

8 Ornithology

8.1 Introduction

8.1.1 This chapter considers the likely significant effects on ornithology associated with the construction and operation of the Bloch Wind Farm (the proposed development). The specific objectives of the chapter are to:

- describe the current ornithological baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address the likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation measures.

8.1.2 The assessment has been carried out by Dr Steve Percival of Ecology Consulting.

8.1.3 The chapter is supported by a set of figures and the following Technical Appendices:

- Technical Appendix 8.1: Breeding Bird Survey 2021;
- Technical Appendix 8.2: Breeding Bird Survey 2022;
- Technical Appendix 8.3: Wintering Bird Survey 2020-21;
- Technical Appendix 8.4: Wintering Bird Survey 2021-22;
- Technical Appendix 8.5: Collision Risk Modelling Calculations;
- Technical Appendix 8.6: Draft Breeding Bird Protection Plan; and
- Technical Appendix 8.7: Shadow Habitats Regulations Assessment.

8.2 Legislation, Policy and Guidance

8.2.1 The ornithological assessment followed the guidance produced by Scottish Natural Heritage (SNH) (now NatureScot) (SNH 2017¹). Additionally, the following documents were taken into account:

- The Wildlife and Countryside Act 1981, as amended;
- European Union (EU) Council Directive 79/409/EEC and 2009/147/EC on the Conservation of wild birds (the 'Birds Directive');

- EU Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive');
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004 (as amended), which translates the Birds and Habitats Directives into Scottish Law;
- The Conservation of Habitats and Species Regulations 2017.
- Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive);
- The Nature Conservation (Scotland) Act 2004;
- The Wildlife and Natural Environment (Scotland) Act 2011;
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.
- Scottish Planning Policy (Scottish Government 2014);
- Planning Advice Note (PAN) 1/2013 - Environmental Impact Assessment (Scottish Government 2013);
- PAN 51: Planning, Environmental Protection and Regulation (Scottish Government, revised 2006);
- PAN 60: Planning for Natural Heritage (Scottish Government 2000);
- Scottish Executive Circular 6/1995 EIR release (as amended June 2000). Information request and response under the Environmental Information (Scotland) Regulations 2004;
- Planning Circular 1/2017; Environmental Impact Assessment Regulations. Guidance on The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (Scottish Government, 2017);
- 'Managing Natura 2000 Sites' (European Communities 2000);
- Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater and Coastal (CIEEM 2018²);
- Recommended bird survey methods to inform impact assessment of onshore wind farms (SNH 2017);
- Assessing significance of impacts from onshore windfarms on birds outwith designated areas: version 2 (SNH 2018a³);
- Assessing the cumulative impact of onshore wind energy developments (SNH 2018b⁴);
- Assessing connectivity with Special Protection Areas (SPAs) (SNH 2016a⁵);

¹ Scottish Natural Heritage 2017. Recommended bird survey methods to inform impact assessment of onshore wind farms. SNH Guidance.

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

³ Scottish Natural Heritage. 2018a. Assessing Significance of Impacts from Onshore Wind Farms Outwith Designated Areas. SNH.

⁴ Scottish Natural Heritage. 2018b. Assessing the cumulative impacts of onshore wind farms on birds. Guidance. SNH

⁵ Scottish Natural Heritage. 2016a. Assessing Connectivity with Special Protection Areas (SPAs) - Version 3. Vol. Version 3. SNH Guidance

- Environmental Statements and Annexes of Environmentally Sensitive Bird Information Guidance for Developers, Consultants and Consultees. Version 2 (SNH 2016b⁶);
- Good Practice during Wind Farm Construction (Scottish Renewables *et al.* 2019⁷);
- Birds of Conservation Concern (BoCC) 5: the Population Status of Birds in the United Kingdom, Channel Islands and the Isle of Man (Stanbury *et al.* 2021⁸);
- The UK Post-2010 Biodiversity Framework; and
- The Scottish Biodiversity List (SBL) (NatureScot 2020: (<https://www.nature.scot/doc/scottish-biodiversity-list>))

8.3 Consultation

8.3.1 Consultation was undertaken primarily through the scoping process, though also directly with NatureScot (NS). The issues raised and key outcomes of this consultation relating to ornithology are summarised in Table 8.1.

Table 8.1. Consultation Responses

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
RSPB 9/5/22	Scoping Opinion	No comment on scoping report	None required
Natural England 11/5/22	Scoping Opinion	Development may have potential to impact the Solway Firth SPA/Ramsar/SSSI	Potential effects on this SPA have been assessed and an HRA report is included in TA 8.7.
		Biodiversity Net Gain (BNG) should be delivered as part of the proposal	An email was sent to Natural England in August 2022 setting out the reasons a BNG assessment would not be undertaken for this development. No response has been received to date.
NatureScot 10/5/22	Scoping Opinion	Proposal has the potential to impact on hen harrier, a qualifying feature of the Langholm - Newcastleton Hills SPA, so a Habitats Regulations Appraisal (HRA) will be needed.	Potential effects on hen harriers and this SPA have been assessed and an HRA report is included in Technical Appendix 8.7.
		Suggest consulting the South of Scotland Golden Eagle Project	Project contacted but no information supplied.
		Computer-generated viewsheds (Figure 9.1) incorrectly assign a viewing area greater than 180° and should be amended for the report.	Updated.
		NS is content with the scope of assessment and data collected to date.	Noted

8.4 Methodology

Scope of Assessment

- 8.4.1 The key issues for the assessment of potential ornithological effects relating to onshore wind farms include the following, based on NS (formerly Scottish National Heritage (SNH)) guidance published in 2018a:
- direct loss of bird habitat through construction of wind farm infrastructure;
 - disturbance of birds during construction and operation (including displacement of flight activity through barrier effects);
 - mortality of birds through collision with wind turbine blades or towers during operation; and
 - cumulative effects of wind farm operational disturbance and collision mortality, on the national and Natural Heritage Zone (NHZ) populations of key target species.
- 8.4.2 Key target species for the assessment have been identified following SNH 2018a guidance using the following criteria:
- species listed on Annex 1 of the EU Birds Directive;
 - species listed on Schedule 1 of the 1981 Wildlife & Countryside Act;
 - species identified by SNH 2018a as ‘Priority bird species for assessment when considering the development of onshore wind farms in Scotland’. These include (a) species that are widespread across Scotland which utilise habitats or have flight behaviours that may be adversely affected by a wind farm, and (b) as ‘restricted range’ species; and
 - red-listed species on the Birds of Conservation Concern list (Stanbury *et al.* 2021).
- 8.4.3 The ornithological assessment has, therefore, given particular consideration to all species recorded during the baseline surveys at the site that meet any of these criteria.
- 8.4.4 No ornithological issues have been scoped out from this assessment, though, following SNH 2018a guidance, the assessment has focussed on the key species likely to be affected by the proposed development.

⁶ Scottish Natural Heritage. 2016b. Environmental Statements and Annexes of Environmentally Sensitive Bird Information Guidance for Developers, Consultants and Consultees. Version 2. SNH Guidance

⁷ Scottish Renewables. 2019. Good Practice during Wind Farm Construction. v.4.

⁸ Stanbury, A., M. Eaton, N. Aebischer, D. Balmer, A. Brown, A. Douse, P. Lindley, N. McCulloch, D. Noble, and I. Win. 2021. The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. *British Birds* 114:723-747.

Baseline Characterisation

Study Area

8.4.5 The ornithology study areas were chosen to include all areas within the potential zone of ornithological influence of the proposed development, with reference to SNH 2010⁹ and 2017 guidance. The specific study areas were as follows:

- Ornithological designated sites: sites designated for ornithological interests within 5km of the site (all statutory protected sites) and within 20km (internationally important sites), see Figure 7.1 Designated Sites.
- Core breeding and wintering bird surveys: included the site boundary (the site), plus a 500m buffer for the main breeding bird surveys (the core breeding bird survey area) covering a total area of 15.7 square kilometres (km²), shown in Figure 8.1.
- Key species surveys (the wider breeding bird survey area): a 2km buffer, where access was possible, covering an additional 34km².
- Flight Activity (Vantage Point) surveys as shown in Figure 8.1; and
- Cumulative Effects: other proposed development within the 'Border Hills' NatureScot Natural Heritage Zone (NHZ20) included in assessment of potential cumulative ornithological effects

Desk Study

8.4.6 The ornithological desk study provided information on the ornithological interest of the study area out to 20km from the site, including the locations of any relevant statutory protected sites and collation of data on key species such as raptors and breeding waders. Data from following sources of information were sought for the desk study:

- NatureScot website (<https://sitelink.nature.scot/home>) - statutory designated site boundaries, including Sites of Special Scientific Interest (SSSI) and SSSI citation details;
- Joint Nature Conservation Committee (JNCC) website (<https://jncc.gov.uk/our-work/special-protection-areas-overview/>) - European protected site boundaries and designations (SPA/Ramsar);
- Wetland Bird Survey annual reports (Frost *et al.* 2021¹⁰);
- The Birds of Scotland (Forrester *et al.* 2007¹¹);

- Bird Atlas 2007-11: The Breeding and Wintering Birds of Britain and Ireland (Balmer *et al.* 2013¹²);
- Information published in Environmental Statements (ES) and Environmental Impact Assessment (EIA) Reports for other developments in the NHZ20 and the adjacent the 'West Southern Uplands and Inner Solway' (NHZ19) (including for the Solwaybank Wind Farm baseline);
- South of Scotland Golden Eagle Project; and
- Dumfries and Galloway Raptor Study Group.

Field Survey

8.4.7 A comprehensive range of bird surveys have been undertaken at the site between October 2020 and August 2022. This has included surveys over two full breeding seasons (2021 and 2022) and two winter periods (2020-21 and 2021-22). These surveys comprised:

- year-round vantage point surveys to quantify bird flight activity;
- breeding bird walkover mapping survey;
- species-specific breeding bird surveys; and
- autumn/winter walkover surveys.

8.4.8 Full details of the surveys, dates and weather conditions are given in Technical Appendices 8.1-8.4.

Vantage Point (VP) Surveys (year-round)

8.4.9 VP surveys were carried out to determine flight activity within the site and its surrounds. The VP surveys quantified the bird numbers that could potentially be at risk of collision (including roost flight observations at dawn/dusk). All flight lines of target species were mapped, and the flight height and duration of each flock/individual recorded. The following species were recorded:

- all birds of prey and owls;
- all waders (including lapwing and golden plover) and gulls;
- all ducks, geese, swans, cormorants, herons, coot and grebes;
- large flocks (>100 birds) of other species (except woodpigeon and rook); and
- any other notable species, including SNH 2018a priority species.

⁹ Scottish Natural Heritage. 2010. Recommended bird survey methods to inform impact assessment of onshore wind farms. SNH Guidance.

¹⁰ Frost, T.M., Calbrade, N.A., Birtles, G.A., Hall, C., Robinson, A.E., Wotton, S.R., Balmer, D.E. and Austin, G.E. 2021. Waterbirds in the UK 2019/20: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford.

¹¹ Forrester, R. W., Andrews, I., McInerny, C. J., and Scott, H. I. (2007). The Birds of Scotland. Scottish Ornithologists' Club.

¹² Balmer, D., Gillings, S., Caffrey, B. J., Swann, R. L., Downie, I. S. and Fuller, R. J. (2013). Bird Atlas 2007-11: the breeding and wintering atlas of Britain and Ireland, Thetford: BTO Book

8.4.10 Two VPs were used, to give sufficient coverage of the site and its surrounds. Computer GIS (Global Mapper v21)-generated viewsheds are shown in Figure 8.1. Though two of the wind turbines fall on the edge of the viewsheds, the collision zone at each could both be clearly viewed in the field and this would not affect the results in any way. The same locations were used for all of the surveys, with the following surveys being undertaken at each VP:

- breeding season:
 - April-August 2021 - 36 hours (6 hours per month).
 - April-August 2022 - 36 hours (6 hours per month).
- autumn/winter:
 - November-March 2020-21 - 36 hours (6-8 hours per month).
 - September-March 2021-22 - 42 hours (6 hours per month).

Core Breeding Bird Walkover Surveys

8.4.11 The breeding bird walkover survey of the core survey area followed the standard Brown and Shepherd 1993¹³ moorland survey method with two additional visits as recommended in SNH 2017 guidance. These surveys covered the site plus a 500m buffer. The extent of the core breeding bird survey area is shown in Figure 8.1: Ornithological Survey Areas.

- 2020 - four visits during April-July; and
- 2021 - four visits during April-July.

8.4.12 All bird locations and behaviour were mapped at 1:10,000 scale, using the standard British Trust for Ornithology (BTO) Common Birds Census notation, and all species were recorded. In addition, the survey effort per unit area was standardised to make the surveys as repeatable as possible, recording systematically for approximately two hours per km². A route was chosen to ensure that all parts of the ornithology study area were covered to within approximately 100m of the observer, where access was possible. The survey route was plotted onto the survey map as it was undertaken.

8.4.13 The surveys avoided strong winds, heavy rain, fog and low cloud. Birds were located by walking, listening and scanning by eye and with binoculars. Standard BTO notation was used to record the birds' activities; singing, calling, carrying nest material, nests or young found, repetitively alarmed adults, disturbance displaying, carrying food or in territorial dispute.

8.4.14 The survey data were analysed to determine spatially distinct clusters of records, equivalent to breeding territories, with the number of such territories used to calculate the breeding population for each species (Gilbert *et al.* 1998)¹⁴. A record in potentially suitable breeding habitat on a single visit was considered sufficient to indicate a potential breeding attempt.

Species-specific Breeding Bird Surveys (Wider Area Surveys)

8.4.15 As the site and its surrounds supported potentially suitable habitat for a range of scarce raptors, divers and black grouse, additional species-specific surveys were undertaken during April-August 2021 and 2022, as set out in the scoping document. Surveys were undertaken within the site and a 2km buffer zone (the 'wider breeding bird survey area') where potentially suitable breeding habitat for these species are present. Walkovers were carried out where access was allowed, supplemented by a series of mini-VPs (short watches from additional VPs) chosen to observe over all of the site plus a 2km buffer. This comprised surveys for black grouse, goshawk, hen harrier, red kite, short-eared owl, barn owl, peregrine and merlin, following the standard methodologies detailed in Gilbert *et al.* (1998) and Hardey *et al.* (2013)¹⁵:

- black grouse surveys - dawn surveys during April-May 2022 over 2-3 visits for each of the two baseline survey years; and
- raptor/owl surveys - walkover and mini-VP surveys, each month for each of the two baseline survey years during March-August 2022.
- In addition, any other key target species observed during these surveys were recorded, including curlew, golden plover and dunlin.

Autumn/Winter Walkover Surveys

8.4.16 Walkover mapping surveys of the wintering birds within the site and a 500m buffer took place in accordance with NS guidance (Figure 8.1). The survey focused on key target species, as set out above for the VP surveys. As well as counting and mapping each species, the behaviour of each flock was also recorded, e.g. feeding/roosting. The surveys included work at dawn and dusk to check the area specifically for roosting hen harriers and other important raptors, and were carried out as follows:

- 2020-21 - monthly surveys, September-March; and
- 2021-22 - monthly surveys, September-March.

¹³ Brown, A. F., and K. B. Shepherd, (1993). *A method for censusing upland breeding waders*. Bird Study 40:189-195.

¹⁴ Gilbert, G., Gibbons, D. W. & Evans, J., (1998). *Bird Monitoring Methods: a manual of techniques for key UK species*. RSPB /BTO/WWT/JNCC/ITE/The Seabird Group.

¹⁵ Hardey, J., H. Q. P. Crick, C. V. Wernham, H. T. Riley, B. Etheridge, and D. B. A. Thompson., (2013). *Raptors: a field guide to survey and monitoring*. The Stationary Office Ltd, Edinburgh. Third Edition.

Collision Risk Modelling

- 8.4.17 In order to further inform the determination of the likelihood of potential significant adverse effects occurring, collision risk modelling was carried out for all the key target species (as per SNH guidance 2018a) recorded flying through the collision risk zone at rotor height. A rotor height envelope of 30-230m above the ground was used for the modelling, to take into account the variation in hub height across the site: actual rotor height would be 30-180 m for the lowest wind turbines, up to 80-230 m for the highest ones. Further details are provided in Technical Appendix 8.5: Collision Risk Modelling Calculations.
- 8.4.18 The modelling included five target raptor species (goshawk, red kite, hen harrier, peregrine and merlin) and three breeding waders (curlew, lapwing and snipe). The collision risk for each of these species was modelled using the non-direct flight model. In addition, wintering/migrating whooper swans, greylag geese, barnacle geese, pink-footed geese, golden plover, dunlin and herring gulls were observed flying through the collision risk zone and were also modelled to determine their collision risk. As their flights were largely direct ones through the site, the direct flight model was applied. No other key species was recorded flying through the collision risk zone at rotor height.
- 8.4.19 The collision risk model used in this assessment was developed by NS and BWEA¹⁶. The model runs as a two-stage process. Firstly, the risk is calculated making the assumption that flight patterns are unaffected by the presence of the wind turbines, i.e. that no avoidance action is taken. This is essentially a mechanistic calculation, with the collision risk calculated as the product of (i) the probability of a bird flying through the rotor swept area, and (ii) the probability of a bird colliding if it does so. This probability is then multiplied by the estimated numbers of bird movements through the wind farm rotors at the risk height (i.e. the height of the rotating rotor blades) in order to estimate the theoretical numbers at risk of collision if they take no avoiding action.

- 8.4.20 The second stage then incorporates the probability that the birds, rather than flying blindly into the wind turbines, will actually take a degree of avoiding action, as has been shown to occur in all studies of birds at existing wind farms. NS has recommended a precautionary approach, using a value of 98% as a general default avoidance rate, 99% for some larger raptors (including red kite and hen harrier) and 99.8% for geese¹⁷. This precautionary approach is useful as an initial filter to identify sites where collision risk is clearly not an issue, but does not necessarily provide a realistic estimate of actual likely collision rates when compared with data from existing wind farms. The magnitude of the impact was determined as a percentage increase in the existing baseline mortality (to put the potential wind farm mortality into the ecological context of the birds' population dynamics), though professional judgement was also applied in the assessment of any non-negligible magnitude collision risks predicted.
- 8.4.21 Details of the input data and the collision risk calculations are given in Technical Appendix 8.5. Body sizes and baseline mortality rates were taken from Robinson 2005¹⁸ and flight speeds from Alerstam *et al.* 2007¹⁹.

Assessment Methodology

- 8.4.22 The significance of the potential effects of the proposed development has been classified by professional consideration of the value of the receptor and the magnitude of the potential effect.
- 8.4.23 The assessment includes a full evaluation of the ornithological importance of the bird populations at the site and identification of any particularly sensitive areas. The assessment has been carried out with reference to the assessment methodologies produced by NatureScot (SNH 2018a) for the wider countryside, and the CIEEM Guidelines (2018).
- 8.4.24 An assessment of the effects of the proposed development on European Protected Sites under the Habitats Regulations is presented separately in Technical Appendix 8.7.

¹⁶ Band, W., Madders, M. & Whitfield, D. P., (2007). *Developing field and analytical methods to assess avian collision risk at wind farms. In Birds and Wind Farms.* (eds. M. Lucas, de, G. F. E. Janss & M. Ferrer), pp. 15pp. Madrid: Quercus.

¹⁷ Scottish Natural Heritage, (2017b). Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model. SNH.

¹⁸ Robinson, R.A. (2005) BirdFacts: profiles of birds occurring in Britain & Ireland (BTO Research Report 407). BTO, Thetford (<http://www.bto.org/birdfacts>).

¹⁹ Alerstam, T., Rosén, M., Bäckman, J., Ericson, P. & Hellgren, O. 2007. Flight speeds among bird species: allometric and phylogenetic effects. *PLoS biology*, 5.

Criteria for Assessing Value (Conservation Importance)

8.4.25 Value (conservation importance) was assigned using the criteria set out in Table 8.2, drawing upon those adopted by NS in Guidelines for Selection of Biological SSSI, using 1% of the resource to define international and national importance (very high and high values) (Frost *et al.* 2021). An additional category of regional importance (medium value) was assigned for species approaching the threshold for national importance and those for which the survey area held a notable concentration in a county context. A further category of 'local importance' (low value) was used for species that did not reach regional importance but were still of some conservation interest. This included all species on the red or amber lists of the 'Birds of Conservation Concern' (Stanbury *et al.* 2021) that did not reach national or regional importance at the site. National reference populations have been taken from Woodward *et al.* 2020²⁰ and regional NHZ populations from Wilson *et al.* 2015²¹. In addition, listing on Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside and Scottish Biodiversity List (SBL) species were all considered in the evaluation process.

8.4.26 The sensitivity (conservation importance, as defined in Table 8.2) of the receptors present in the 20km study area were identified, then the magnitude of the possible impact on those receptors determined (as described in Table 8.3).

Table 8.2: Value (conservation importance) of bird species

Value	Definitions
Very High	Cited interest of SPAs, Special Areas of Conservation (SACs) and SSSIs. Cited means mentioned in the citation text for those protected sites as a species for which the site is designated (SPAs/SACs) or notified (SSSIs).
High	Other species that contribute to the integrity of an SPA or SSSI. A local population of more than 1% of the national population of a species. Any ecologically sensitive species, e.g. large birds of prey or rare birds (<300 breeding pairs in the UK). EU Birds Directive Annex 1, EU Habitats Directive priority habitat/species and/or Wildlife and Countryside Act Schedule 1 species (if not covered above). Other specially protected species.
Medium	Regionally important population of a species, either because of population size or distributional context. UK Biodiversity Action Plan (BAP) priority species (if not covered above).
Low	Any other species of conservation interest, e.g. species listed on the Birds of Conservation Concern not covered above, present in only locally important numbers
Nil	Green-listed species (Eaton <i>et al.</i> 2015) of favourable conservation status.

Magnitude of Impact

8.4.27 An impact is defined as a change of particular magnitude to the abundance and/or distribution of a population as a result of the proposed development. The magnitude of impact is assessed in terms of the extent of the impact (spatial) and the temporal aspects of the impact, in terms of timing, frequency, duration and reversibility. Table 8.3 shows the definitions of the impact magnitude classification used for the assessment.

Table 8.3: Definition of terms relating to the magnitude of ornithological impacts

Magnitude	Definition
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions such that post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. Guide: >80% of population/habitat lost
High	Major alteration to key elements/ features of the baseline conditions such that post development character/composition/attributes will be fundamentally changed. Guide: 20-80% of population/habitat lost
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/ composition/ attributes of baseline will be partially changed. Guide: 5-20% of population/habitat lost
Low	Minor shift away from baseline conditions. Change arising from the loss/ alteration will be discernible but underlying character/composition/ attributes of baseline condition will be similar to pre-development circumstances/patterns. Guide: 1-5% of population/habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. Guide: <1% of population/habitat lost

Significance Criteria

8.4.28 The combined assessment of the magnitude of an impact and the value of the receptor was used to determine the significance of potential effects. These two criteria were cross-tabulated to assess the overall effect and significance of that effect (Table 8.4). This gives a guide as to the determination of significance, though the final assessment was still subject to professional judgment.

²⁰ Woodward, I., N. Aebischer, D. Burnell, M. Eaton, T. Frost, C. Hall, D. Stroud, and D. Noble. 2020. Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 113:69-104.

²¹ Wilson, M. W., G. E. Austin, G. S., and C. V. Wernham. 2015. Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned report number 1504.

Table 8.4: Matrix of magnitude of impact and sensitivity used to test the significance of effects.

		SENSITIVITY				
		Very high	High	Medium	Low	Nil
MAGNITUDE	Very high	Major	Major	Major-moderate	Moderate	Negligible
	High	Major	Major	Moderate	Minor	Negligible
	Medium	Major	Major-moderate	Minor	Negligible	Negligible
	Low	Moderate	Minor	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible

8.4.29 The significance category of each combination is shown in each cell. Shaded cells indicate potentially significant effects in terms of the EIA Regulations.

8.4.30 The interpretation of these significance categories was as follows:

- Negligible and minor are not normally of concern, though normal design care should be exercised to minimise any adverse effects;
- Moderate represents a potentially significant adverse effect on which professional judgment has to be made, though for which it is likely that mitigation will reduce it below the significance threshold; and
- Major and major/moderate represent significant adverse effects on bird populations which are regarded as significant for the purposes of EIA.

8.4.31 The SNH (2018a) wider countryside assessment guidance defines the key significance test as follows: “An impact should be judged as of concern where it would adversely affect the favourable conservation status of a species, or stop a recovering species from reaching favourable conservation status, at international or national level or regionally.” It notes that the key baseline population against which the assessment should be made for breeding birds is the SNH Natural Heritage Zone (NHZ) population (NHZ 20, ‘Border Hills’, in this case).

8.4.32 A cumulative ornithological assessment (using the same criteria as the main assessment) has been undertaken following the SNH 2018b guidance on ‘Assessing the cumulative impacts of onshore wind farms on birds’, considering impacts on the favourable conservation status of key species within the relevant NHZ, in this case NHZ 20 ‘Border Hills’.

8.4.33 As the 20km study area held species specially protected under Schedule 1 of the 1981 Wildlife and Countryside Act, information on the breeding sites and associated flight activity of the species listed on that Schedule is provided in a Confidential Technical Appendix 6.2. It is important that their breeding locations are kept confidential to minimise the risk of persecution and disturbance. Following SNH (2016b) guidance, the amount of information contained in that Technical Appendix has been kept to a minimum but includes all data that indicate breeding locations.

Limitations and Assumptions

8.4.34 No significant information gaps have been identified. Inevitably with any ornithological survey it cannot be guaranteed to detect all target species/individuals and surveys cannot be fully representative of all conditions (e.g. severely reduced visibility). However, in this case it was concluded that the baseline surveys provide a robust data set on which to carry out the assessment.

8.4.35 Access was restricted to part of the core survey area during the April and May 2021 breeding bird surveys because of lambing activities (to avoid disturbance to lambing ewes), so the numbers that year should be treated as minimum values as some early breeding birds and birds that failed in the first part of the breeding season may have been missed. The area affected is shown in Technical Appendix 8.1.

8.4.36 NatureScot recommended contacting the South of Scotland Golden Eagle Group but no reply was received from them. The site is generally, though, of low suitability for golden eagle, given its low altitude (golden eagle prefer ground over 300m - the highest point on the site in 270m) and generally flat topography (eagles prefer more slopes exceeding 10° and areas within 300m of ridges), Fielding *et al.* (2020)²².

8.5 Baseline

Statutory Protected Sites

8.5.1 There are eight statutory designated nature conservation sites in the search area around the proposed development (5km for nationally important Sites of Special Scientific Interests (SSSI) and 20km for internationally important European Protected Special Protection Areas (SPA) and Ramsar Sites):

- Bigholms Burn SSSI - adjacent to the northern edge of the site - a small (1.7ha.) Site notified for its geological interest. No ornithological interest features, so not considered further in this chapter.

²² Fielding, A. H., P. F. Haworth, D. Anderson, S. Benn, R. Dennis, E. Weston, and D. P. Whitfield. 2020. A simple topographical model to predict Golden Eagle *Aquila chrysaetos* space use during dispersal. *Ibis* 162:400-415.

- River Esk, Glencartholm SSSI - 3.7km east from the site - another site notified for its geological interest. No ornithological interest features, so not considered further in this Chapter.
- Bell's Flow SSSI - 2.6km south from the site - an intermediate raised bog notified for its botanical interest. No ornithological interest features, so not considered further in this chapter.
- Langholm - Newcastleton Hills SPA/SSSI - 2.6km north-east from the site - upland moorland designated for its breeding hen harrier population (SPA), its upland breeding bird assemblage, upland habitats and geological interest (SSSI).
- Upper Solway Flats and Marshes SPA/Ramsar/SSSI - 13km south from the site - a very extensive inter-tidal habitat with an internationally important wintering waterfowl community including bar-tailed godwit, barnacle goose, golden plover, whooper swan, ringed plover, curlew, dunlin, knot, oystercatcher, pink-footed goose, pintail and redshank.
- Castle Loch, Lochmaben SPA/Ramsar/SSSI - 19km west from the site - designated for its internationally important wintering population of pink-footed geese. The SPA citation cites a population of 8,300 pink-footed geese (4% of the international population), though numbers have been rather lower in more recent years, probably as a result of more geese roosting on the Solway Firth rather than at this site (Mitchell 2012, Frost *et al.* 2021). It also supports a nationally important wintering population of goosander (winter peak mean of 66, 1% of the British population).

8.5.2 The potential connectivity of each of these SPAs to the proposed development is summarised in Table 8.5. This lists the qualifying features for each SPA, the distance from the site at its closest point and an initial assessment of whether the site falls within the core range of each (as set out in SNH 2016a). As set out in this guidance, *“In most cases the core range should be used when determining whether there is connectivity between the proposal and the qualifying interests”*, so this has been used for this assessment (though with consideration of the maximum ranges too).

Table 8.5: Special Protection Areas within 20km of the proposed development, their qualifying features and likely connectivity to the site.

SPA	Distance from site	Qualifying features	Qualifying features for which site lies within core range (SNH 2016a)
Langholm - Newcastleton Hills	2.6km	Breeding hen harrier	None (outside 2km core but within maximum range of 10km)
Upper Solway Flats and Marshes	13km	Internationally important wintering waterfowl community including bar-tailed godwit, barnacle goose, golden plover, whooper swan, ringed plover, curlew, dunlin, knot, oystercatcher, pink-footed goose, pintail and redshank	Pink-footed goose (15-20km) and barnacle goose (15km)
Castle Loch, Lochmaben SPA	19km	Wintering pink-footed goose	Pink-footed goose

Current Baseline

Desk Study Results: Consultee data

8.5.3 The desk study found the following data on key bird populations using the site and its surrounds:

- Hen harrier - a winter roost was reported in Solwaybank Environmental Statement (ES) to the west of the site (but no evidence was found during the baseline surveys of any roosts within the potential impact zone of the wind farm).
- Barn Owl - there were eight records of this species within 2km of the site in the South West Scotland Environmental Information Centre (SWSEIC) database, dating from 2005-2016.
- Kingfisher - there was a single record of a kingfisher about 2km south-east from the site in the SWSEIC database from October 2014.
- Breeding waders - the SWSEIC database held numerous records of breeding oystercatcher, lapwing, curlew and snipe within the site.

- Wintering geese - the site lies within the ranging distance of barnacle and pink-footed geese from the Upper Solway Flat and Marshes SPA, and from the Castle Loch SPA, so might be expected to be overflowed by birds moving to/from their feeding sites and roosts on the SPA. However, the habitat within/around the site is predominantly upland moorland and forestry, unsuitable for feeding geese, and a review of goose feeding areas around SPAs in Scotland (Mitchell 2012²³) has demonstrated that there are no frequently used feeding areas in the area that would be likely to result in large-scale over-flights of the site for the either SPA goose species.

Field Survey Results: Breeding Birds

8.5.4 The breeding bird populations found within the core survey area during each of the breeding bird surveys are summarised in Table 8.6. This Table shows the estimated number of breeding pairs recorded during each of the two survey years (2021 and 2022), and the overall peak number of breeding pairs. Details of all the breeding bird populations are set out in Technical Appendices 8.1 and 8.2.

Table 8.6: Breeding Bird Populations in the Core Study Area (April-August 2021 and 2022)

Species	Number of pairs in 2021	Number of pairs in 2022
Greylag Goose	0	2
Mallard	6	4
Red Grouse	0	6
Grey Partridge	0	2
Pheasant	8	5
Buzzard	9	6
Kestrel	1	1
Oystercatcher	5	5
Lapwing	3	8
Snipe	9	6
Curlew	7	7
Common Sandpiper	0	1
Feral Pigeon	1	3
Stock Dove	2	4
Woodpigeon	52	57
Cuckoo	7	6
Great Spotted Woodpecker	4	2
Skylark	290	411
Sand Martin	12	17
Swallow	21	26

Species	Number of pairs in 2021	Number of pairs in 2022
House Martin	5	3
Tree Pipit	3	2
Meadow Pipit	1022	1181
Grey Wagtail	7	8
Pied Wagtail	25	32
Dipper	2	2
Wren	59	90
Dunnock	9	11
Robin	24	33
Redstart	5	2
Whinchat	6	4
Stonechat	27	47
Wheatear	3	4
Blackbird	18	26
Song Thrush	17	38
Mistle Thrush	13	7
Grasshopper Warbler	5	9
Sedge Warbler	7	15
Blackcap	4	5
Whitethroat	2	2
Chiffchaff	7	9
Willow Warbler	73	91
Goldcrest	9	12
Spotted Flycatcher	3	0
Pied Flycatcher	1	0
Long-tailed Tit	3	2
Blue Tit	8	10
Great Tit	5	14
Coal Tit	22	15
Treecreeper	1	0
Jay	0	4
Jackdaw	18	74
Carrion Crow	32	35
Raven	2	3
Starling	9	8
House Sparrow	5	9
Chaffinch	58	79
Goldfinch	10	8
Siskin	29	17
Linnet	20	20

²³ Mitchell, C. 2012. Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland. 1881, Wildfowl & Wetlands Trust / Scottish Natural Heritage Report, Slimbridge.

Species	Number of pairs in 2021	Number of pairs in 2022
Lesser Redpoll	37	84
Common Crossbill	0	2
Bullfinch	0	5
Reed Bunting	52	76

Note: access was restricted to parts of the survey area in 2021 to avoid disturbance to lambing ewes, so the numbers for that year should be treated as minimum values.

Species-Specific Breeding Bird Survey Results

8.5.5 The following key target species were recorded within the survey area (core and wider areas), but no evidence was found for any of them of breeding within the core or wider 2km buffer survey area.

- Hen harrier;
- Goshawk;
- Osprey;
- Peregrine; and
- Short-eared Owl.

8.5.6 Two additional Schedule 1 species were recorded during the surveys, kingfisher and barn owl. No specific nest sites were identified, but both were likely to have been breeding in the area (though the potential impact zone of the wind farm did not support suitable nesting habitat for either species).

8.5.7 There were no records of black grouse during the specific surveys for this species or during any of the other baseline surveys.

Vantage Point Survey Results: Breeding Season

8.5.8 The rates of bird flight movement observed across the site during the breeding season VP surveys are summarised in Table 8.7. This gives the flight rate per hour of observation in each year and the overall mean flight rate per hour. Overall flight rates of key species over the site were low, with no major differences apparent between years.

8.5.9 Table 8.7 also gives the percentage of flights of each species that were recorded at rotor height over both years' baseline data (taking rotor height conservatively as between 21m and 250m above ground level to allow for errors in flight height estimation; the actual rotor height would be 30-180 m for the lowest wind turbines, up to 80-230 m for the highest ones).

Table 8.7: Key Species Flight Rates recorded over the VP survey area during the 2021 and 2022 breeding season vantage point surveys

Species	Flight rate in 2021 (birds/hour)	Flight rate in 2022 (birds/hour)	Total number observed	% flights at rotor height (21-250m)
Greylag Goose	0.10	0.00	7	25%
Mallard	0.06	0.21	19	33%
Goosander	0.01	0.00	1	100%
Cormorant	0.00	0.06	4	100%
Grey Heron	0.04	0.00	3	100%
Red Kite	0.00	0.03	2	100%
Hen Harrier	0.01	0.04	4	50%
Goshawk	0.03	0.01	3	67%
Sparrowhawk	0.00	0.04	3	67%
Buzzard	1.10	1.39	179	80%
Osprey	0.01	0.00	1	100%
Kestrel	0.33	0.17	36	46%
Merlin	0.00	0.01	1	0%
Peregrine	0.03	0.00	2	0%
Oystercatcher	0.19	0.43	45	17%
Lapwing	1.13	4.15	380	9%
Snipe	0.14	0.17	22	58%
Curlew	0.68	0.90	114	31%
Common Gull	0.01	0.19	15	50%
Lesser Black-backed Gull	1.18	1.33	181	70%
Herring Gull	0.04	0.10	10	88%
Great Black-backed Gull	0.10	0.26	26	65%
Greylag Goose	0.10	0.00	7	25%
Mallard	0.06	0.21	19	33%
Goosander	0.01	0.00	1	100%

Field Survey Results: Wintering Birds

8.5.10 The results of the autumn/winter walkover surveys are summarised in Table 8.8. The Table shows the mean and peak counts recorded in each of the two survey years (2020-21 and 2021-22).

Table 8.8: Autumn/Winter Bird Populations (wintering bird walkover survey area during 2020-21 and 2021-22)

Species	Mean count 2020-21	Mean count 2021-22	Peak count 2020-21	Peak count 2021-22
Pink-footed Goose	15.0	0.1	75	1
Greylag Goose	0	2.6	2	18
Mallard	2.2	1.4	4	3
Goosander	0	0.1	0	1
Red Grouse	4.8	2.3	9	8

Species	Mean count 2020-21	Mean count 2021-22	Peak count 2020-21	Peak count 2021-22
Cormorant	0	0	0	1
Grey Heron	0	0.3	0	1
Red Kite	0.2	0	1	0
Hen Harrier	1.0	0.6	3	3
Goshawk	0.8	0	3	0
Sparrowhawk	0.4	0.4	1	1
Buzzard	9.0	4.9	11	7
Kestrel	1.4	0.9	2	3
Merlin	0.6	0.1	2	1
Peregrine	0	0.1	0	1
Oystercatcher	0.8	0	2	0
Golden Plover	5.0	0.7	23	3
Lapwing	1.0	3.7	3	14
Jack Snipe	0.6	0.3	1	1
Snipe	18.2	8.3	59	23
Woodcock	0.2	0.3	1	2
Curlew	1.2	0.4	6	3
Common Gull	1.4	12.7	7	89
Lesser Black-backed Gull	0	0.6	0	2
Herring Gull	0	0.6	0	4
Great Black-backed Gull	0.2	0.4	1	2
Black-headed Gull	0.6	0	3	0
Barn Owl	0.1	0.1	1	1

Vantage Point Survey Results: Winter

- 8.5.11 The rates of bird flight movement observed across the site during the autumn/winter VP surveys are summarised in Table 8.9. This shows a comparison of the flight rates recorded in each of the two autumn/winters (2020-21 and 2021-22). Overall flight rates of key species over the site were low, with no major differences apparent between years.
- 8.5.12 Table 8.9 also gives the overall percentage of flights of each species that were recorded at rotor height (between 21m and 250m above ground level to allow for errors in flight height estimation and variations in hub heights; the actual rotor height would be about 30-180 m for the lowest wind turbines, up to 80-230 m for the highest ones).

Table 8.9: Key Species Flight Rates recorded over the VP survey area during the 2020-21 and 2021-22 autumn/winter vantage point surveys

Species	Flight rate in 2020-21 (birds/hour)	Flight rate in 2021-22 (birds/hour)	Total number observed over-flying	% flights at rotor height (21-250m)
Whooper Swan	0	0.07	6	100%
Pink-footed Goose	14.24	6.07	1535	84%
Greylag Goose	0.03	0.11	11	100%
Barnacle Goose	0	1.45	122	75%
Mallard	0.01	0.26	23	10%
Goosander	0	0.01	1	100%
Red Grouse	0.08	0	6	0%
Cormorant	0	0.01	1	100%
Grey Heron	0.04	0.02	5	40%
Red Kite	0.01	0.01	2	50%
Hen Harrier	0.19	0.21	32	16%
Goshawk	0.14	0.02	12	33%
Sparrowhawk	0.13	0.04	12	30%
Buzzard	0.99	0.52	115	46%
Kestrel	0.99	0.04	74	11%
Merlin	0.06	0.04	7	29%
Peregrine	0	0.06	5	40%
Oystercatcher	0.01	0	1	0%
Golden Plover	0	0.19	16	100%
Lapwing	0.26	0.42	54	19%
Dunlin	0	0.01	1	100%
Jack Snipe	0.01	0	1	0%
Snipe	0.04	0.23	22	33%
Woodcock	0.01	0	1	0%
Curlew	0.19	0.10	22	27%
Common Gull	2.38	4.93	585	58%
Lesser Black-backed Gull	0.04	0.29	27	69%
Iceland Gull	0.01	0	1	100%
Herring Gull	11.42	0.25	843	80%
Great Black-backed Gull	0.33	0.10	32	82%
Black-headed Gull	0	0.01	1	0%
Barn Owl	0.03	0	2	0%

Future Baseline

8.5.13 In the “do nothing” scenario without the construction of the proposed development, it is anticipated that the current management of the site will continue as part of wider estate management activities and that the bird populations currently present will continue at the site, though subject to changes occurring at the national and regional levels, such as the national decline in curlew population (Franks *et al.* 2017²⁴). Local future trends in numbers will be dependent primarily on habitat change. Further afforestation could reduce open ground species such as the breeding waders, but temporarily improve conditions for black grouse and hen harrier. The main current land use within the site (sheep grazing), would likely continue into the future. Changes are also likely to occur as a result of climate change, though would be anticipated to be minor over the lifetime of the proposed wind farm.

Ornithological Conservation Evaluation

Conservation Evaluation of Breeding Bird Populations

8.5.14 The conservation value of the breeding bird populations was determined using the criteria specified in Table 8.2. The results are summarised in Table 8.10. All of the species with very high - low value have been taken forward in the ornithological assessment (i.e. only those with nil value have been scoped out at this stage).

Table 8.10: Conservation Evaluation of the Breeding Bird Populations at the Site (2021 and 2022)

Species	Peak breeding pairs 2021/22	>1% NHZ	EU Birds Dir Ann 1	Wildlife and Country side Act Sch 1	Red [R]/ Amber [A] List	UK priority sp	Scottish BAP sp	Conservation Value
<i>Breeding Species:</i>								
Greylag Goose	2				A			Low
Mallard	6				A			Low
Red Grouse ¹	6					✓		Medium
Grey Partridge	2				R	✓	✓	Medium
Pheasant	8							Nil
Buzzard ²	9							Nil
Kestrel	1				A		✓	Low
Oystercatcher	5				A			Low

Species	Peak breeding pairs 2021/22	>1% NHZ	EU Birds Dir Ann 1	Wildlife and Country side Act Sch 1	Red [R]/ Amber [A] List	UK priority sp	Scottish BAP sp	Conservation Value
Lapwing	8				R	✓	✓	Medium
Snipe ²	9				A			Low
Curlew ²	7				R	✓	✓	Medium
Common Sandpiper	1				A			Low
Feral Pigeon	3							Nil
Stock Dove	4				A			Low
Woodpigeon	57				A			Low
Cuckoo	7				R	✓	✓	Medium
Kingfisher	1		✓	✓			✓	High
Barn Owl	1			✓			✓	High
Great Spotted Woodpecker	4							Nil
Skylark	411				R	✓	✓	Medium
Sand Martin	17							
Swallow	26							
House Martin	5				R			Low
Tree Pipit	3				R	✓	✓	Medium
Meadow Pipit	1181				A			Low
Grey Wagtail ²	8				A			Low
Pied Wagtail	32							Nil
Dipper ^{2.5}	2				A			Low
Wren	90				A			Low
Dunnock	11				A	✓		Medium
Robin	33							Nil
Redstart	5							Nil
Whinchat ²	6				R			Low
Stonechat ²	47							Nil
Wheatear ¹	4				A			Low
Blackbird	26							Nil
Song Thrush	38				A	✓	✓	Medium
Mistle Thrush	13				R			Low
Grasshopper Warbler	9				R	✓	✓	Medium
Sedge Warbler	15				A			Low

²⁴ Franks, S. E., Douglas, D. J. T., Gillings, S. and Pearce-Higgins, J. W. 2017. Environmental correlates of breeding abundance and population change of Eurasian Curlew *Numenius arquata* in Britain. *Bird Study*, 64: 393-409

Species	Peak breeding pairs 2021/22	>1% NHZ	EU Birds Dir Ann 1	Wildlife and Country side Act Sch 1	Red [R]/ Amber [A] List	UK priority sp	Scottish BAP sp	Conservation Value
Blackcap	5							Nil
Whitethroat	2							Nil
Chiffchaff	9							Nil
Willow Warbler	91				A			Low
Goldcrest	12							Nil
Spotted Flycatcher	3				R	✓	✓	Medium
Pied Flycatcher	1				A			Low
Long-tailed Tit	3							Nil
Blue Tit	10							Nil
Great Tit	14							Nil
Coal Tit	22							Nil
Treecreeper	1							Nil
Jay	4							Nil
Jackdaw	74							Nil
Carrion Crow	35							Nil
Raven ³	3							Nil
Starling	9				R	✓		Medium
House Sparrow	9				R	✓	✓	Medium
Chaffinch	79							Nil
Goldfinch	10							Nil
Siskin	29						✓	Low
Linnet	20				R	✓	✓	Medium
Lesser Redpoll	84					✓	✓	Medium
Common Crossbill	2			✓				High
Bullfinch	5				A	✓	✓	Medium
Reed Bunting	76				A	✓	✓	Medium
<i>Additional non-breeding species:</i>	<i>Peak count</i>							
Grey Heron	1							Nil
Hen Harrier	1		✓	✓	R		✓	High
Goshawk	1			✓				High
Osprey	1		✓	✓	A		✓	High
Peregrine	1		✓	✓			✓	High

Species	Peak breeding pairs 2021/22	>1% NHZ	EU Birds Dir Ann 1	Wildlife and Country side Act Sch 1	Red [R]/ Amber [A] List	UK priority sp	Scottish BAP sp	Conservation Value
Golden Plover	19		✓				✓	High
Black-headed Gull	1				A			Low
Common Gull	1				A			Low
Lesser Black-backed Gull	21				A			Low
Herring Gull	2				R	✓	✓	Medium
Great Black-backed Gull	3				A			Low
Short-eared Owl	1		✓		A		✓	High
Swift	14				R		✓	Low
Redwing	2				A		✓	Low
Fieldfare	46				R			Low

- 8.5.15 Only one high value species was recorded breeding within the core breeding bird survey area: common crossbill (with two pairs in coniferous plantations in the central parts of the survey area).
- 8.5.16 Two additional high value species were recorded during the surveys; kingfisher and barn owl, but no specific nest sites were identified. Both were considered likely to have been breeding in the area, though outside the potential impact zone of the wind farm.
- 8.5.17 Seventeen breeding species within the core breeding area were classed as medium conservation value: red grouse, grey partridge, lapwing, curlew, cuckoo, skylark, tree pipit, dunnock, song thrush, grasshopper warbler, spotted flycatcher, starling, house sparrow, linnet, lesser redpoll, bullfinch and reed bunting. All were classed as medium value for their listing as UK Biodiversity Action Plan priority species.
- 8.5.18 A further twenty-one breeding species were classed as low sensitivity, through their listing on RSPB *et al.*'s (Stanbury *et al.* 2021) amber lists of birds of conservation concern and/or the Scottish Biodiversity List.

8.5.19 The overall conservation value of the breeding bird community, measured from the core survey data as the breeding bird assemblage score, was 19.5. This is below the threshold for national importance (27) but above the threshold for regional importance (14) for the main habitat within the survey area, 'Upland moorland and grassland without water bodies' (Drewitt *et al.* 2020²⁵). The core survey area therefore supports a regionally important breeding bird community.

8.5.20 Other non-breeding species recorded during the surveys included six high sensitivity species (red kite, hen harrier, goshawk, osprey, peregrine, golden plover and short-eared owl), classed as high value receptors, through their listing as EU Birds Directive Annex 1 and/or Wildlife and Countryside Act Schedule 1 species.

Conservation Evaluation of Wintering Bird Populations

8.5.21 The conservation value of the wintering bird populations was determined using the criteria specified in Table 8.2. The results are summarised in Table 8.11. All of the species with very high - low value have been taken forward in the ornithological assessment (i.e. only those with nil value have been scoped out at this stage).

8.5.22 Two species (pink-footed goose and barnacle goose) were classed as very high sensitivity as the site lies within the connectivity range of the Upper Solway Flats and Marshes SPA, for which they are qualifying species. Nine species were classed as high sensitivity (whooper swan, red kite, hen harrier, goshawk, peregrine, merlin, golden plover, dunlin and barn owl) that are EU Birds Directive Annex 1/Wildlife and Countryside Act Schedule 1 species, four medium sensitivity species (UK BAP priority/red listed species of conservation concern; red grouse, lapwing, curlew and herring gull), and 12 low sensitivity species

Table 8.11: Conservation Evaluation of the Wintering Bird Populations at the Site (2021 and 2022)

Species	Peak count 2020-21	Peak count 2021-22	EU Birds Dir Ann 1	Wildlife and Countryside Act Sch 1	Red [R]/ Amber [A] List	UK priority sp	Scottish BAP sp	Conservation Value
Whooper Swan	0	6	✓	✓	A		✓	High
Pink-footed Goose	495	145			A			Very high
Greylag Goose	2	18			A			Low
Barnacle Goose	0	90	✓		A		✓	Very high
Mallard	4	3			A			Low

²⁵ Drewitt, A. L., S. Whitehead, and S. Cohen. 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.

Species	Peak count 2020-21	Peak count 2021-22	EU Birds Dir Ann 1	Wildlife and Countryside Act Sch 1	Red [R]/ Amber [A] List	UK priority sp	Scottish BAP sp	Conservation Value
Goosander	0	1						Nil
Red Grouse	9	8				ü		Medium
Cormorant	0	1						Nil
Grey Heron	1	1						Nil
Red Kite	1	1	✓	✓			✓	High
Hen Harrier	3	3	✓	✓	R		✓	High
Goshawk	3	1		✓				High
Sparrowhawk	1	1			A			Low
Buzzard	11	7						Nil
Kestrel	2	3			A		✓	Low
Merlin	2	1	✓	✓	R		✓	High
Peregrine	0	1	✓	✓			✓	High
Oystercatcher	2	0			A			Low
Golden Plover	23	15	✓				✓	High
Lapwing	3	14			R	✓	✓	Medium
Jack Snipe	1	1						Nil
Dunlin	0	1	✓				✓	High
Snipe	59	23			A			Low
Woodcock	1	2			R		✓	Low
Curlew	6	3			R	✓	✓	Medium
Common Gull	7	89			A			Low
Lesser Black-backed Gull	2	2			A			Low
Iceland Gull	1	0			A			Low
Herring Gull	126	4			R	✓	✓	Medium
Great Black-backed Gull	1	2			A			Low

Species	Peak count 2020-21	Peak count 2021-22	EU Birds Dir Ann 1	Wildlife and Countryside Act Sch 1	Red [R]/Amber [A] List	UK priority sp	Scottish BAP sp	Conservation Value
Black-headed Gull	3	1			A			Low
Barn Owl	1	1		✓			✓	High

8.5.23 Key wintering bird populations recorded included:

- **Over-flying pink-footed geese** - pink-footed geese were occasionally seen over-flying, with 10 flocks observed in 2020-21 and 9 in 2021-22 (Figure 8.3). None were seen on the ground during any of the surveys in either winter. The only potential impact of the proposed development on this species would be collision risk.
- **Other over-flying geese and swans** - whooper swans and barnacle geese were both observed over-flying the site during the 2021-22 winter (see Figure 8.4), though neither were seen in the previous winter. The only whooper swan record was a single flock of 6 birds flying over on 14/1/22. Four barnacle goose flocks were seen, with three of these on 13/10/21 (flocks of 10, 21 and 90 - migratory birds arriving into the Solway for the winter) and a single bird over-flying with pink-footed geese in January. As for pink-footed geese, any risk from the wind farm to these species would be of collision.
- **Hen Harrier** - this species was regularly seen hunting over the site through the winter, with 14 flights in 2020-21 and 18 during the 2021-22 VP surveys (Figure 8.5). No evidence was found in either winter of any night roost in the survey area, and most flights seen were below rotor height.
- **Goshawk** - there were 10 sightings of this species during the 2020-21 winter and two in 2021-22. Overall, it was seen mainly in the afforested habitats around the site, with occasional flights over the site itself (Figure 8.6).
- **Peregrine** - this species was not recorded at all during the 2020-21 surveys, but there were five sightings during the 2021-22 VP surveys, mostly over the eastern part of the site (Figure 8.8). There was no evidence that the site is of particular importance to this species.
- **Merlin** - there were occasional records of this species - four during the 2020-21 VP surveys and three during the walkover surveys in that winter, and three during the 2021-22 VP surveys and one during the walkover surveys (Figure 8.9). This included a small number of flights over the site, but no evidence that the site was of particular importance.

- **Golden Plover** - there were occasional records through the winter, but numbers recorded were very low (peak 15 in 2020-21 and 12 in 2021-22) (Figure 8.12).
- **Other scarce raptors and owls** - red kite (Figure 8.7) and barn owl were both recorded during both winters' surveys, but only infrequently in low numbers. There was no indication that the survey area was important to either of these species.

8.6 Assessment of Potential Effects

8.6.1 The key issues for the assessment of potential ornithological effects relating to the proposed development are identified below (SNH 2018a):

- Direct loss of bird habitat through construction of the proposed development;
- Disturbance of birds during construction and operation; and
- Collision risk to birds during operation.

8.6.2 No ornithological issues were scoped out from this assessment, though, following SNH (2018a) guidance, the assessment has focussed on the key species likely to be affected by the proposed development. Key species were defined using the following criteria:

- species listed on Annex 1 of the EU Birds Directive;
- species listed on Schedule 1 of the 1981 Wildlife & Countryside Act;
- species identified by SNH 2018a as 'Priority bird species for assessment when considering the development of onshore wind farms in Scotland'. These include (a) species that are widespread across Scotland which utilise habitats or have flight behaviours that may be adversely affected by a wind farm, and (b) as 'restricted range' species; and
- red-listed species on the Birds of Conservation Concern list.

8.6.3 The assessment also takes into account and applies the tests given in NS guidance on the assessment of effects of wind farms in the wider countryside (SNH 2018a). This guidance lists a range of priority 'species potentially at risk of impact', of which the following were recorded during the baseline surveys: whooper swan, barnacle goose, pink-footed goose, greylag goose, hen harrier, goshawk, red kite, osprey, merlin, peregrine, golden plover, lapwing, dunlin, curlew, herring gull and short-eared owl. The potential effects of the proposed development on each of these have been specifically considered and assessed below.

NatureScot Key Species Potentially at Risk

- 8.6.4 NatureScot (SNH 2018a) has identified a range of key species as being at potential risk of impact from wind farms. These species form the key focus of the ornithological impact assessment in the following section. In total three such species potentially at risk of impact were found breeding within the potential disturbance zone around the site (see Figure 8.2), these include:
- greylag goose (2 pairs);
 - lapwing (2 pairs); and
 - curlew (4 pairs);
- 8.6.5 Key species recorded using the potential disturbance zone outside the breeding season included red kite, hen harrier, goshawk, curlew, golden plover, peregrine and merlin.
- 8.6.6 Key species recorded at risk of collision (i.e. flying through the site at rotor height) included whooper swan, pink-footed goose, greylag goose, barnacle goose, red kite, hen harrier, goshawk, curlew, golden plover, lapwing, dunlin, peregrine and merlin.

Construction Effects

Direct Effects: Loss of Habitat (Direct loss or degradation of habitat through construction of the proposed development)

- 8.6.7 The site is predominantly upland moorland. Habitat loss would be likely to be an effect of negligible magnitude in ornithological terms, with only a very small area taken up by the proposed development.
- 8.6.8 Direct habitat loss will reduce habitat availability to the species breeding and foraging on the site, including lapwing and curlew (both medium value) and greylag goose (low value). This loss will be negligible in the context of the availability of these habitats, and in the context of the sizes of these birds' home ranges.
- 8.6.9 This very small loss of breeding and foraging habitat of negligible magnitude on a high/medium value receptors results in an effect of negligible significance (as per Table 8.4) for all of the bird species affected and would not be significant.

Nature of Impact

- 8.6.10 There will be a direct loss of habitat resulting from the construction of the proposed development. As set out in Chapter 7, the main habitats within the study area are wet modified bog, marshy grassland (rush pasture and *Molinia* grassland) blanket bog and wet heath. Tables 7.10 and 7.11 set out the losses of each habitat that would occur as a result of the development.

- 8.6.11 The direct loss of habitat for all bird species associated with construction of the proposed development would be an effect of low/negligible magnitude. The permanent land take would be limited to the wind turbine and associated foundations, access tracks, permanent crane hardstands and substation/battery storage hardstands which account collectively for about 1.2% of the total area within the site. Additional temporary land take during construction would add further temporary habitat loss of about another 1.6% of the site area.
- 8.6.12 The use of existing tracks and the careful selection of routes for the access tracks and wind turbine locations, alongside use of proven construction techniques would ensure that such effects on birds would be of low/negligible magnitude (even in a local context). In addition, the applicant has committed to the production and implementation of a Construction Environmental Management Plan (CEMP) to the satisfaction of NatureScot and other relevant stakeholders, before construction commences, and would follow Windfarm Good Construction Guidance by Scottish Renewables *et al.* (2015). As a result, direct bird habitat loss during construction would be of negligible magnitude and not significant.

Ornithological Receptor Value

- 8.6.13 Direct habitat loss will reduce habitat availability to the species breeding and foraging on the site, including two medium value breeding key species (lapwing and curlew), one low value species (greylag goose), and six high value species recorded foraging (red kite, hen harrier, goshawk, peregrine, merlin and golden plover).

Magnitude of Impact

- 8.6.14 This very small loss of breeding and foraging habitat will be of negligible magnitude for all of the bird species affected.

Significance of Effects

- 8.6.15 Ornithological effects of the direct habitat loss resulting from the construction of the proposed development would be of negligible magnitude and not significant.

Indirect Effects: Construction Disturbance (Noise and Visual)

8.6.16 Experience from existing UK wind farms has shown that many species are tolerant of the presence of operational wind turbines and not unduly disturbed by them. Some short-term displacement during wind farm operation of species such as curlew may occur following construction, but populations have subsequently re-established themselves²⁶. Most species that have been studied have not been significantly affected^{27, 28, 29, 30, 31 and 32}. An RSPB study reported partial displacement of breeding upland birds around wind turbines for a distance up to 800m; reported significant reductions in golden plover density up to 400m from wind turbines, though another study on the same species found no significant operational disturbance to this species. The scale and pattern of displacement is similar to that reported for breeding waders in general³³, with most studies reporting only small scale (0-200m) displacement distances and a smaller number over a greater distance. For the purposes of this assessment it has been assumed that all breeding birds within 300m of wind turbines could be at risk of disturbance during operation, with consideration also given to the breeding populations within a 500m buffer as well, and a 600m buffer outside the breeding season. As for the construction phase disturbance, it was assumed for the purposes of the assessment that all birds occurring within these zones were at risk of disturbance.

8.6.17 The indirect effect of disturbance is likely to be highest during construction owing to the increased activity on site. Pearce-Higgins *et al.*³⁴ found that red grouse, snipe and curlew densities all declined at wind farm sites during construction, whilst densities of skylark and stonechat increased. Construction also involves the presence of work personnel on site which itself can be an important source of potential disturbance. Pearce-Higgins *et al.* for example reported decreases in curlew density during construction of 40% and snipe by 53%. Other species, such as golden plover³⁵, though have been shown to be unaffected by construction disturbance. The assessment of construction disturbance has assumed that all breeding birds within 500m of the proposed development could potentially be at risk of displacement, and a slightly wider zone (600m) for wintering birds^{36, 37}. It should be noted that only partial displacement within these zones might be expected³⁸, but it is assumed for the purposes of this assessment that all birds occurring within the zone are at risk of disturbance. For SNH 2018a priority species consideration has also been given to the disturbance distances given in Ruddock and Whitfield (2007³⁹). Noise and visual disturbance associated with construction activities could potentially affect breeding and foraging birds in the locality of the site. Birds that are disturbed at breeding sites are vulnerable to a variety of potential effects that could lead to a reduction in the productivity or survival of their populations; these include the chilling or predation of exposed eggs and chicks and damage of eggs and chicks due to panicked adults. Birds subject to disturbance outside the breeding season may also feed less efficiently or resort to less favoured roosting areas, either of which may reduce their survival prospects. The potential impact will vary between species according to each species' tolerance of disturbance from human activity and the availability of suitable alternative breeding and foraging habitat.

²⁶ Bullen Consultants, (2002). Ovenden Moor Ornithological Monitoring - breeding bird survey 2002. Report to Powergen Renewables Ltd.

²⁷ Phillips, J. F., (1994). The effects of a windfarm on the Upland breeding bird communities of Bryn Titli, Mid-Wales: 1993-94. RSPB Report to National Windpower.

²⁸ Thomas, R., (1999). *Renewable Energy and Environmental Impacts in the UK; Birds and Wind Turbines*. In Thesis submitted for Master of Research degree in Environmental Science, University College London., MSc: University College London.

²⁹ Gill, J.P., (2004). *Changes in Populations of Wading Birds Breeding at Dun Law Wind Farm 1999-2003*. Report to Scottish Power plc, Renewable Energy Systems Ltd. & CRE Energy Ltd.

³⁰ Devereux, C. L., Denny, M. J. H. & Whittingham, M. J., (2008). *Minimal effects of wind turbines on the distribution of wintering farmland birds*. *Journal of Applied Ecology*, 45: 1689-1694pp.

³¹ Percival, S. M. & Percival, T., (2011). *Knab's Ridge Wind Farm: Post-construction breeding bird surveys 2010*. Report to RWE Npower Renewables Ltd.

³² 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: 37-43pp.

³³ Hotker, H., Thomsen, K. M. & Jeromin, H., (2006). Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats - facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Michael-Otto-Institut im NABU, Bergenhusen: 65pp.

³⁴ Pearce-Higgins, J. W., Stephen, L., Douse, A. & 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.

³⁵ Sansom, A., Pearce-Higgins, J. W. & Douglas, D. J. T., (2016). Negative impact of wind energy development on a breeding shorebird assessed with a BACI study design. *Ibis*, 158: 541-555.

³⁶ Percival, S. M., (2005). *Birds and wind farms: what are the real issues?* *British Birds*, 98: 194-204

³⁷ Drewitt, A. L. & Langston, R. H. W., (2006). *Assessing the impacts of wind farms on birds*. *Ibis*, 148: 29-42.

³⁸ Pearce-Higgins, J. W., Stephen, L., Langston, R. H. W., Bainbridge, I. P. & Bullman, R., (2009). *The distribution of breeding birds around upland wind farms*. *Journal of Applied Ecology*.

³⁹ Ruddock, M. and Whitfield, D.P.A., (2007). A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage. Available at: <http://www.snh.gov.uk/docs/B313999.pdf>.

Nature of Impact

- 8.6.18 The estimated on-site construction period for the proposed development is expected to last approximately 17 months. The construction works will take place through the year, including the summer months when the weather is more favourable and ground conditions are drier.
- 8.6.19 Noise and visual disturbance associated with construction activities could potentially affect breeding and foraging birds in the locality of the wind turbine positions, access tracks and other infrastructure components. Birds that are disturbed at breeding sites are vulnerable to a variety of potential effects that could lead to a reduction in the productivity or survival of their populations; these include the chilling or predation of exposed eggs and chicks and damage of eggs and chicks due to panicked adults. Birds subject to disturbance outside the breeding season may also feed less efficiently or resort to less favoured roosting areas, either of which may reduce their survival prospects. The potential impact will vary between species according to each species' tolerance of disturbance from human activity and the availability of suitable alternative breeding and foraging habitat.

Ornithological Receptor Value

- 8.6.20 Table 8.12 shows the peak breeding bird populations of conservation importance that were found within 500m of the proposed wind turbine locations and with the other associated infrastructure (including access tracks) during the baseline surveys, where this distance has been used to identify the potential disturbance zone (though also giving consideration to particularly sensitive species in a wider area around that).

Table 8.12. Conservation Importance of Breeding Birds in the Wind Farm Potential Disturbance Zone

Species	Peak breeding pairs <500m from wind turbines	Scale of Importance of Breeding Population Within Potential Disturbance Zone	Conservation Value Within Potential Disturbance Zone
Greylag Goose	2	Local	Low
Red Grouse	3	Local	Medium
Kestrel	1	Local	Low
Oystercatcher	1	Local	Low
Lapwing	2	Local	Medium
Snipe	4	Local	Low
Curlew	4	Local	Medium
Stock Dove	1	Local	Low
Woodpigeon	21	Local	Low
Cuckoo	4	Local	Medium

Species	Peak breeding pairs <500m from wind turbines	Scale of Importance of Breeding Population Within Potential Disturbance Zone	Conservation Value Within Potential Disturbance Zone
Skylark	290	Local	Medium
Tree Pipit	1	Local	Medium
Meadow Pipit	751	Local	Low
Grey Wagtail	3	Local	Low
Wren	42	Local	Low
Duncock	6	Local	Medium
Whinchat	4	Local	Low
Wheatear	2	Local	Low
Song Thrush	21	Local	Medium
Mistle Thrush	6	Local	Low
Grasshopper Warbler	4	Local	Medium
Sedge Warbler	6	Local	Low
Willow Warbler	50	Local	Low
Starling	3	Local	Medium
Siskin	15	Local	Low
Linnet	13	Local	Medium
Lesser Redpoll	52	Local	Medium
Common Crossbill	2	Local	High
Bullfinch	2	Local	Medium
Reed Bunting	47	Local	Medium

Note: Bold indicates species identified as 'Priority bird species for assessment when considering the development of onshore wind farms in Scotland' in SNH (2018a) guidance.

- 8.6.21 Table 8.13 shows the peak wintering bird populations of conservation importance that were found within 600m of the proposed wind turbine locations and with the other associated infrastructure (including access tracks) during the baseline surveys, where this distance has been used to identify the potential disturbance zone (though also giving consideration to particularly sensitive species in a wider area around that).

Table 8.13. Conservation Importance of Wintering Birds in the Wind Farm Potential Disturbance Zone

Species	Peak walkover count <600m from wind turbines	Scale of Importance of Breeding Population Within Potential Disturbance Zone	Conservation Value Within Potential Disturbance Zone
Mallard	4	Local	Low
Red Grouse	9	Local	Medium
Red Kite	1	Local	High
Hen Harrier	3	Local	High
Goshawk	3	Local	High
Sparrowhawk	1	Local	Low

Species	Peak walkover count <600m from wind turbines	Scale of Importance of Breeding Population Within Potential Disturbance Zone	Conservation Value Within Potential Disturbance Zone
Kestrel	3	Local	Low
Merlin	2	Local	High
Peregrine	1	Local	High
Oystercatcher	2	Local	Low
Golden Plover	23	Local	High
Lapwing	14	Local	Medium
Snipe	59	Local	Low
Woodcock	2	Local	Low
Curlew	6	Local	Medium
Common Gull	59	Local	Low
Lesser Black-backed Gull	2	Local	Medium
Great Black-backed Gull	1	Local	Low
Barn Owl	1	Local	High

Note: Bold indicates species identified as 'Priority bird species for assessment when considering the development of onshore wind farms in Scotland' in SNH (2018a) guidance.

Effects of Construction Disturbance on NS Key Species

8.6.22 The following section assesses the construction disturbance effects on each of the NS (SNH 2018) key species that were found within the potential disturbance zone within the breeding season (Table 8.12) and at other times of year (Table 8.13).

Curlew

8.6.23 Four pairs of curlew were found within 500m of the site, and hence would be at risk of disturbance during construction (Figure 8.2). This species is a red-listed Scottish BAP species, so has been classed as medium value. The NHZ population is 1,400 pairs (Wilson *et al.* 2015), so the numbers within the potential disturbance zone would be considered to be of local importance.

8.6.24 This species has been shown to be affected by disturbance, particularly during construction (Pearce-Higgins *et al.* 2012), so some displacement of breeding birds during the construction phase would be expected (though only affecting up to four pairs). Given that those present in potential disturbance zone are only a very small proportion of the NHZ population (0.3%), the effect even in a worst case would be of negligible magnitude on a medium value receptor, which would be of negligible significance and not significant.

Lapwing

8.6.25 Two pairs of lapwing were found within 500m of the site (Figure 8.2), and hence would be at risk of disturbance during construction. This species is a red-listed Scottish BAP species, so has been classed as medium value. No NHZ population estimate is available (Wilson *et al.* 2015) but the numbers within the potential disturbance zone would be considered to be of local importance. Some disturbance of these birds is likely during construction, though probably not the complete displacement assumed in this worst-case assessment. Even in that worst case, a complete displacement of two pairs would be only of negligible magnitude on a medium value receptor resulting in an effect of negligible significance, which would not be significant.

Greylag Goose

8.6.26 Two pairs of greylag goose were found within 500m of the site, and hence would be at risk of disturbance during construction (Figure 8.2). This species is an amber-listed species of conservation concern, so has been classed as low value. No NHZ population estimate is available (Wilson *et al.* 2015) but the numbers within the potential disturbance zone would be considered to be of local importance. Some disturbance of these birds is likely during operation, though probably not the complete displacement assumed in this worst-case assessment. Even in that worst case, a complete displacement of two pairs would be only of negligible magnitude on a low value receptor resulting in an effect of negligible significance, which would not be significant.

Scarce raptor species

8.6.27 Several high value raptor species were observed flying over the site during the baseline surveys, including osprey, goshawk, red kite, peregrine, merlin and short-eared owl. All were, however, only seen infrequently, with no evidence of breeding within the survey area or that it was important for foraging for any of them. Whilst some displacement may occur during construction, this would be any effect of negligible magnitude on all these species and not significant.

Potential Operational Effects

Operational Displacement

Nature of Impact

- 8.6.28 The presence and operation of wind turbines could potentially displace birds from breeding and foraging areas. Birds may avoid the operational wind turbines and the surrounding area due to the visual appearance of large vertical structures in the landscape, the mechanical noises and wind noises of the blades, or the presence of periodic maintenance vehicles and personnel. Displacement due to operational wind turbines could force birds into less suitable habitat and this might reduce their ability to survive and reproduce. If not displaced, birds may experience reduced foraging success or reduced productivity. Displacement effects can vary over time as birds habituate to the presence of operating wind turbines or site-faithful birds are lost from the population.
- 8.6.29 Ornithological Receptor Value Table 8.12 shows the peak breeding bird populations that were found within 500m of the proposed wind turbine locations during the baseline surveys, where this distance has been used to identify the potential distance zone (though also giving consideration to particularly sensitive species in a wider area around that). The Table also gives the distance between the breeding locations of each key species and the nearest proposed wind turbine.
- 8.6.30 Table 8.13 shows the peak wintering bird populations that were found within 600m of the proposed wind turbine locations during the baseline surveys, where this distance has been used to identify the potential distance zone (though also giving consideration to particularly sensitive species in a wider area around that). The Table also gives the distance between the breeding locations of each key species and the nearest proposed wind turbine.

Effects of Operational Disturbance on NatureScot Key Species

- 8.6.31 The following section assesses the operational disturbance effects on each of the NS key species that were found within the potential disturbance zone within the breeding season (Table 8.12) and at other times of year (Table 8.13).

Curlew

- 8.6.32 Four pairs of curlew were found within 500m of the site (Figure 8.2), and hence would be at risk of disturbance during operation. This species is a red-listed Scottish BAP species, so has been classed as medium value. The NHZ population is 1,400 pairs (Wilson *et al.* 2015), so the numbers within the potential disturbance zone would be considered to be of local importance.

- 8.6.33 This species has been shown to be affected by disturbance, particularly during construction (Pearce-Higgins *et al.* 2012), so some displacement of breeding birds during operation would be expected (though only affecting up to four pairs). Given that those present in potential disturbance zone are only a very small proportion of the NHZ population (0.3%), the effect even in a worst case would be of negligible magnitude on a medium sensitivity receptor, which would be of negligible significance and not significant.

Lapwing

- 8.6.34 Two pairs of lapwing were found within 500m of the site (Figure 8.2), and hence would be at risk of disturbance during operation. This species is a red-listed Scottish BAP species, so has been classed as medium value. No NHZ population estimate is available (Wilson *et al.* 2015) but the numbers within the potential disturbance zone would be considered to be of local importance. Some disturbance of these birds is likely during operation, though probably not the complete displacement assumed in this worst-case assessment. Even in that worst case, a complete displacement of two pairs would be only of negligible magnitude on a medium sensitivity receptor resulting in an effect of negligible significance, which would not be significant.

Greylag Goose

- 8.6.35 Two pairs of greylag goose were found within 500m of the site (Figure 8.2), and hence would be at risk of disturbance during operation. This species is an amber-listed species of conservation concern, so has been classed as low value. No NHZ population estimate is available (Wilson *et al.* 2015) but the numbers within the potential disturbance zone would be considered to be of local importance. Some disturbance of these birds is likely during operation, though probably not the complete displacement assumed in this worst-case assessment. Even in that worst case, a complete displacement of two pairs would be only of negligible magnitude on a low sensitivity receptor resulting in an effect of negligible significance, which would not be significant.

Scarce raptor species

- 8.6.36 Several high value raptor species were observed flying over the site during the baseline surveys, including osprey, goshawk, red kite, peregrine, merlin and short-eared owl. All were, however, only seen infrequently, with no evidence of breeding within the survey area or that it was important for foraging for any of them. Whilst some displacement may occur during operation, this would be any effect of negligible magnitude on all these species and not significant.

Direct Effects: Collision Mortality

- 8.6.37 There have been a number of wind farms that have caused significant bird mortalities through collision, but their characteristics are very different to those at the proposed development. Most notably, at Altamont Pass in California and Tarifa in southern Spain, large numbers of raptors have been killed^{40, 41, 42}, through collision with wind turbines. Such problems have occurred where large numbers of sensitive species occur in close proximity to very large numbers (hundreds/thousands) of wind turbines, and usually also where the wind farm area provides a particularly attractive feeding resource. At onshore wind farm sites in the UK, with similar bird densities to the site, collision rates have generally been very low and not considered to be significant^{43, 44, 45, 46, 47}.
- 8.6.38 The collision risk zone for the proposed development was taken as the wind turbines plus a 500 m buffer (following NS guidance).
- 8.6.39 Reference NHZ population sizes were derived from Wilson *et al.* (2015).

Nature of Impact

- 8.6.40 Birds that collide with a wind turbine blade are likely to be killed or fatally injured. Increased mortality rates from collision with wind turbines could potentially affect the maintenance of bird populations, particularly for species that are otherwise experiencing poor reproductive or survival levels due to other factors e.g. food availability. The frequency of collision with wind turbines is assumed to be dependent on the amount of flight activity across the site and the ability of birds to detect the rotating blades and take avoidance action.
- 8.6.41 Operational displacement and collision with wind turbines are spatially mutually exclusive (if a bird is displaced from the wind farm areas it is not at risk of collision). However, displacement effects may change temporarily as birds that were at first displaced from an area may habituate to the presence of the operating wind turbines after a period of time and become exposed to the risk of collision

- 8.6.42 Table 8.14 summarises the collision risk analysis for each of species. Data are presented separately for each of the two baseline survey years (2020-21 and 2021-22), for further details see Technical Appendix 8.5: Collision Risk Modelling Calculations.
- 8.6.43 Table 8.14 gives the number of collisions predicted per year based on the precautionary NS avoidance rate of 99% for red kite and hen harrier, 99.5% for swans and gulls, 99.8% for the three goose species and 98% for all of the other species, the percentage increase that this would represent over the baseline mortality and an assessment of the magnitude of these effects. The magnitude was predicted as low for goshawk (though in 2020-21 only), and negligible for all the other species modelled.

Table 8.14: Collision Risk Modelling Predictions

Species	Precautionary Predicted Number of Collisions per Year (NS avoidance rate)		Percentage Increase in Baseline Mortality		Magnitude
	2020-21	2021-22	2020-21	2021-22	
Whooper Swan	0	0.04	0%	0.02%	Negligible
Pink-footed Goose	1	1.03	0.02%	0.02%	Negligible
Greylag Goose	0.01	0.02	0.01%	0.01%	Negligible
Barnacle Goose	0	0.05	0%	<0.01%	Negligible
Hen Harrier	0.04	0.03	0.36%	0.27%	Negligible
Goshawk	0.08	0	1.03%	0%	Low/Negligible
Red Kite	0.23	0.02	0.23%	0.02%	Negligible
Peregrine	0	0.01	0%	0.05%	Negligible
Merlin	0.002	0.02	0.01%	0.09%	Negligible
Golden Plover	0	0.28	0%	0.02%	Negligible
Lapwing	0.02	0.004	<0.01%	<0.01%	Negligible
Dunlin	0	0.01	0%	<0.01%	Negligible
Snipe	0.13	0.51	0.01%	0.04%	Negligible
Curlew	1.34	0.32	0.11%	0.03%	Negligible
Herring Gull	0.35	0.08	0.11%	0.02%	Negligible

⁴⁰ Orloff, S. & Flannery, A., (1992). Wind turbine effects on Avian activity, habitat use, and mortality in Altamont Pass and Solano County Wind Resource Areas 1989-1991. Biosystems Analysis Inc. California Energy Commission: 160pp.

⁴¹ Janss, G., (1998). *Bird behavior in and near a wind farm at Tarifa, Spain: management considerations*. NWCC National Avian - Wind Power Planning Meeting III: 110-114pp.

⁴² Thelander, C. G., Smallwood, K. S. & Ruge, L., (2003). Bird risk behaviours and fatalities at the Altamont Pass Wind Resource Area: Period of performance: March 1998-December 2000. National Renewable Energy Laboratory Report: 92pp.

⁴³ Meek, E. R., Ribbands, J. B., Christer, W. B., Davy, P. R. & Higginson, I. (1993). The effects of aero-generators on moorland bird populations in the Orkney Islands, Scotland. *Bird Study*, 40: 140-143pp.

⁴⁴ Tyler, S. J. (1995). *Bird strike study at Bryn Tytli windfarm, Rhayader*. RSPB Report to National Wind Power: 2pp.

⁴⁵ Bioscan (UK) Ltd., (2001). Novar Windfarm Ltd Ornithological Monitoring Studies - Breeding bird and birdstrike monitoring 2001 results and 5-year review. Report to National Wind Power Ltd.

⁴⁶ Percival, S. M., Percival, T., Hoit, M. & Langdon, K., (2009). Red House Farm Wind Cluster, Lincolnshire: Post-construction breeding bird, marsh harrier surveys and collision monitoring 2008. Report to Fenland Wind Farms Ltd.

⁴⁷ Percival, S. M., Percival, T. & Piner, S., (2013). *Kelburn Wind Farm: Post-construction Phase Breeding Bird Surveys 2013*. Report to RES UK & Ireland Ltd.

8.6.44 The following section assesses the operational collision risk to each of the NS key species that were found within the collision risk zone (Table 5.14).

Whooper Swan

8.6.45 A single flock of six whooper swans was flying through the collision risk zone in January 2022 (Figure 8.4). Whooper swan is listed on Schedule 1 of the Wildlife and Countryside Act and Annex 1 of the EU Birds Directive, so is of high value. Collision risk was estimated at 0.04 collisions per year based on the 2021-22 data (equivalent to a 0.02% increase over the baseline mortality), an effect of negligible magnitude that would not be significant.

8.6.46 There would clearly be no threat to the regional or national population of this species, so no significant adverse effect, following the SNH 2018a guidance, would occur.

Pink-footed Goose

8.6.47 Pink-footed goose was classed as very high value as a qualifying feature of the Upper Solway Flats and Marshes SPA and the Castle Loch, Lochmaben SPA. Pink-footed geese were regularly recorded overflying the site, mainly during their autumn and spring migration (Figure 8.3). Collision risk was predicted as 1.0 in each of the two baseline years. This is equivalent to a 0.02% increase over the baseline mortality, an effect of negligible magnitude that would not be significant in both the context of the NHZ population and the SPA populations, which would not be significant.

Greylag Goose

8.6.48 Greylag goose flight activity over the site was lower than for the previous species but occurred year-round as there were two breeding pairs recorded in 2022. Flights through the collision risk zone occurred infrequently (Figure 8.4), with a predicted collision risk of 0.01 in 2020-21 and 0.02 in 2021-22 (a 0.01% increase over the baseline mortality), an effect of negligible magnitude, which would not be significant.

Hen Harrier

8.6.49 Hen harrier was classed as very high value as a qualifying species of the Langholm-Newcastleton SPA. The information available on collision risk to hen harriers at existing wind farms is not yet comprehensive. That which has been published suggests that they are not particularly vulnerable to collision and that they will forage and even nest in proximity to wind turbines in some circumstances⁴⁸ and⁴⁹. Very few harrier collisions have been reported and harrier collision rates are considerably lower than that recorded for raptors in general⁵⁰, though there have been two hen harrier collisions documented at the Griffin Wind Farm in Perthshire.

8.6.50 Hen harriers were regularly seen flying over the site throughout the year (Figure 8.5), but only a very low number of flights were recorded at rotor height through the collision risk zone, with resulting collision risks predicted at 0.04 per year using the 2020-21 data and 0.03 per year using the 2021-22 data, equivalent to a 0.36% and 0.27% increase over the baseline mortality respectively for each year). Collision risk to this species would be of negligible magnitude and not significant.

Goshawk

8.6.51 Goshawk is listed on Schedule 1 of the Wildlife and Countryside Act, so is of high value. A low number of goshawk flights were recorded at rotor height through the collision risk zone in 2020-21 (Figure 8.6), with resulting collision risks predicted at 0.08 per year, equivalent to a 1.03% increase over the baseline mortality). No flights were observed through the collision risk zone in 2021-22. Collision risk to this species would be of low magnitude (in the context of the small NHZ population of only 13 pairs) based on the 2020-21 data but would not be significant. Incorporating the 2021-22 data as well would reduce the magnitude of this impact to negligible.

Red Kite

8.6.52 Red kite is listed on Schedule 1 of the Wildlife and Countryside Act and Annex 1 of the EU Birds Directive, so is of high value. Only a low number of red kite flights were recorded at rotor height through the collision risk zone (Figure 8.7), with resulting collision risks are predicted at 0.23 per year using the 2020-21 data and 0.02 per year using the 2021-22 data, equivalent to only a 0.23% and 0.02% increase over the baseline mortality respectively). Collision risk to this species would be of negligible magnitude and not significant.

⁴⁸ Steele, D., (2005). Ornithological Assessment for the proposed Hunter's Hill wind farm, Co. Tyrone.

⁴⁹ Madders, M. & Whitfield, D. P., (2006). *Upland raptors and the assessment of wind farm impacts*. Ibis, 148: 43-56pp.

⁵⁰ Illner, H., (2011). *Comments on the report "Wind Energy Developments and Natura 2000"*, edited by the European Commission in October 2010.

Peregrine

8.6.53 Peregrine is listed on Schedule 1 of the Wildlife and Countryside Act and Annex 1 of the EU Birds Directive, so is of high value. No flights through the collision zone were observed during the 2020-21 surveys and only a single one in 2021-22 (Figure 8.8). The collision risk was very low (0.01 using the 2021-22 data, equivalent to a 0.01% increase over the baseline mortality). Collision risk to this species would therefore be of negligible magnitude and not significant.

Merlin

8.6.54 Merlin is listed on Schedule 1 of the Wildlife and Countryside Act and Annex 1 of the EU Birds Directive, so is of high value. Only a very low number of merlin flights were recorded at rotor height through the collision risk zone (Figure 8.9), so the collision risk was very low (0.002 using the 2020-21 data and 0.02 using the 2021-22 data equivalent to only a 0.01% and 0.09% increase over the baseline mortality respectively). Collision risk to this species would be of negligible magnitude and not significant.

Curlew

8.6.55 Curlew were frequently observed flying through the collision risk zone (Figure 8.10). Collision risk to curlew (a medium value receptor) was predicted to be 1.34 per year using the 2020-21 baseline data and 0.32 from the 2021-22 data. This would represent a 0.11% increase over the baseline mortality for this NHZ population in 2020-21 and 0.03% in 2021-22, so would be an effect of negligible magnitude and not significant.

Lapwing

8.6.56 Lapwing were seen regularly flying through the collision risk zone, but this flight activity was concentrated around their main breeding area to the north of the proposed development (Figure 8.11). Collision risk to lapwing (a medium value receptor) was predicted to be 0.02 per year using the 2020-21 baseline data and 0.004 from the 2021-22 data. This would represent less than a 0.01% increase over the baseline mortality for this NHZ population, so would be an effect of negligible magnitude and not significant.

Golden Plover

8.6.57 Only four golden plover flocks were recorded over-flying during the VP surveys, all in winter 2021-22 (Figure 8.12). Collision risk to golden plover (a high value receptor) was predicted to be 0.28 per year using the 2021-22 baseline data (though none were recorded through the collision risk zone in the previous year). This would represent only a 0.02% increase over the baseline mortality for this NHZ population, so would be an effect of negligible magnitude and not significant.

Dunlin

8.6.58 There was only a single dunlin flight recorded through the collision risk zone (Figure 8.12). Collision risk to dunlin (a high value receptor) was predicted to be 0.01 per year using the 2021-22 baseline data (though none were recorded through the collision risk zone in the previous year). This would represent only less than a 0.01% increase over the baseline mortality for this NHZ population, so would be an effect of negligible magnitude and not significant.

Herring Gull

8.6.59 Herring gulls were frequently observed flying through the collision risk zone (Figure 8.13). Collision risk to herring gull (a medium value receptor) was predicted to be 0.35 per year using the 2020-21 baseline data and 0.08 from the 2021-22 data. This would represent a 0.11% increase over the baseline mortality for this NHZ population in 2020-21 and 0.02% in 2021-22, so would be an effect of negligible magnitude and not significant.

Indirect Effects: Barrier Effect

8.6.60 A further potential operational disturbance effect could be disruption to important flight lines (barrier effect). Birds may see the proposed development and change their route to fly around (rather than through) it. This would reduce the risk of collision but could possibly have other effects, for example potentially making important feeding areas less attractive (by acting as a barrier to the birds reaching them) and (if diversions were of a sufficient scale) resulting in increased energy consumption. The distance needed to divert around the proposed development would be relatively small and would not be expected to act as a major barrier to movements and no important regularly used flight routes across the site have been identified. Accordingly, the ecological consequences of any such changes in flight lines would be of negligible magnitude and not significant.

Assessment of Effects on Other High Value Species

8.6.61 Three additional high value species were recorded in the study area during the baseline surveys: kingfisher, barn owl and common crossbill. All are specially protected from disturbance during breeding under Schedule 1 of the Wildlife and Countryside Act, so have been classed as high value.

Kingfisher

8.6.62 There was a single sighting of this species on the Bigholms Burn on the northern edge of the site, but no nest site identified and no records within the potential impact zone of the wind farm (so there would be no risk of disturbance during either construction or operation). It is possible that it could breed within the site in the future, so it has therefore been included in the breeding bird protection plan (see section 5.5)

8.6.63 No flights at rotor height were observed through the collision risk zone, so there would be a negligible risk of collision, which would not be significant.

Barn Owl

8.6.64 There were several records of this species during the baseline surveys but none within the potential impact zone of the wind farm (so there would be negligible risk of disturbance during either construction or operation). It is possible that it could breed within the site in the future, so it has therefore been included in the breeding bird protection plan (see section 5.5)

8.6.65 No flights at rotor height were observed through the collision risk zone, so there would be a negligible risk of collision, which would not be significant.

Common Crossbill

8.6.66 This species was breeding in the coniferous plantation (with two pairs in coniferous plantations in the northern and central parts of the survey area) around the site and was also present there outside the breeding season. Though these numbers are only locally important, this species is classed as high value because it is specially protected from disturbance during the breeding season under Schedule 1 of the 1981 Wildlife and Countryside Act. In the absence of any forest felling associated with the construction of the proposed development, this high value species would be unaffected, with no significant impacts.

Assessment of Effects on Other Medium Value Species

8.6.67 Fifteen other medium value species were recorded breeding in the core survey area: red grouse, grey partridge, cuckoo, skylark, tree pipit, dunnoek, song thrush, grasshopper warbler, spotted flycatcher, starling, house sparrow, linnets, lesser redpoll, bullfinch and reed bunting. All are SBL species. None would be likely to be affected by the proposed development, given experience from other wind farms (Meek *et al.* 1993, Phillips 1994, Thomas 1999, Percival 2005, Devereux *et al.* 2008, *op. cit.*) and their large UK and Scottish population sizes. Effects would be of low/negligible magnitude and not significant.

Assessment of Effects on Other Low Value Species

8.6.68 The low value species are of lesser concern, as a higher magnitude impact would be necessary in order for a significant effect to occur. As these species are generally at low density within the core survey area, such a magnitude of effect would be very unlikely and it can be safely concluded that there would not be any significant effect on any of these species.

Effects on Protected Sites

European Protected Sites

8.6.69 The potential ornithological effects of the proposed development on European Protected Sites are assessed in Technical Appendix 8.7. Possible effects on the Langholm - Newcastleton Hills SPA hen harrier population, on the Upper Solway Flats and Marshes SPA barnacle goose and pink-footed goose populations, and on the Castle Loch, Lochmaben SPA pink-footed goose population, constituted the only possible Likely Significant Effect (LSE) of the proposed development (either alone or in-combination) in the context of the Habitats Regulations.

8.6.70 The proposed development is (at the closest point) 2.6km from Langholm - Newcastleton Hills SPA, 13km from the Upper Solway Flats and Marshes SPA/Ramsar and 19km from Castle Loch, Lochmaben SPA/Ramsar.

8.6.71 Langholm - Newcastleton Hills SPA is an upland moorland site designated for its breeding hen harrier population. The proposed development is just beyond the 2km core range distance advised by NatureScot (SNH 2016), but it has still been assessed in the context of the Habitats Regulations (see Technical Appendix 8.7).

- 8.6.72 Disturbance to hen harriers during both construction and operation would not occur in the SPA, given the separation distance from the development (2.6km from the nearest wind turbine/associated infrastructure). Some disturbance to hen harriers outside the Langholm - Newcastleton Hills SPA during construction and operation could occur, though would be only a negligible magnitude effect. There is no potential for the conservation objective 'to avoid significant disturbance to the species' to be undermined. There will not be any adverse effect on the integrity of the Langholm - Newcastleton Hills SPA due to construction or operational disturbance.
- 8.6.73 There would be a collision risk to hen harriers, but this would be only a negligible magnitude effect on the Langholm - Newcastleton Hills SPA population. The conservation objective 'to maintain the population of the species as a viable component of the SPA' would not be undermined. This level of additional mortality would not represent an adverse effect on the integrity of the SPA.
- 8.6.74 Upper Solway Flats and Marshes SPA/Ramsar is a very extensive inter-tidal area with an internationally important wintering waterfowl community including barnacle goose and pink-footed goose (the only two qualifying species that range a sufficient distance to have a possible ecological link to the proposed development). Castle Loch, Lochmaben SPA/Ramsar is designated for its internationally important wintering population of pink-footed geese and lies within the foraging range of this species (SNH 2016).
- 8.6.75 There would be a collision risk to Upper Solway Flats and Marshes SPA barnacle goose and pink-footed goose populations, and to the Castle Loch, Lochmaben pink-footed goose population, but this would be only a negligible magnitude effect on the SPA population for both species. The conservation objective 'to maintain the population of the species as a viable component of the SPA' would not be undermined. This level of additional mortality would not represent an adverse effect on the integrity of the SPA.
- 8.6.76 Neither cumulative disturbance nor cumulative collision risk would represent an adverse effect on the integrity of the SPA.
- Other Protected Sites**
- 8.6.77 No significant effects would be likely to occur on the ornithological interest features of any other statutory protected sites, with no other SSSIs with any ornithological interest features within 5km.

8.7 Mitigation

- 8.7.1 The proposed development is not likely to result in any significant ornithological effects, but nonetheless the best practice measures described below would be followed throughout all of the proposed development, and to ensure compliance with the nature conservation legislation.

Mitigation of the Construction Phase

- 8.7.2 The applicant has committed to the production of a CEMP to the satisfaction of NatureScot and other relevant stakeholders, before construction commences, and would follow Windfarm Good Construction Guidance, Scottish Renewables *et al.* (2010). An outline CEMP is included as Technical Appendix 2.1. An Ecological Clerk of Works (ECoW) will be appointed to monitor the implementation of the CEMP, the Breeding Bird Protection Plan (BBPP) and the Habitat Management Plan (HMP).
- 8.7.3 A BBPP will be required to ensure compliance with the Wildlife and Countryside Act (a) to avoid any disturbance to species specially protected under Schedule 1 of that Act and (b) to avoid any damage to active nests. A draft BBPP is included within Technical Appendix 8.6.
- 8.7.4 Several species specially protected from disturbance during breeding under Schedule 1 of the Wildlife and Countryside Act were recorded during the surveys, including hen harrier, merlin, and common crossbill. It will be essential to ensure that no Schedule 1 species are disturbed during the breeding season, particularly during the construction phase, therefore, a BBPP will be developed and implemented. Further surveys for hen harrier, merlin, and common crossbill and any other Schedule 1 species will be undertaken to inform the BBPP at fortnightly intervals through the breeding season (March-August) during the construction period. If any nesting Schedule 1 birds are found then potentially disturbing activities would be suspended for the breeding season within an appropriate zone (dependent on the location of the birds and the species involved, to be agreed with NS and the local authority, and following Ruddock and Whitfield 2007). The BBPP will also include measures to ensure the protection of all other nesting birds.

8.7.5 Where works affecting habitats that could be used by nesting birds take place between March and August (inclusive), they will only be carried out following an on-site check for nesting birds by an experienced ecologist. If this indicates that no nesting birds are likely to be harmed by the works, then the works will proceed. If nesting birds are found to be present, work will not take place in that area until the adult birds and young have left the nest. A protection zone will be clearly marked around the nest site to prevent accidental disturbance or damage.

Mitigation of the Operational Phase

8.7.6 No mitigation for the operational phase of the proposed development will be required.

8.7.7 Notwithstanding this, a HMP will be delivered to ensure that the development delivers a net gain overall to the local bird communities. An outline HMP is included in Technical Appendix 8.6

8.8 Assessment of Residual Effects

8.8.1 The residual ornithological effects of the proposed development will be a non-significant loss of a small amount of upland moorland habitat to the elements of the proposed, and a non-significant risk of disturbance and collision.

8.8.2 Using evidence from existing wind farms it is considered unlikely that there will be any long-term impact on the integrity of the study area's ornithological features, or the conservation status of the species found here.

8.9 Assessment of Cumulative Effects

8.9.1 The potential for cumulative ornithological effects were considered following the SNH 2018b guidance on 'Assessing the Cumulative Impacts of Onshore Wind Farms on Birds', considering impacts on the favourable conservation status of key species within the relevant NHZ (in this case NHZ 20 The Border Hills, within which most of the development falls, though consideration has also been given to NHZ 19 West Southern Uplands, which has three of the 21 wind turbines). Given this overlap of NHZ areas, the cumulative assessment has focussed on developments within 35km of the site boundary.

8.9.2 All of the potential effects of wind farms (direct habitat loss and disturbance during construction; and collision risk and disturbance during operation) have the potential to contribute to the cumulative ornithological impacts, therefore have been considered in the cumulative assessment. However, the predicted effects of the proposed development, with regard to habitat loss and disturbance are so low (negligible magnitude) it was considered that these would not make any material contribution to any potentially significant cumulative impact at the NHZ level.

8.9.3 Consideration of the cumulative collision risk was carried out to determine whether the proposed development could materially contribute to a potentially significant cumulative collision risk. However, given the combination of very low collision risks resulting from the Bloch Wind Farm, both numerically and in the context of the NHZ populations, it was concluded that these would not make any material contribution to any potentially significant cumulative impact at the NHZ level.

8.10 Summary

8.10.1 Table 8.17 provides a summary of the effects of the proposed development on features of ornithological interest detailed within this chapter.

8.10.2 Overall, there are not likely to be any significant impacts on ornithology as a result of the proposed development. In relation to the key NS wider countryside test, the proposed development would not affect the favourable conservation status of any bird species of conservation importance within the NHZ, either alone or in-combination with other schemes. It would also not contribute to any Likely Significant Effect on any SPA qualifying interests. No effects would result in any breach of the Habitats Regulations.

Table 8.17. Summary of the effects of the proposed development on features of ornithological interest.

Project Phase	Summary of Effect	Value	Magnitude	Nature of Effect			Mitigation Measure	Residual Significance
				Positive/ negative	Permanent/ temporary	Reversible/ irreversible		
Construction	Habitat loss: construction of infrastructure including wind turbine bases and access tracks	Low/ negligible	Negligible	Negative	Temporary	Reversible	Avoidance of more sensitive habitats in design process	Not significant
	Disturbance to Schedule 1 and Annex 1 breeding species	Up to very high	Negligible	Negative	Temporary	Reversible	Development and implementation of BBPP, to include pre-construction survey checks; if present avoid disturbing activity in proximity with species-specific buffer zone implemented.	Not significant
	Disturbance to other breeding species	Up to medium	Negligible	Negative	Temporary	Reversible	Pre-construction survey and active nests avoided.	Not significant
	Disturbance to wintering birds	Up to very high	Negligible	Negative	Temporary	Reversible	None required	Not significant
	Mortality through bird collision with wind turbines	Up to very high	Negligible	Negative	Temporary	Reversible	None required	Not significant
Operation	Displacement of birds from zone around wind turbines	Up to high	Negligible	Negative	Temporary	Reversible	None required	Not significant
	Disturbance to Schedule 1 and Annex 1 breeding species	Up to very high	Negligible	Negative	Temporary	Reversible	None required.	Not significant
	Disturbance to other breeding species	Up to medium	Negligible	Negative	Temporary	Reversible	None required	Not significant
	Disturbance to wintering birds	Up to high	Negligible	Negative	Temporary	Reversible	None required	Not significant
	Collision risk	High	Low	Negative	Temporary	Reversible	None required	Not significant