeding season as a cause of the Proposed Development is 5.59 birds (56% of the SSSI breeding population noted in the SCM report, assuming the presence of two birds per breeding territory). However, many of the golden plover flights were recorded at height band 5 (HB5 = >180 m). CRM was conducted assuming

[64] *Coiffait, L., Cathrine, C. & Gillen, C. (2020). Site Condition Monitoring of breeding bird assemblage feature on Greenlaw Moor SSSI. Scottish Natural Heritage (Now NatureScot) Research Report No. 1117.*

a maximum RSH of 200 m (see Section 1.8.3, Paragraph 1.8.3.23). Height band 5 was included in CRM to account for an additional 20 m of maximum RSH, it is likely that the collision mortality rate was overestimated as flights could have been greater than 200 m. In a CRM scenario during which height band 5 was removed, breeding season collision risk reduced to 0.28 individuals per breeding season. This would result in a more accurate collision mortality of 2.8% of the SSSI population.

8.6.23. The majority of flights recorded during the breeding season were recorded during March and April and as such are considered to be associated with birds on passage. It is therefore considered that these flights were not associated with birds breeding within the SSSI, and therefore it is considered unlikely that a collision mortality of golden plover would impact on golden plover breeding within Greenlaw Moor SSSI.

8.6.24. Predicted breeding season collision mortality rates of oystercatcher and lapwing (0.03 and 0.41 birds), also included in the SSSI breeding bird assemblage, if realised would equate to 1.5% and 2.9% of the most recently recorded oystercatcher and lapwing breeding population within the SSSI. However, given the high number of lapwing territories recorded within the Proposed Development Site, it is likely that flights recorded are associated with lapwing breeding within the Proposed Development Site rather than those breeding within Greenlaw Moor SSSI.

8.6.25. The SSSI is heavily managed for red grouse shoots, with extensive muirburn to the east of the SSSI noted in the most recent SCM report. It was reported that 21 red grouse territories were present within the SSSI in 2017. As the habitat within the SSSI is heavily managed for breeding red grouse, and the SSSI population is regularly subject to disturbance through recreational shoots, it is considered unlikely that the Proposed Development would impact the SSSI population.

8.6.26. Although short-eared owl and black grouse were not recorded within the SSSI during the most recent SCM, there is suitable breeding habitat present within the SSSI. It is considered in the SCM report by NatureScot that the absence of short-eared owl may be due to the nomadic nature of the species or under-recording given the difficulty to survey this species. Conversely, the absence of black grouse within the SSSI is attributed to local decline of black grouse within the Lammermuir Hills (64% between 1989-99 and 2006-12), such that the lek site recorded within the SSSI during the SCM in 2009 may no longer be in use.

8.6.27. Additionally, no red grouse, short-eared owl or black grouse flights were recorded in the CRZ at PCH. It is therefore considered that any impacts of collision risk would be negligible for these species. Furthermore, impacts of disturbance on breeding birds within Greenlaw Moor SSSI are considered to be negligible and would be temporary during construction and decommissioning of the Proposed Development. Any impacts of disturbance would be avoided with the implementation of embedded mitigation (see Section 1.8.6, Paragraphs 1.8.6.3 to 1.8.6.13).

8.6.28. Although the Proposed Development may result in a collision mortality rate of 2.8%, 1.5% and 2.9% of the golden plover, oystercatcher and lapwing population of the SSSI, this is unlikely to be realised. Furthermore, golden plover, oystercatcher and lapwing are part of the larger breeding bird assemblage, one qualifying feature for which Greenlaw Moor SSSI is designated. Therefore, the impact of the Proposed Development on the integrity of Greenlaw Moor SSSI is considered to be of **moderate negative magnitude** and **not significant**.

Golden Plover

Introduction

8.6.29. Golden plover is an Annex I-listed species of international conservation concern, which is also listed on the SBL and Scottish Borders LBAP. It is a widespread resident breeder in upland areas; found in lowland farmland and near coasts in winter. The most recent golden plover breeding population estimate in Scotland is 15,000 breeding pairs (approximately 80% of the

UK breeding population), with an NHZ 20 breeding population estimated at 1,058 breeding pairs in 2005[34]. The population increases during spring and autumn passage (10,000-30,000 and 20,000-60,000 individuals, respectively). Similarly, an estimated 25,000-35,000 individuals winter in Scotland, with resident birds joined by migrants from Fennoscandia and Greenland[62].

Baseline Summary

8.6.30. A single breeding territory was identified within the Proposed Development Site during the MBBS in 2020.

8.6.31. A total of 10 flights by 588 birds was recorded during the breeding season VP surveys, with 32 flights of 509 birds recorded during the non-breeding season VP surveys in 2020-2021.

Potential Habitat Loss Impacts

8.6.32. The construction of the Proposed Development is expected to result in a temporary loss of 4.32 ha of overall habitat within the Proposed Development Site (532.64 ha) during construction, a permanent loss of 9.28 ha, and a permanent change of 69.77 ha of habitat within the Proposed Development Site during operation (see Chapter 7: Ecology, Volume 2 of the EIAR). This will result in a direct impact on habitat availability for golden plover, with 1.28 ha (1.17%) of 109.59 ha of heathland habitat (see Table 7.11 in Chapter 7: Ecology, Volume 2) within the Proposed Development Site lost temporarily, 4.44 ha (4.05%) of heathland habitat lost permanently, and 41.59 ha (37.95%) permanently changed within the solar PV area. Permanent loss and change of heathland habitat within the Proposed Development Site represents 0.48% (46.03 ha) of the estimated available heathland habitat within NHZ 20 (9512.4 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2).

8.6.33. Although 37.95% of the heathland habitat within the Proposed Development Site will be changed permanently, nesting and foraging opportunities will remain within the solar PV array following construction and restoration of habitat beneath and surrounding the array. There is also extensive suitable breeding habitat for golden plover within the surrounding area, particularly in Greenlaw Moor SSSI where heather moorland is managed. Additionally, existing wetland and peatland habitats will be restored and additional habitat created with the implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12). The impact of temporary habitat loss is therefore considered to be of **negligible magnitude** and **not significant**, whereas the impact of permanent habitat loss is considered to be of **low negative magnitude** and **not significant**.

Potential Disturbance and Displacement Impacts

8.6.34. Golden plover is likely to be susceptible to disturbance, particularly during the chick-rearing stage[65] and should the disturbance level be sufficient, this can lead to displacement. In relation to wind developments, the construction phase of wind turbines and associated infrastructure has a greater impact of disturbance on golden plover than during the operational phase[66]. Embedded mitigation is in place to ensure that, where possible, construction works take place outside of the main breeding bird season (March to August). Where this is not possible, mitigation measures outlined in Section 1.8.6, Paragraphs 8.6.3 to 8.6.13, should be followed to avoid disturbance to breeding golden plover. As such, the potential impact of temporary

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

[66] *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.*

disturbance during construction, operational and decommissioning is considered to be of **low negative magnitude** and **not significant**.

8.6.35. A single breeding territory was identified during the MBBS in 2020, within 400 m of associated infrastructure of the Proposed Development. Golden plover is relatively well studied in relation to disturbance and 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[67]. 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)[68]. 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[66]. Moreover, golden plover was not identified as being particularly sensitive to wind farm developments during the wintering period[69].

8.6.36. Displacement from the solar PV area is expected to be permanent (>25 years in duration), with 0.09% of the NHZ population permanently displaced. It is expected that approximately 0.007% of the breeding population in Scotland may be permanently displaced over the lifetime of the Proposed Development. Given the relative abundance of alternative habitat to the south-west of the Proposed Development (within the Greenlaw Moor SSSI) the effect of the loss of nesting or foraging habitat for golden plover within the Proposed Development Site will be negligible. Therefore, the impact of displacement during operation on the breeding population of golden plover is considered to be of **negligible magnitude** and **not significant**.

8.6.37. 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.

Potential Collision Risk Impacts

8.6.38. Of the 10 flights recorded during the breeding season VP surveys, five flights of 240 individuals were recorded in the CRZ at PCH. During the non-breeding VP surveys, 14 of 32 flights, by 235 individuals, were recorded in the CRZ at PCH. Assuming a 98% avoidance rate, as recommended by NatureScot[22], collision risks of 5.59 collisions per breeding season (0.27% of the NHZ 20 breeding population and 0.06% of the spring passage population in Scotland) and 4.67 per non-breeding season (an approximate maximum of 0.02% of the wintering population and 0.02% of the autumn passage population in Scotland) were predicted. The combined annual collision risk estimate for golden plover is therefore 10.35 birds.

8.6.39. However, many of the golden plover flights were recorded at height band 5 (HB5 = >180 m). CRM was conducted assuming a maximum RSH of 200 m (see Section 1.8.3, Paragraph 1.8.3.23). Height band 5 was included in CRM to account for an additional 20 m of maximum RSH, it is likely that the collision mortality rate was overestimated as flights could have been greater than 200 m. In a CRM scenario during which height band 5 was removed, collision risk reduced to 0.28 individuals per breeding season and 3.95 individuals per non-breeding season, with a combined annual risk of 4.23 individuals (see Technical Appendix 8.1: Ornithology,

[67] *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).*

[68] *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.*

[69] *McGuinness, S., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S. & Crowe, O. (2015). Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland. BirdWatch Ireland, Kilcoole, Wicklow.*

Volume 4 of the EIAR). It is unlikely that the predicted collision rate would be detectable against an annual background mortality of 22% in the UK[70]

8.6.40. The majority of flights by golden plover were recorded during the autumn passage period, with 32 flights recorded across September, November and December. Nine flights were recorded during the spring passage period in March and April, and a single flight was recorded during July 2020. As most of the flights were recorded during passage periods, it is likely that the flights recorded during these months are associated with birds overflying the Proposed Development Site on passage. Although a greater number of flights was recorded during the autumn passage period, a greater survey effort was completed during the autumn passage period, with migration VPs completed between September and November during both survey years, whereas spring migration VPs were only completed during the first year of surveys. As such, to reduce bias, the assessment is based on both the spring and autumn passage populations.

8.6.41. A measurable effect on the NHZ 20 breeding population, breeding population in Scotland and spring passage population in Scotland is unlikely to be realised. As such, the potential collision impacts on golden plover during the operational phase are considered to be of **moderate negative magnitude** and **not significant.**

Snipe

Introduction

8.6.42. Snipe are included on the UK BoCC Amber List and the Scottish Borders LBAP as a species of local importance. Scotland is estimated to support 34,000-40,000 breeding pairs, approximately 65% of the UK breeding population[62]. Most recently, the NHZ 20 population was estimated at 908 breeding pairs, approximately 2.6% of the breeding population in Scotland[34].

Baseline Summary

8.6.43. Eleven breeding territories were identified within the Proposed Development Site during the moorland breeding bird surveys in 2020, with eight identified in 2021.

8.6.44. A total of 23 flights by 37 birds was recorded during the breeding season VP surveys, with three flights of six birds recorded during the non-breeding season VP surveys in 2020-2021.

Potential Habitat Loss Impacts

8.6.45. The construction of the Proposed Development is expected to result in a temporary loss of 4.32 ha of overall habitat within the Proposed Development Site (532.64 ha) during construction, a permanent loss of 9.28 ha, and a permanent change of 69.77 ha of habitat within the Proposed Development Site during operation (see Chapter 7: Ecology, Volume 2 of the EIAR). This will result in a direct impact on habitat availability for snipe, with 1.5 ha (1.14%) of 131.91 ha of marshy grassland, wet heathland and flush habitat combined (see Table 7.11 in Chapter 7: Ecology, Volume 2) lost temporarily within the Proposed Development Site, 3.72 ha (2.82%) of marshy grassland, wet heathland and flush habitat lost permanently, and 56.11 ha (42.54%) permanently changed within the solar PV area. Permanent loss and change of marshy grassland and wet heathland habitat within the Proposed Development Site represents 2.31% (59.83 ha) of the estimated available marshy grassland and wet heathland habitat within NHZ 20 (2594.4 ha; see Table 7.18 in Chapter 7: Ecology, Volume 2).

8.6.46. Although 42.54% of the combined marshy grassland, wet heathland and flush habitat within the Proposed Development Site will be changed permanently, nesting and foraging opportunities will remain within the solar PV array following construction and restoration of habitat beneath

[70] *Pearce-Higgins, J. W. & Yalden, D. W. (2003) Golden plover Pluvialis apricaria breeding success on a moor managed for shooting red grouse Lagopus lagopus. Bird Study, 50:2, 170-177.*

and surrounding the array. As there is extensive suitable breeding habitat for snipe within the surrounding area, the impact of temporary habitat loss is considered to be of **negligible magnitude** and **not significant**. Additionally, as existing wetland and peatland habitats will be restored and additional habitat created with the implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12), the impact of permanent habitat loss is considered to be of **low negative magnitude** and **not significant**.

Potential Disturbance and Displacement Impacts

8.6.47. Snipe is likely to be susceptible to disturbance during the construction phase, and to occasional disturbance during the operational phase of the Proposed Development. Embedded mitigation is in place to ensure that, where possible, construction works take place outside of the main breeding bird season (March to August). Where this is not possible, mitigation measures outlined in Section 1.8.6, Paragraphs 8.6.3 to 8.6.13, should be followed to ensure disturbance to breeding snipe is avoided. Where embedded mitigation measures are followed, the potential impact of temporary disturbance during construction, operational and decommissioning is considered to be of **low negative magnitude** and **not significant**.

8.6.48. The effects of solar PV arrays on displacement of birds have been historically understudied and results of existing studies show varying effects on different species[29,71] , including beneficial effects[72]. However, studies of the behaviour of breeding skylark, a ground-nesting bird, within solar farms, indicate that nesting within solar farms is reduced in comparison to suitable breeding habitat that is undeveloped[28,72]. As it is considered that skylark and other open habitat ground-nesting birds require unbroken lines of sight in order to nest, it is possible that the presence of solar PV arrays will have a similar effect on snipe.

8.6.49. Of the 11 breeding territories identified during the MBBS in 2020, nine were located within 500 m of the Proposed Development and six of these were located within 50 m of the solar PV area. In 2021 seven of the eight breeding territories were located within 500 m of the Proposed Development, of which four were located within 50 m of the solar PV area. Displacement in relation to the turbines is therefore based on the annual maximum of nine breeding territories which represents 1% of the NHZ 20 population. As turbine construction displacement is considered to be temporary during construction/decommissioning only, this would result in 1% of the NHZ 20 population being temporarily displaced.

8.6.50. As construction of the solar PVs will result in a loss of ground nesting habitat, displacement from the solar PV area is considered to be permanent (>25 years in duration). A maximum of six breeding territories were recorded within 50 m of the solar PV area. This represents 0.7% of the NHZ 20 breeding population and 0.02% of the breeding population in Scotland which may be permanently displaced.

8.6.51. However, the area surrounding the Proposed Development is abundant in suitable breeding habitat for snipe, which will be improved with implementation of the OEMP (see Section 1.8.6, Paragraphs 1.8.6.11 to 1.8.6.12), which includes the creation of scrapes and the improvement of existing wetland. Therefore, the impact of displacement during construction, operation and decommissioning on the breeding population of snipe within NHZ 20 is considered to be of **low negative magnitude** and **not significant**.

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[71] *Taylor, R., Conway, J., Gabb, O. & Gillespie, J. (2019). Potential ecological impacts of ground-mounted photovoltaic solar panels. Available from - https://www.bsg-ecology.com/wp-content/uploads/2019/04/Solar-Panels-and-Wildlife-Review-2019.pdf [Accessed: 03/10/2023]*

[72] *H. Montag, G Parker & T. Clarkson. (2016). The Effects of Solar Farms on Local Biodiversity; A Comparative Study. Clarkson and Woods and Wychwood Biodiversity.*

Potential Collision Risk Impacts

8.6.52. Of the 23 flights recorded during the breeding season VP surveys, seven flights of 11 individuals were recorded in the CRZ at PCH. During the non-breeding VP surveys, a single flight by a single individual was recorded in the CRZ at PCH. Assuming a 98% avoidance rate, as recommended by NatureScot[22], collision risks of 0.21 collisions per breeding season and annual mortality rate of 0.21 (0.01% of the NHZ 20 breeding population) were predicted.

8.6.53. Furthermore, the predicted mortality during the breeding season would equal 7.35 collisions throughout the lifespan of the Proposed Development (35 years), representing 0.4% of the NHZ 20 breeding population (908 breeding pairs).

8.6.54. As such, the potential impact as a result of collision risk is considered to be of **negligible magnitude**, resulting in an effect which is **not significant** for snipe.

8.7. Mitigation and Residual Effects

8.7.1. The Proposed Development is predicted to have a moderate negative impact on Greenlaw Moor SSSI breeding bird assemblage and golden plover, and a low negative impact on snipe. These impacts are considered to result in effects that are not significant.

8.7.2. For all IOFs, various embedded measures (described in Section 1.8.6, Paragraphs 8.6.3 to 8.6.13) will be implemented to ensure compliance with legislation, and to follow good practice guidance with regards to breeding birds, including the implementation of an OEMP.

8.7.3. The OEMP in accordance with the outline OEMP provided in Technical Appendix 7.3: Operational Environmental Management Plan, Volume 4 of the EIAR, will include provision to monitor impacts on bird species within the Proposed Development Site, and will be subject to agreement with NatureScot. The measures proposed in the OEMP are summarised below:

- Upland breeding bird surveys to monitor the use of the Proposed Development Site by breeding birds during operation, including restored and created habitats within the Proposed Development Site; and
- Monitoring of scrape suitability and use by breeding waders.

8.7.4. Additional mitigation measures, also subject to agreement with NatureScot, to monitor the potential impact of the Proposed Development on Greenlaw Moor SSSI and golden plover during the operational phase will also be included within the OEMP:

- Monthly carcass searching for bird species during the spring (March to May) and autumn (September to November) passage periods for the first three years of operation; and
- If impacts on Greenlaw Moor SSSI and/or golden plover as a result of the Proposed Development are identified during the operational phase, additional mitigation measures will be discussed and implemented in agreement with NatureScot.

8.7.5. Given no black grouse leks were recorded within the Proposed Development Site, there is a negligible risk of potential collision with fence infrastructure associated with the solar PV array for black grouse in the short-term. However, as there is existing suitable habitat present within the Proposed Development Site for black grouse, it may be used for lekking during the lifetime of the Proposed Development. It is therefore recommended that should black grouse leks be

recorded within the Proposed Development Site, that mitigation in the form of fence marking is considered to reduce impacts of potential collision with fence infrastructure[73,74].

[73] *Cole, A., Bailey, C., Hawkes, R., Gordon, J., Fraser, A., Boles, Y., O'Brien, M. and Grant, M. (2012). A Review of Management Prescriptions for Black Grouse Tetrao tetrix in Britain: An update and revision. RSPB, Edinburgh.*

[74] *Game and Wildlife Conservation Trust (2013). Black grouse Fence collisions and marking. Game and Wildlife Conservation Trust, County Hampshire.*

8.8. Summary of Effects

Table 8.14: Summary of pre-mitigation and residual effects on each IOF, and the residual significance of effects

IOF	Conservation importance	Nature of potential pre-mitigation effect	Magnitude of pre-mitigation effect	Significance of pre-mitigation effect	Specific mitigation/ enhancement measure	Magnitude of residual effect	Residual significance	Level of certainty/ comments
				Construction/Decommission				
Greenlaw Moor SSSI	National	Disturbance and/or displacement	Negligible	Not significant	No specific mitigation required (after implementation of embedded mitigation)	Negligible	Not significant	Confidence in the prediction: high
Golden plover	Local	Habitat loss	Negligible	Not significant	No specific mitigation required (after implementation of the OEMP)	Negligible	Not significant	Confidence in the prediction: high
		Disturbance and/or displacement	Low negative	Not significant	No specific mitigation required (after implementation of embedded mitigation)	Negligible	Not significant	Confidence in the prediction: high
Snipe	Regional	Habitat loss	Negligible	Not significant	No specific mitigation required (after implementation of the OEMP)	Negligible	Not significant	Confidence in the prediction: high

IOF	Conservation importance	Nature of potential pre-mitigation effect	Magnitude of pre-mitigation effect	Significance of pre-mitigation effect	Specific mitigation/ enhancement measure	Magnitude of residual effect	Residual significance	Level of certainty/ comments
		Disturbance and/or displacement	Low negative	Not significant	No specific mitigation required (after implementation of embedded mitigation)	Negligible	Not significant	Confidence in the prediction: high
				Operation				
Greenlaw Moor SSSI	National	Collision risk	Moderate negative	Not significant	Implementation of an OEMP	Low negative	Not significant	Confidence in the prediction: moderate-high
Golden plover	Local	Habitat loss	Low negative	Not significant	No specific mitigation required (after implementation of the OEMP)	Negligible	Not significant	Confidence in the prediction: high
		Disturbance	Low negative	Not significant	No specific mitigation required (after implementation of embedded mitigation)	Negligible	Not significant	Confidence in the prediction: high
		Displacement	Negligible	Not significant	No specific mitigation required (after implementation of the OEMP)	Negligible	Not significant	Confidence in the prediction: high

IOF	Conservation importance	Nature of potential pre-mitigation effect	Magnitude of pre-mitigation effect	Significance of pre-mitigation effect	Specific mitigation/ enhancement measure	Magnitude of residual effect	Residual significance	Level of certainty/ comments
		Collision risk	Moderate negative	Not significant	Implementation of an OEMP	Low negative	Not significant	Confidence in the prediction: moderate-high
Snipe	Regional	Habitat loss	Low negative	Not significant	No specific mitigation required (after implementation of the OEMP)	Negligible	Not significant	Confidence in the prediction: high
		Disturbance	Low negative	Not significant	No specific mitigation required (after implementation of embedded mitigation)	Negligible	Not significant	Confidence in the prediction: high
		Displacement	Low negative	Not significant	No specific mitigation required (after implementation of the OEMP)	Negligible	Not significant	Confidence in the prediction: high
		Collision risk	Negligible	Not significant	No specific mitigation required	Negligible	Not significant	Confidence in the prediction: high

8.9. Cumulative Impact Assessment

8.9.1. The following section assesses the predicted cumulative effects on IOFs from the Proposed Development along with all other plans or projects within an appropriate ZoI following NatureScot guidance[15].

8.9.2. Following agreement at scoping, cumulative effects have been considered only for wind developments of more than three turbines within 25 km of the Proposed Development for geese, and within 10 km of the Proposed Development for other species. Projects of three or fewer turbines were excluded due to the lack of publicly available data for developments of this size. Only IOFs for which a greater than negligible residual impact is predicted are considered, as negligible impacts will not result in a detectable increase in cumulative impacts.

8.9.3. Within 10 km of the Proposed Development, a single development (Black Hill Wind Farm) has been included in the CIA for all IOFs other than Greenlaw Moor SPA and Ramsar site, and the Firth of Forth and St Andrews Bay Complex SPA (Table 8.15). For Greenlaw Moor SPA and Ramsar site, a further 16 developments within 25 km of the SPA and Ramsar site have been included in the CIA (Table 8.16):

- Aikengall I;
- Aikengall II;
- Aikengall IIa;
- Crystal Rig I;
- Crystal Rig II;
- Crystal Rig III;
- Crystal Rig IV;
- Drone Hill;
- Fallago Rig;
- Hoprigshiels;
- Howpark;
- Keith Hill;
- Penmansheil;
- Pogbie;
- Pogbie Extension; and
- Quixwood Moor.

8.9.4. For the Firth of Forth and St Andrews Bay Complex, the above developments and a further seven developments within 25 km of the SPA have been included in the CIA (Table 8.17):

- Ark Hill;
- Binn Eco Park;
- Earlseat;
- Harburnhead;
- Little Raith;
- Pearie Law; and
- Westfield.

8.9.5. Developments Camilty Plantation, Dun Law, Dun Law Extension, Longpark and Toddleburn have not been included in the CIA as information relating to ornithological impacts to support the applications could not be located. Developments at the scoping or pre-scoping stage have also not been included as impacts have not yet been assessed and the projects have yet to go through planning. As the Outer Firth of Forth and St Andrews Bay Complex SPA was designated in 2020, several developments included in the CIA were carried out before the SPA was

proposed. Therefore, where qualifying features of the SPA were assessed individually for such developments, these have been included in the CIA.

8.9.6. No significant cumulative impacts are predicted to result from the Proposed Development in combination with other wind developments within 10 km. Additionally, no significant cumulative impacts are predicted to result from the Proposed Development in combination with other wind developments within 25 km of the Proposed Development for Greenlaw Moor SPA and Ramsar site, and the Firth of Forth and St Andrews Bay Complex SPA.

Table 8.15: Cumulative Impact Assessment of IOFs within 10 km of the Proposed Development

Site	No. of turbines	Habitat loss	Site status	Baseline surveys undertaken	Greenlaw Moor SSSI	Golden plover
Lees Hill Renewable Energy Park (Proposed Development)	6	Temporary habitat loss of 5.59 ha, permanent habitat loss of 10.36 ha, and permanent habitat change of 68.79 ha following installation of the solar PV array, of a total of 532.64 ha within the Proposed Development Site.	Submitted	March 2020 to February 2022	Predicted annual collision mortality of 2.8%, 1.5% and 2.9% of the SSSI breeding populations of golden plover, oystercatcher and lapwing, respectively, due to the Proposed Development is considered to be of **moderate negative magnitude** and **not significant** to the integrity of Greenlaw Moor SSSI.	A single breeding territory recorded during the MBBS in 2020. A total of 10 flights by 588 birds was recorded during the breeding season VP surveys and 32 flights of 509 birds during the non-breeding season VP surveys. Predicted annual mortality of 10.35 birds using 98% avoidance rate. A high negative impact and significant effect predicted.
Black Hill	22	Unknown	Operational	April to June 1999 and 2000	Not mentioned in ES.	A flock of approximately 200 present between March and May 2000. CRM not undertaken.
Cumulative residual effects	28	Permanent habitat loss of 5.59 ha and permanent habitat change of 68.79 ha.	-	-	No cumulative impact predicted.	No cumulative impact predicted.

Table 8.16: Cumulative Impact Assessment of Developments within 25 km of IOFs Greenlaw Moor SPA and Ramsar site

Site	No. of turbines	Site status	Baseline surveys undertaken	Greenlaw Moor SPA	Greenlaw Moor Ramsar site
Lees Hill Renewable Energy Park (Proposed Development)	6	Submitted	March 2020 to February 2022	No LSE predicted.	No LSE predicted.
Aikengall I	16	Operational	May to October 2004	Not mentioned in ES.	Not mentioned in ES.
Aikengall II	18	Operational	September 2007 to September 2008	Not mentioned in ES.	Not mentioned in ES.
Aikengall IIa	19	Operational	November 2009 October 2011; further surveys in 2013.	Negligible to low negative impact.	Negligible to low negative impact.
Black Hill	22	Operational	April to June 1999 and 2000	Not mentioned in ES.	Not mentioned in ES.
Crystal Rig I	25	Operational	Estimates of likely territory density derived from the south-east Scotland bird Atlas and breeding bird surveys undertaken on adjacent land in 2000.	Not mentioned in NTS.	Not mentioned in NTS.
Crystal Rig II	60	Operational	Breeding bird surveys undertaken during 2000, 2002, 2003 and 2004. Crossbill surveys undertaken in February 2003 and 2004. Black grouse survey undertaken April 2003. Raptor surveys and VP surveys	Not mentioned in ES.	Not mentioned in ES.

			undertaken in spring 2003.		
Crystal Rig III	6	Operational	September 2009 to March 2011	Predicted mortality of 0.41 pink-footed geese per year. 0.004% of the cited SPA population. No LSE predicted.	Predicted mortality of 0.41 pink-footed geese per year. 0.004% of the cited SPA population. Effect on Ramsar site not assessed.
Crystal Rig IV	11	Operational	March 2014 to February 2015	Predicted mortality of 0.11 pink-footed geese per year. <0.001% of the cited SPA population. No LSE predicted.	Predicted mortality of 0.11 pink-footed geese per year. <0.001% of the cited SPA population Effect on Ramsar site not assessed.
Drone Hill	22	Operational	June 2003 to May 2004. Additional VP surveys undertaken January to April 2006.	No pink-footed goose flights recorded in the CRZ at PCH. CRM not undertaken. Effect on SPA not assessed.	No pink-footed goose flights recorded in the CRZ at PCH. CRM not undertaken. Ramsar site not mentioned in ES.
Fallago Rig	48	Operational	October 2012 to July 2015	No pink-footed geese recorded. Effect on SPA not assessed.	No pink-footed geese recorded. Effect on Ramsar site not assessed.
Hoprigshiels	22	Operational	September 2009 to August 2010	One flight of <10 pink-footed goose within the CRZ at PCH. CRM not undertaken. Effect on SPA not assessed.	One flight of <10 pink-footed goose within the CRZ at PCH. CRM not undertaken. Effect on Ramsar site not assessed.

Howpark	8	Operational	March 2014 to May 2015	Negligible impact on pink-footed goose. No LSE predicted.	Not mentioned in ES.
Keith Hill	5	Operational	March 2007 to March 2008, and September 2008	Three flights of pink-footed geese, not recorded within the CRZ at PCH. CRM not undertaken. Effect on SPA not assessed.	Three flights of pink-footed geese, not recorded within the CRZ at PCH. CRM not undertaken. Effect on Ramsar site not assessed.
Penmansheil	14	Operational	VP surveys undertaken December 2009 March 2011. Breeding bird survey undertaken 2010. Winter walkover surveys December 2009 to March 2010 and September 2010 to March 2011.	Four flights of 82 pink-footed geese within the CRZ at PCH. CRM not undertaken. Effect on SPA not assessed.	Four flights of 82 pink-footed geese within the CRZ at PCH. CRM not undertaken. Effect on Ramsar site not assessed.
Pogbie	6	Operational	VP surveys undertaken March 2007 to May 2008. Black grouse surveys undertaken April 2007.	Five flights of pink-footed geese recorded in Environmental Report. CRM not undertaken. SPA not mentioned in Environmental Report.	Five flights of pink-footed geese recorded in Environmental Report. CRM not undertaken. Ramsar site not mentioned in Environmental Report.
Pogbie Extension	6	Operational	Breeding bird surveys undertaken April to July 2014.	Not mentioned in NTS or Technical Annexes.	Not mentioned in NTS or Technical Annexes.
Quixwood Moor	13	Operational	October 2010 to August 2011.	Predicted mortality of six pink-footed geese per year. 0.06% of the cited SPA population. No LSE predicted.	Predicted mortality of six pink-footed geese per year. 0.06% of the cited Ramsar site population. No LSE predicted.

Cumulative Impacts	327	-	-	Cumulative collision estimate of 7.92 individuals per year, equivalent to 0.06% of the cited SPA population. No cumulative LSE predicted on this SPA.	Cumulative collision estimate of 7.4 individuals per year, equivalent to 0.05% of the cited Ramsar site population. No cumulative LSE predicted on this Ramsar site.

Table 8.17: Cumulative Impact Assessment of Developments within 25 km of IOF Outer Firth of Forth and St Andrews Bay Complex SPA

Site	No. of turbines	Site status	Baseline surveys undertaken	Outer Firth of Forth and St Andrews Bay Complex SPA
Lees Hill Renewable Energy Park (Proposed Development)	6	Submitted	March 2020 to February 2022	No LSE predicted.
Aikengall I	16	Operational	May to October 2004	Herring gull recorded during baseline surveys. A low negative impact considered to be not significant was predicted.
Aikengall II	18	Operational	September 2007 to September 2008	Herring gull, common gull and black-headed gull recorded during baseline surveys. No breeding territories identified, and no CRM undertaken. A low negative impact considered to be not significant was predicted.

Aikengall IIa	19	Operational	November 2009 October 2011; further surveys in 2013.	No qualifying features recorded.
Ark Hill	8	Operational	Not mentioned in NTS	No qualifying features mentioned in the NTS.
Binn Eco Park	4	Construction	March 2012 to May 2013	Herring gull recorded during baseline surveys. No breeding territories identified, and no CRM undertaken. A low negative impact considered to be not significant was predicted.
Black Hill	22	Operational	April to June 1999 and 2000	No qualifying features recorded.
Crystal Rig I	25	Operational	Estimates of likely territory density derived from the south-east Scotland bird Atlas and breeding bird surveys undertaken on adjacent land in 2000.	No qualifying features mentioned in the ES.
Crystal Rig II	60	Operational	Breeding bird surveys undertaken during 2000, 2002, 2003 and 2004. Crossbill surveys undertaken in February 2003 and 2004. Black grouse survey undertaken April 2003. Raptor surveys and VP surveys undertaken in spring 2003.	Herring gull recorded during baseline surveys. No breeding territories identified, and no CRM undertaken. A low negative impact considered to be not significant was predicted.
Crystal Rig III	6	Operational	September 2009 to March 2011	Herring gull and common gull recorded during baseline surveys. No breeding territories identified, and no CRM undertaken. Effect on these species not assessed.

Crystal Rig IV	11	Operational	March 2014 to February 2015	Herring gull was recorded during baseline surveys. CRM carried out, with a predicted mortality of 2.01 birds per breeding season (0.07% of the cited SPA population). Collision risk to herring gull considered to be of low negative magnitude and not significant.
Drone Hill	22	Operational	June 2003 to May 2004. Additional VP surveys undertaken January to April 2006.	No qualifying features recorded.
Earlseat	8	Operational	October 2007 to March 2010	No qualifying features recorded.
Fallago Rig	48	Operational	October 2012 to July 2015	No qualifying features recorded.
Harburnhead	22	Operational	September 2009 to October 2010	Goldeneye, common scoter, red-breasted merganser, herring gull, common gull and black-headed gull recorded during baseline surveys. Effect on these species not assessed.
Hoprigshiels	22	Operational	September 2009 to August 2010	Herring gull, common gull and black-headed gull recorded during baseline surveys. Effect on these species not assessed.
Howpark	8	Operational	March 2014 to May 2015	Herring gull recorded during baseline surveys. CRM not undertaken. Low negative impact and not significant effect predicted for herring gull.

Keith Hill	5	Operational	March 2007 to March 2008, and September 2008	Herring gull, common gull and black-headed gull recorded during baseline surveys. Effect on these species not assessed.
Inch Cape	72	Pre-construction	September 2010 to September 2012	No adverse effect of disturbance and/ or displacement or habitat loss predicted in HRA Report.
Little Raith	9	Operational	April to June 2004	Herring gull, common gull and black-headed gull recorded during baseline surveys. No breeding territories identified, and no CRM undertaken. Effect on these species not assessed.
Neart na Gaoithe	54	Construction	November 2009 to October 2011	Gannet, little gull, herring gull, kittiwake, arctic tern, guillemot, razorbill, puffin recorded during baseline surveys. Low/moderate negative effect of minor significance predicted for little gull. Low negative effect of minor significance predicted for razorbill. Low negative impact and not significant effect predicted for gannet, guillemot and puffin. Negligible impact and not significant effect predicted for herring gull, kittiwake and arctic tern.
Pearie Law	6	Operational	April 2010 to August 2011	Goldeneye, herring gull, common gull and black-headed gull recorded during baseline surveys. Effect on these species not assessed.

Penmansheil	14	Operational	VP surveys undertaken December 2009 March 2011. Breeding bird survey undertaken 2010. Winter walkover surveys December 2009 to March 2010 and September 2010 to March 2011.	Herring gull recorded during baseline surveys. CRM not undertaken. Low negative impact and not significant effect predicted for herring gull.
Pogbie	6	Operational	VP surveys undertaken March 2007 to May 2008. Black grouse surveys undertaken April 2007.	Black-headed gull and herring gull recorded during baseline surveys. Effect on these species not assessed in Environmental Report.
Pogbie Extension	6	Operational	Breeding bird surveys undertaken April to July 2014.	No qualifying features mentioned in NTS or Technical Annexes.
Seagreen	114	Operational	December 2009 to November 2011	No adverse effect predicted in HRA Report.
Quixwood Moor	13	Operational	October 2010 to August 2011	Common gull and herring gull recorded during baseline surveys. Effect on these species not assessed.
Westfield	4	Operational	September 2007 to September 2009	A single record of a single goldeneye. Effect on goldeneye not assessed.
Cumulative Impacts	628	-	-	No cumulative LSE predicted on this SPA.

8.10. Screening for Appropriate Assessment

8.10.1. Under the Conservation of Habitats and Species Regulations 2017 (as amended), any development that may have a LSE on an SPA or Ramsar site, either alone or in combination with other projects, requires an 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 or Ramsar site.

8.10.2. 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 Stage 1 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 internationally designated sites and therefore whether an AA is required.

8.10.3. Where LSE cannot be ruled out, a shadow AA is provided (Stage 2).

8.10.4. For the purposes of this screening assessment, reasoned argument and professional judgement of biological significance are used to determine whether no adverse effect on the integrity of the designated site can be concluded.

Stage 1: Screening for LSE

8.10.5. Stage 1: Screening for LSE is undertaken to remove any proposals, or components of proposals, which do not require consideration under AA (Stage 2: Shadow AA). For the ornithological component of the HRA process, Screening should largely consider three important aspects of the proposal and the qualifying features of the site:

- Connectivity between the proposal and the site;
- Route to impact between the proposal and the site; and
- Numbers of qualifying features (birds) available for impact (trivial or non-trivial?).

8.10.6. If any one of the above aspects can be clearly demonstrated, it can be concluded that there is no LSE on the site. If, however, there is any doubt that no LSE can be concluded in Stage 1, the process should move on to Stage 2.

8.10.7. Firstly, any SPAs or Ramsar sites with potential connectivity to the Proposed Development are identified, as those designated sites without potential connectivity will have no route to impact and no adverse effect.

8.10.8. Typically, an HRA considers internationally designated sites within 10 km. A surrounding search area of 10 km around the Proposed Development is sufficient to determine potential connectivity for most terrestrial ornithological features, as most species have a foraging range that is well below this distance (the exceptions being features such as breeding diver species or wintering grey geese species). However, marine species (unlike terrestrial species) typically have large foraging distances (well in excess of 10 km), but any statutory sites designated for breeding populations of seabird species will not have connectivity with the Proposed Development due to the project's inland location and so can be excluded.

8.10.9. Two statutory sites lie within 10 km of the Proposed Development: Greenlaw Moor SPA and Ramsar site, both designated for non-breeding pink-footed goose. An additional statutory site, Outer Firth of Forth and St Andrews Bay Complex SPA, designated for internationally important assemblages of non-breeding waterfowl, breeding seabirds and non-breeding seabirds, lies within 25 km of the Proposed Development.

8.10.10. 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.

8.10.11. As with the assessment of the predicted cumulative effects of wind farm developments within the vicinity of the Proposed Development on IOFs, an assessment of the predicted cumulative effects on the SPAs and Ramsar site was also undertaken.

Greenlaw Moor SPA

8.10.12. Greenlaw Moor SPA (1.7 km to the south-west of the Proposed Development) is designated for supporting an internationally important wintering population of pink-footed geese. The Greenlaw Moor SPA citation relates to a winter peak of 14,200 individuals (based on an average peak count across a five year period: 1987/88-1991/92)[57]. The site condition of this species in the Greenlaw Moor SPA is favourable, maintained, which is a reflection of the continuing increase in the UK pink-footed goose wintering population (124% increase between 1992/93 and 2017/18)[75]. The predicted additional annual mortality of 1.42 pink-footed geese per year through collision with the Proposed Development turbines is equivalent to 0.01% of the SPA population. The natural mortality rate of pink-footed geese is 14%, equivalent to 1,988 individuals from the SPA population. Even if it is assumed that all of the birds flying over the site at potential collision height are part of this SPA population, the collision rate predicted of 1.42 birds per year would not result in a LSE on this SPA. Additionally, no LSE was predicted on the SPA as a result of cumulative impacts (see Section 1.8.9, Table 8.16).

8.10.13. Therefore, it is recommended that an AA will not be required for Greenlaw Moor SPA.

Greenlaw Moor Ramsar Site

8.10.14. Greenlaw Moor Ramsar site (1.7 km to the south-west of the Proposed Development) is designated for supporting an internationally important wintering population of pink-footed geese. The Greenlaw Moor Ramsar citation relates to a winter peak of 14,200 individuals (based on an average peak count across a five year period: 1987/88-1991/92)[58]. The site condition of this species in the Greenlaw Moor Ramsar is favourable, maintained, which is a reflection of the continuing increase in the UK pink-footed goose wintering population (124 % increase between 1992/93 and 2017/18)[75]. The predicted additional annual mortality of 1.42 pink-footed geese per year through collision with the Proposed Development turbines is equivalent to 0.01% of the Ramsar site population. The natural mortality rate of pink-footed geese is 14%, equivalent to 1,988 individuals from the Ramsar site population. Even if it is assumed that all of the birds flying over the site at potential collision height are part of this Ramsar site population, the collision rate predicted of 1.42 birds per year would not result in a LSE on this Ramsar site. Additionally, no LSE was predicted on the Ramsar site as a result of cumulative impacts (see Section 1.8.9, Table 8.16).

8.10.15. Therefore, it is recommended that an AA will not be required for Greenlaw Moor Ramsar site.

Outer Firth of Forth and St Andrews Bay Complex SPA

8.10.16. The Outer Firth of Forth and St Andrews Bay Complex SPA is located approximately 18 km to the north-east of the Proposed Development. The SPA is designated for its internationally important non-breeding waterfowl assemblage, and breeding and non-breeding seabird

[75] *Burns F, Eaton MA, Balmer DE, Banks A, Caldow R, Donelan JL, Douse A, Duigan C, Foster S, Frost T, Grice PV, Hall C, Hanmer HJ, Harris SJ, Johnstone I, Lindley P, McCulloch N, Noble DG, Risely K, Robinson RA, Wotton S (2020). The state of the UK's birds 2020. The RSPB, BTO, WWT, DAERA, JNCC, NatureScot, NE and NRW, Sandy, Bedfordshire.*

assemblages. Goldeneye, included as a notified feature in the non-breeding waterfowl assemblage, was the only species included as a feature of the SPA that was recorded within the Proposed Development Site. The SPA supports a wintering population of 589 individuals (2006/07-2010/11 winter mean peak), approximately 2.9% of the Great Britain population. A single flight of five individuals was recorded during the non-breeding VP surveys. This flight was not recorded within the CRZ at PCH and did not qualify for CRM. Additionally, the SPA is >10 km from the Proposed Development. It is therefore considered unlikely that there is connectivity between the Proposed Development and the SPA, and the number of birds recorded is not considered to be crucial to the integrity of the SPA. Additionally, no LSE was predicted on the SPA as a result of cumulative impacts (see Section 1.8.9, Table 8.17).

8.10.17. In consideration of the above, it is recommended that an AA will not be required for the Outer Firth of Forth and St Andrews Bay Complex SPA.

Summary

8.10.18. The main conclusions from the screening for LSE are:

- The predicted annual collision mortality rate of 1.42 pink-footed geese at the Proposed Development will not affect the integrity of the non-breeding pink-footed goose population at Greenlaw Moor SPA or Greenlaw Moor Ramsar site. The Proposed Development would therefore not result in a LSE on Greenlaw Moor SPA or Ramsar site.
- Goldeneye, the only target notified feature of the Outer Firth of Forth and St Andrews Bay Complex SPA recorded within the Proposed Development Site, did not qualify for CRM. It is not considered to be at risk of collision, and the integrity of the SPA population is considered not to be affected by the Proposed Development due to the distance (18 km) between the SPA and the Proposed Development. The Proposed Development would therefore not result in a LSE on the Outer Firth of Forth and St Andrews Bay Complex SPA.

8.10.19. In conclusion, the Proposed Development is not expected to impact upon the qualifying interest of Greenlaw Moor SPA or Ramsar site, or the Outer Firth of Forth and St Andrews Bay Complex SPA, and therefore **no likely significant effect** on these SPAs and Ramsar site can be concluded. An AA is therefore not required.

8.11. Statement of Significance

8.11.1. An assessment has been made of the predicted significance of effects of the Proposed Development on IOFs. The Proposed Development includes for a 50 m micrositing allowance where the environmental impacts would be assessed and signed-off by the ECoW.

8.11.2. By applying effective embedded mitigation measures and following good practice guidelines during construction, the magnitude of residual effects of the Proposed Development on all IOFs is assessed as being **low negative/negligible** in terms of magnitude, and **not significant**.

8.12. Statement of Competence

8.12.1. The author of this chapter has five years of experience in the environmental sector in ecology and conservation, with four of those years in environmental consultancy focused on onshore renewable energy developments including wind and solar. During this time, they have been involved with management of onshore wind development projects, production of EIAR ornithology chapters, scoping reports, technical baseline reports, operational monitoring reports as well as client and consultee liaison. They are an experienced ornithologist, with seven years of experience in conducting various ecology and ornithology surveys, including breeding raptor and wader monitoring, seabird population monitoring and boat-based seabird surveys.