

9 Ornithology

Introduction

- 9.1 This chapter presents the findings of the assessment of potential effects of the Development on birds. It summarises the methods used to establish the bird populations within the Development Area and its surroundings, the results of the baseline surveys, and the process used to determine the sensitivity of the bird populations present. The ways in which birds might be affected (directly or indirectly) by the construction and operation of the Development are assessed, prior to and after any mitigation measures are considered. In addition, any cumulative effects of the Development are considered, taking together effects of other developments or activities in the area whether operational, consented or at application.
- 9.2 This chapter complements the assessment of potential ecological effects presented in **Chapter 8: Ecology**.
- 9.3 This chapter is supported by **Appendix 9.1** which contains the following Annexes:
- **Annex A - Legal Protection.**
 - **Annex B - Ornithological Survey Methodologies.**
 - **Annex C – Ornithological Survey Effort & General Information.**
 - **Annex D – Ornithological Survey Results.**
 - **Annex E - Collision Risk Assessments.**
- 9.4 Confidential information relating to the breeding locations of protected species is presented in **Confidential Appendix 9.2**.
- 9.5 Proposed habitat management measures in relation to ornithology are presented in **Appendix 8.6 Outline Conservation Management Plan (OCMP)**.
- 9.6 Planning policies of relevance to this assessment are provided in **Chapter 5: Policy Context**.
- 9.7 The ornithology assessment was undertaken by MacArthur Green.

Scope of the Assessment

Effects Assessed in Full

- 9.8 The following effects have been assessed where appropriate in relation to construction and operation of the Development:
- Direct habitat loss for birds through construction of the Development infrastructure.
 - Displacement of birds through indirect loss of habitat where birds avoid the Development and its surrounding area due to construction activities or turbine operation and maintenance. Displacement can also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds due to the presence of turbines or other infrastructure.
 - Habitat modification due to change in land cover (e.g. forestry removal), and consequent effects on bird populations.
 - Death or injury through collision with turbine blades, or fences associated with the Development.
 - Cumulative effects of the Development when considering other developments within a particular geographical frame of reference.

Effects Scoped Out

- 9.9 On the basis of the desk based and survey work undertaken, the professional judgement of the EIA team, consultation with Scottish Natural Heritage (SNH), experience from other relevant projects and policy guidance or standards (e.g. SNH, 2006ⁱ), the following topic areas have been 'scoped out':
- 9.10 Species which do not fall within the following categories were scoped out of the assessment:
- Those species recognised in statute as requiring special conservation measures, e.g. birds on Annex 1 to the Birds Directiveⁱⁱ, regularly occurring migratory species, and birds on Schedule 1 to the Wildlife & Countryside Act 1981 (as amended).
 - Species on non-statutory lists (e.g. Red and Amber-listed Birds of Conservation Concern (BoCC)ⁱⁱⁱ), presenting a picture of birds whose populations are at some risk either generally or in parts of their range.

Assessment Methodology

Legislation and Guidance

Legislation

- 9.11 The assessment has been undertaken in line with the following European legislation, policy, and guidance:
- Directive 2009/147/EC on the Conservation of Wild Birds (Birds Directive);
 - Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (Habitats Directive);
 - The Environmental Impact Assessment Directive 85/337/EEC (as amended).
- 9.12 The following national legislation, policy and guidance are considered as part of the assessment:
- The Wildlife and Countryside Act 1981 (as amended);
 - The Nature Conservation (Scotland) Act 2004 (as amended);
 - Electricity Works (EIA) Scotland Regulations 2000;
 - The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (The Habitats Regulations);

Guidance

- 9.13 This assessment is carried out in accordance with the principles contained within the following documents:
- SERAD (Scottish Executive Rural Affairs Department) 2000. Habitats and Birds Directives, Nature Conservation; Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna and the Conservation of Wild Birds ("the Habitats and Birds Directives"). Revised Guidance Updating Scottish Office Circular No 6/1995;
 - European Commission (October 2010) Natura 2000 Guidance Document 'Wind Energy Developments and Natura 2000'. European Commission, Brussels;
 - The UK Biodiversity Action Plan (BAP) and UK Post-2010 Biodiversity Framework;
 - Scottish Natural Heritage (2000) Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action. SNH Guidance Note;
 - Scottish Natural Heritage (2006) Assessing significance of impacts from onshore windfarms on birds outwith designated areas;
 - Scottish Natural Heritage (September, 2009) Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees;
 - Scottish Natural Heritage (March 2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments;
 - Scottish Natural Heritage (2014) Recommended bird survey methods to inform impact assessment of onshore Windfarms.

- Scottish Natural Heritage (2016) Assessing connectivity with Special Protection Areas; and
- Eaton et al. (2015). Birds of Conservation Concern 4iii.

Consultation

9.14 In undertaking the assessment, consideration has been given to the scoping responses and other consultation undertaken as detailed in **Table 9.1**.

Table 9.1: Consultation Responses

| Consultee and Date | Scoping/Other Consultation | Issue Raised | Response/Action Taken |
|--|-------------------------------------|--|--|
| SNH 13 November 2015 (meeting) and 7 January 2016 (email) | Pre-application consultation | SNH advised that additional focussed effort should be made on target species, including 2015-2016 winter roost surveys for hen harrier ensuring sufficient survey effort. | Additional winter walkovers in 2015-16 focussed on locating any hen harrier roosts within suitable habitat across the Development Area. These surveys were often timed around dusk and dawn to maximise the chances of recording any roosts. |
| | | SNH commented that due to the difficult topography of the site, some of the vantage points (VPs) are very close to proposed turbines, which may create issues for collision modelling. | Consideration is given to these points in the assessment and is explained in Technical Appendix 9.1 . |
| | | SNH also commented that the viewsheds did not provide full coverage of the turbines (based on the layout at that time). | |
| | | SNH recommended an additional year of breeding bird surveys, and scarce breeding bird surveys which should include targeted flight activity vantage points to establish flight activity around nest sites. | These surveys were undertaken in 2016 (see Technical Appendix 9.1 for details). |
| Scottish Natural Heritage 24 February 2016 | Scoping Response | The Scoping Report appears to have largely taken account of SNH's pre-application bird comments, and the recent/ proposed bird survey work looks to be generally appropriate. | Noted. |
| | | Given that scarce breeding bird surveys will be carried out in 2016, we suggest that some limited additional VP survey in 2016 <i>could</i> be useful to understand related flight patterns around any hen harrier breeding locations. | Scarce breeding bird surveys in 2016 used various vantage points to record hen harrier and other target species flight distributions. |
| | | SNH welcomes the applicant's consideration of potential associated enhancement measures. | Enhancement measures are presented in Appendix 8.6 and are considered in the Assessment of Effects section. |
| Scottish Natural Heritage 23 September 2016 | Consultation on interim bird report | Highlighted the proximity of particular turbines to historic Schedule 1 raptor nest sites and area of high bird activity around Glenrae Dod. | The potential ornithological impacts of these turbine locations were considered as part of the design layout process, and accounted for accordingly through amendments to the design. |
| | | General approach to surveys and proposed assessment is fine and VP coverage is adequate based on current layout. This will be confirmed after ES is published which should include various survey details such as VP spatial and temporal coverage and simultaneous watches. | Details of VP methods, timings and coverage are provided in Technical Appendix 9.1 . |

| Consultee and Date | Scoping/Other Consultation | Issue Raised | Response/Action Taken |
|--|----------------------------|--|--|
| | | Proximity of some VPs to potential turbines may affect flight activity rates and therefore collision risk modelling results. This could be investigated. | Consideration of how VP locations may affect results is presented in Technical Appendix 9.1 . It has been concluded that vantage point locations would not adversely affect survey results. |
| | | Habitat management proposals are welcomed and all are considered to be possibilities (based on limited detail presented to date). Particular impacts that require mitigation should be outlined in the ES. | Habitat management proposals are outlined in Technical Appendix 8.6 . |
| Royal Society for the Protection of Birds (RSPB) 24 February 2016 | Scoping Response | The indicative location of turbines within 5-700m of the Muirkirk and North Lowther Special Protection Area (SPA) could result in a range of impacts arising from collision, disturbance and displacement of birds, including SPA qualifying species. | As a result of consideration of ornithological effects during the design process, the closest turbine is now over 1km from the SPA boundary. This is considered to remove disturbance-displacement effects on any SPA nest sites. |
| | | Targeted felling of forestry should take into account breeding birds, for example goshawks, and should be scheduled to take place outwith the breeding season (March – July inclusive). | It is assumed that a Breeding Bird Protection Plan (BBPP) will be agreed in consultation with SNH in advance of construction under the terms of an appropriate planning condition. This plan will ensure that all necessary measures are taken to avoid disturbance to breeding birds and to avoid damage to, or destruction of, nest sites. |
| | | We welcome the commitment to assessing cumulative impacts with other existing and planned Windfarms, but in respect to cumulative impact on the SPA, this should also extend to all relevant development types (e.g. opencast coal, hydro-pump etc.). | Cumulative effects as part of the EIA process, and in-combination effects as part of the Habitats Regulations Appraisal (HRA) process are considered in the Assessment of Effects section. These take into consideration non-Windfarm activities subject to EIA. |
| | | RSPB suggest that careful consideration is given to recent and historical information available from RSPB Scotland and Dumfries & Galloway Raptor Study Group (DGRSG). | Historic raptor data were obtained from the DGRSG, and alongside baseline survey data from 2014 to 2016, this fed into the design layout of the Development (and Assessment of Effects). |
| | | RSPB is particularly concerned with breeding hen harrier, merlin and short-eared owl, together with proximity to breeding and foraging areas for these species, plus peregrine and golden plover, in the SPA. A minimum buffer distance of 500m should be applied between any black grouse leks and turbines. | The design layout process has taken into consideration the location of key breeding / lekking species onsite, and removed turbine locations from within 500m of these locations. |
| | | RSPB notes that there is considerable overlap in the viewsheds from some VPs. | Consideration is given to this in Technical Appendix |

| Consultee and Date | Scoping/Other Consultation | Issue Raised | Response/Action Taken |
|-----------------------------|----------------------------|--|---|
| | | Failure to account for this in the collision risk assessment could lead to an underestimation of the predicted collision risk. This would be particularly concerning if a number of the VP watches were undertaken simultaneously. | 9.1 and in sections 9.51-9.54. It is concluded that overlapping viewsheds do not affect collision modelling results, if data are collated appropriately, as has been done for the Development. |
| | | The proximity of VPs to proposed turbines raises concerns that the presence of observers may have interfered with the flightlines of priority birds and thereby could cast some doubt on the validity of the collision risk assessment. | Consideration is given to this in Technical Appendix 9.1 . It was concluded that proximity of VPs to turbines does not affect collision modelling results. |
| | | RSPB was concerned that some of the turbines are located on the edge of the visible range of accurate identification and location of birds in flight, in relation to the closest VP. | Consideration is given to this in Technical Appendix 9.1 . It was concluded that the distance of VPs to turbines has not affected collision modelling results. |
| | | The locations of proposed turbines 41 and 42 appear to have been overlooked during one breeding season, though we expect this to be addressed in 2016, but this would require VP surveys of this area to continue throughout the 2016 breeding season. | Further surveys were undertaken during the 2016 breeding season to close this gap. These turbine locations were subsequently removed from the Development as part of the design layout process. |
| | | VPs should allow adequate coverage of potential flights between the SPA and the Development Area. | VPs were distributed widely across the Development Area, including some that are in close proximity of the SPA to the north (see Figures 9.3 and 9.4). |
| | | There are a number of potentially significant impacts on SPA species, such as collision risk, displacement and disturbance, which may have impacts on the SPA populations, or individual Annex 1 species. All impacts should be properly assessed, and any potential impacts on SPA qualifying species must be considered in the context of the SPA Conservation Objectives. | Potential effects on the SPA have been fully considered in the Information to Inform an Appropriate Assessment section, following the HRA process. |
| | | In addition to the cumulative impact assessment on target populations proposed, we consider that an assessment of the 'in-combination' effects of other plans and projects will be required in relation to cumulative impacts on the SPA. This should include both Windfarm, opencast coal and any other developments that have potential to impact on the SPA. | Cumulative effects as part of the EIA process, and in-combination effects as part of the HRA process are considered in the Assessment of Effects section. These take into consideration non-Windfarm activities subject to EIA. |
| | | A detailed consideration of the use of mitigation measures will be required as part of the HRA process. | Mitigation measures are outlined for specific receptors, including SPA species, in the Information to Inform an Appropriate Assessment Section. |
| | | Without prejudice to our ultimate view on the acceptability of the proposed Windfarm, we note and agree that there is considerable potential for habitat and species conservation measures for birds and peatland habitat. | Habitat enhancement measures have been fully considered in the Outline Conservation Management Plan in Appendix 8.6 . |
| Wanlockhead Village Council | Scoping Response | It is noted there have been no surveys of geese migration through the site. Given that the proposed windfarm falls within the | Flight activity surveys during the migration and winter periods have taken place |

| Consultee and Date | Scoping/Other Consultation | Issue Raised | Response/Action Taken |
|---|----------------------------|---|---|
| 24 February 2016 | | flightpath of various geese species, it is suggested that the potential for collision impacts is high. | across the Development Area from 2014-16. The results from these have been used to calculate collision risk for geese. |
| Leadhills Community Council 23 February 2016 | Scoping Response | The local community are aware of increasing populations of raptors. The Scoping Report appears to be concentrated on "existing conditions" but the local community would request that the EIA properly consider the fact that local ecological conditions are changing. | Within the Assessment of Effects, full consideration is given to the conservation status of each species, and therefore the likely populations in future years for the lifespan of the Development. |

Study Area

9.15 The ornithological assessment focuses on the Development Area and appropriate buffer areas (collectively the "study areas") which have been applied, as recommended by SNH (2014^{iv}) guidance (see **Appendix 9.1** and **Figure 9.2**). The specific study areas are as follows:

- Designated and non-designated sites – Development Area plus a 20km buffer (**Figure 9.1**);
- Flight activity (Vantage Point) surveys - areas within a 500m buffer of the outermost turbine locations, referred to for collision risk modelling purposes as the Collision Risk Analysis Area (CRAA) (see Appendix 9.1, Annex E and **Figures 9.3 and 9.4**);
- Breeding birds (general) – 500m buffer around all infrastructure (**Figure 9.2**);
- Scarce breeding bird surveys (2km buffer around all infrastructure) (**Figure 9.2**);
- Black grouse surveys (1.5km buffer around all infrastructure) (**Figure 9.2**);
- Non-breeding bird/winter walkover surveys (500m buffer around all infrastructure) (**Figure 9.2**); and
- Cumulative effects – projects or activities within the same Natural Heritage Zone (NHZ) as the Development Area (**Figure 9.21**).

Desk Based Research and Data Sources

9.16 The following data sources were considered as part of the assessment:

- DGRSG (provision of historic raptor nest locations, breeding success and hen harrier breeding success within the Muirkirk & North Lowther Uplands SPA);
- SNH SiteLink (www.snh.gov.uk/sitelink) (information on designated sites); and
- Any relevant ES Chapters or technical reports from other developments or proposed developments in the local area.

Field Surveys

9.17 All surveys followed SNH (2014^{iv}) recommended methods (see **Appendix 9.1 Annex B**) and the scope of surveys was undertaken in consultation with SNH and RSPB (**Table 9.1**). The survey areas relate to the area of land covered during a particular baseline survey, which differs depending on survey method, species surveyed and proposed Development layout at the time of survey. In all cases the survey area covered the location of all final layout infrastructure and an appropriate buffer.

9.18 Ornithological fieldwork commenced in April 2014 and was completed in August 2016, and comprised the following surveys (see **Appendix 9.1, Annexes B, C and D** for further details):

- Flight activity (VP) surveys. Fieldwork carried out from April 2014 to August 2016 inclusive;
- Upland Breeding Bird Surveys (BBS). Fieldwork carried out in spring-summer 2015 and 2016 (four visits between April and July);
- Scarce breeding bird surveys. Fieldwork carried out in spring-summer 2014, 2015 and 2016 (regular visits from March to August);

- Black grouse lek surveys. Fieldwork carried out in spring-summer 2014 and 2015 (at least two visits in April and May); and
- Non-breeding bird/winter walkover surveys, including hen harrier roost searches. Fieldwork carried out in winter 2014/15 and 2015/16 (at least three visits between October and March). After consultation with SNH (Table 9.1), it was agreed that additional monthly surveys, targeted for locating any hen harrier roosts would be carried out in winter 2015/16, focussing on dawn and dusk periods.

Methodology for Assessing Wider-Countryside Ornithological Interests

- 9.19 The evaluation for wider-countryside interests (interests unrelated to an SPA, but including a Site of Special Scientific Interest, SSSI) involves the following process:
- Identification of the potential effects of the Development;
 - Consideration of the likelihood of occurrence of potential effects where appropriate;
 - Defining the Nature Conservation Importance and Conservation Status of the bird populations present to establish level of sensitivity;
 - Establishing the magnitude of the likely effect (both spatial and temporal);
 - Based on the above information, a judgement is made as to whether or not the identified effect is significant with respect to the EIA Regulations;
 - If a potential effect is determined to be significant, measures to mitigate or compensate the effect are suggested where required;
 - Opportunities for enhancement are considered where appropriate; and
 - Residual effects after mitigation, compensation or enhancement are considered.
- 9.20 In assessing the significance of effects, emphasis is given to the national and NHZ/regional populations of the species as appropriate (or the designated site, where relevant).

Methodology for Assessing Likely Significant Effects on an SPA

- 9.21 The method for assessing the significance of a likely effect on an SPA is different from that employed for wider-countryside ornithological interests. The Habitats Directive is transposed into domestic legislation by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland). Regulation 48 includes a number of steps to be taken by the competent authority before granting consent (these are referred to here as a Habitats Regulations Appraisal, HRA). In order of application, the first four are:
- **Step 1.** Consider whether the proposal is directly connected to or necessary for the management of the SPA (Regulation 48 (1b)).
 - If not, **Step 2.** Consider whether the proposal, alone or in combination, is likely to have a significant effect on the SPA (Regulation 48 (1a)).
 - If so, **Step 3.** Make an Appropriate Assessment of the implications for the SPA in view of that SPA's conservation objectives (Regulation 48 (1)).
 - **Step 4.** Consider whether it can be ascertained that the proposal will not adversely affect the integrity of the SPA ("Integrity Test") having regard to the manner in which it is proposed to be carried out or to any conditions or restrictions subject to which they propose that the consent, permission or other authorisation should be given (Regulation 48 (5 & 6)). Relevant information regarding mitigation can be considered at Step 2.
- 9.22 It has already been established that the Development does not meet the criteria for Step 1. The assessment on the integrity of the SPA in relation to the Development is presented in this chapter. The results of baseline surveys and scientific conclusions presented in this chapter are used to inform the appraisal process, for likely significant effects, and potentially for the competent authority to conduct an Appropriate Assessment, if required.

Assessing Significance

- 9.23 This section defines the methods used to assess the significance of effects through the process of an evaluation of sensitivity (a combination of nature conservation importance and conservation status) and magnitude of effect for each likely effect on relevant Valued Ornithological Receptors (VORs).

Sensitivity

- 9.24 Determination of the level of sensitivity of a receptor is based on a combination of the receptor's nature conservation importance and conservation status, described in the sections below.
- 9.25 There are three levels of Nature Conservation Importance as detailed below in **Table 9.2**.

Table 9.2: Determining Factors of a Population's Nature Conservation Importance

| Importance | Definition |
|------------|---|
| High | Populations receiving protection by a SPA, proposed SPA, Ramsar Site, SSSI or which would otherwise qualify under selection guidelines. Species present in nationally important numbers (>1% national breeding or wintering population). |
| Medium | The presence of species listed in Annex 1 of the Birds Directive (but population does not meet the designation criteria under selection guidelines). The presence of breeding species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The presence of target species noted on the latest BoCC Red list. Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the Development. Species present in regionally important numbers (>1% regional breeding population). |
| Low | All other species' populations not covered by the above categories. |

- 9.26 VORs were taken to be those species of High and Medium nature conservation importance, with those species determined to be of Low conservation importance scoped out of the assessment.
- 9.27 As defined by SNH (2006ⁱ), the conservation status of a species is "the sum of the influences acting on it which may affect its long-term distribution and abundance, within the geographical area of interest (which for the purposes of the Birds Directive is the EU)" (Para. 14).
- 9.28 Conservation status is considered "favourable" under the following circumstances (Para.15):
- "Population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats; and
 - the natural range of the species is not being reduced, nor is likely to be reduced for the foreseeable future; and
 - there is (and probably will continue to be) a sufficiently large habitat to maintain its population on a long-term basis".
- 9.29 SNH (2006ⁱ) states that, "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" (Para. 17).
- 9.30 In the case of non-designated sites, the relevant scale for breeding species is considered to be the appropriate NHZ which the Development Area falls within. The Development falls within the Western Southern Uplands and Solway NHZ (NHZ 19). For wintering or migratory species, the national UK population is often considered to be the relevant scale for determining effects on the conservation status and this approach is applied here.
- 9.31 An effect is defined as a change of a particular magnitude to the abundance and/or distribution of a population as a result of the Development. Effects can be adverse, neutral or favourable.
- 9.32 There can often be varying degrees of uncertainty over the magnitude of effects as a result of limited information. A precautionary approach is adopted where the response of a population to an effect is uncertain.
- 9.33 In determining the magnitude of effects, the resilience of a population to recover from temporary adverse conditions is considered in respect of each potentially affected population.

Magnitude

- 9.34 The sensitivity of individual species to disturbance during relevant behaviours is considered when determining spatial and temporal magnitude of effect and is assessed using guidance described by Bright *et al* (2006^v), Hill *et al* (1997^{vi}) and Ruddock and Whitfield (2007^{vii}).
- 9.35 Effects are judged in terms of magnitude in space and time. There are five levels of spatial effects and temporal effects as detailed in **Table 9.3** and **Table 9.4** below respectively.

Table 9.3: Spatial Effect Magnitude

| Spatial Magnitude | Definition |
|-------------------|--|
| Very High | Total/near total loss of a bird population due to mortality or displacement. Total/near total loss of productivity in a bird population due to disturbance. Guide: >80% of population lost through additive mortality. |
| High | Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 21-80% of population lost through additive mortality. |
| Medium | Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 6-20% of population lost through additive mortality. |
| Low | Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 1-5% of population lost through additive mortality. |
| Negligible | Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation. Guide: < 1% population lost through additive mortality. |

Table 9.4: Temporal Effect Magnitude

| Temporal Magnitude | Definition |
|--------------------|---|
| Permanent | Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period. Where this is the case, Long-Term may be more appropriate. |
| Long-term | Approximately 15 - 25 years or longer (see above). |
| Medium-term | Approximately 5 - 15 years. |
| Short-term | Up to approximately 5 years. |
| Negligible | <12 months. |

Significance

- 9.36 The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude of change as detailed in **Table 9.5** below. Major and moderate effects are considered significant in the context of the EIA Regulations.

Table 9.5: Significance Criteria

| Significance of Effect | Description |
|------------------------|--|
| Major | The effect is likely to result in a long term significant adverse effect on the integrity of the feature. |
| Moderate | The effect is likely to result in a medium term or partially significant adverse effect on the integrity of the feature. |
| Minor | The effect is likely to adversely affect the feature at an insignificant level by virtue of its limited duration and/or extent, but there will probably be no effect on its integrity. |
| Negligible | No material effect. |

Assessment Limitations

- 9.37 During consultation, SNH and the RSPB raised some queries relating to VP locations and viewshed coverage, and whether collected data would be sufficiently robust to allow an accurate assessment of effects, primarily collision risk (see **Table 9.1**). These queries have been addressed below.

Vantage Point Numbers and Locations

- 9.38 VPs were selected carefully, following SNH (2014^{iv}) guidance that states "It is very important that VPs are chosen to achieve maximum visibility with the minimum number of points". VP locations are shown in **Figures 9.3 and 9.4**.
- 9.39 Due to the size and topography of the Development Area, vantage points were mainly located on high plateau areas, in order to be able to view similar areas where turbines (and therefore the collision risk volume airspace) are most likely to be located. Much of the Development Area comprises steep-sided cleuchs and low-lying farmland where turbines would not be located, and hence visual coverage of these areas is not required to inform collision risk analysis. In some parts, visual coverage was much restricted by topography, and so VP position was limited to a single location, with no practical alternatives, when landowner and layout constraints were taken into account.
- 9.40 VP selection was an iterative process involving GIS viewshed analysis, an initial reconnaissance site visit and feedback from surveyors. Potential VP locations were first selected using OS maps and aerial imagery, and a viewshed was generated for each potential VP location, to show theoretical visual coverage at 20m (taken at that time to correspond with theoretical minimum potential lower rotor tip height above ground).
- 9.41 Once a number of VPs were selected in order to be able to provide sufficient visual coverage of the Development Area (all potential turbine locations plus buffer, within 2 km of a VP), a site reconnaissance visit was made to ensure that coverage was similar to that predicted, or whether micro-siting VPs would enhance visual coverage. This was backed-up by feedback from surveyors during their initial survey visit to each VP. Once confirmed, VPs remained consistent throughout that season. Surveyors positioned themselves as inconspicuously as possible so as to minimise their effects on bird movements (e.g. by selecting VP locations that avoid breaking the horizon, using tents/shelters).
- 9.42 Sensitive locations such as nest, roost or lek sites were avoided by suitable buffer distances from VPs to avoid disturbance. Regular feedback from field surveyors ensured that if sensitive activity was recorded within close proximity of the VP, then either relocation, postponement of surveys, or removal of VP resulted.
- 9.43 At the end of the 2014 breeding season there was a change in proposed turbine layout, which required the relocation/addition of some VPs to ensure sufficient coverage of all proposed turbine locations. A similar procedure for VP selection to that outlined above was conducted prior to 2014-15 non-breeding season surveys, and these VP locations have been consistent since. Consequently, due to this detailed process, the VP coverage is different in the 2014 breeding season to that throughout the subsequent survey period.

Survey Coverage Gaps

- 9.44 **Table 9-1 of Technical Appendix 9.1** provides a summary of the spatial and temporal coverage of VPs in relation to proposed turbine locations. It shows that 33 of 35 turbines were covered by at least one viewshed during at least 3 of the 4 seasons (breeding season 2014, non-breeding season 2014-15, breeding season 2015 and non-breeding season 2015-16). A total of 26 of 35 turbines were covered in all four seasons.
- 9.45 Of the two turbines not covered in any season, T20 is in a gap between a number of viewsheds. Representative activity rates within the vicinity of this turbine, in similar habitat, are therefore likely to have been recorded during surveys. The area does not apparently host any habitat of particular importance for key species, such as nest or roost sites, which may have been affected by surveyor presence. The other turbine, T11 is approximately 100m from viewshed coverage at 20m above ground level meaning that any at-risk flights at rotor height will likely have been recorded.
- 9.46 The overall spatial coverage is therefore considered to provide representative flight activity levels within the Development Area to enable robust collision modelling to take place.

Vantage Points Close to Turbine Locations

- 9.47 As noted above, the size and topography of the Development Area makes it difficult to select VPs that have good coverage of proposed turbine areas, yet are all located at a sufficient distance so that there is no possible disturbance effects around any proposed turbine location. In given survey periods, four of the 35 proposed turbine locations (T2, T5, T7, T8) are within 500m of three VP locations (VPs 8, 11, 18).
- 9.48 In these cases, a trade-off between possible disturbance effects, optimisation of VP numbers and decreases in detectability of flights (particularly of smaller species such as merlin, golden plover) has been considered. As SNH (2014^{iv}) states “As detection of flight activity will decrease with distance, VPs should be located as close to the survey area as possible”. With no viable alternative VP locations close by to cover these proposed turbine areas, it was considered that it was of greater importance to be able to detect the largest proportion of flights possible in that area, rather than relocate a VP, or add further VPs up to or over 2km away to avoid any possible disturbance effects.
- 9.49 It should be noted that no VPs were located within 500m of any key species’ nest, roost or lek site, and so important and more intensive activity associated with such sites will not have been affected by surveys. Instead, it is considered more likely that the mean baseline activity rates throughout the remainder of the viewshed are similar to those close to the VP and proposed turbine location, and so results are representative of the area around proposed turbine locations, and unlikely to be compromised by the proximity of the VP.
- 9.50 This is important within the context of the collision model output, which is the end product of the survey data. The collision model does not consider the location of individual turbines within a windfarm area, only the total number of turbines, to calculate a collision rate for the windfarm. It uses a method of calculating one average activity rate for each species across the whole windfarm, and so technically it does not matter if vantage points are located close to proposed turbine locations - as long as the activity recorded within “unaffected” areas is comparable to the baseline activity within the “affected” areas close to vantage points, when surveyors are absent. This is considered to be the case for the Development, and where activity may have been affected by surveyor presence, this VP was removed.

Viewshed Overlap and Simultaneous Surveys

- 9.51 During consultation RSPB raised a concern that overlap of viewsheds could affect the results of the collision model by underestimating collision risk, particularly if VP watches were undertaken simultaneously (see **Table 9.1**).
- 9.52 No survey effort where a surveyor was within another surveyor’s viewshed was included in collision modelling. Surveys were planned in advance to avoid potential effects of disturbance caused by surveyor presence within a viewshed.
- 9.53 **Figures 9.3 and 9.4** show that in a number of cases viewsheds do spatially (but do not temporally) overlap due to the restrictions imposed by topography (see above). It is however considered that spatially overlapping viewsheds should not affect the reliability of flight activity survey data used in the collision model. All VP watches are considered to be separate entities in the theoretical model, so there is no “overlap” in time, or space. Each survey provides an estimate of a mean activity rate (e.g. seconds per hour) within that viewshed, before an overall mean activity rate per season is calculated for the whole turbine area, by considering all viewshed activity rates from all VPs. Thus regardless of viewshed overlap, the number of hours surveyed, and duration of flights recorded within each individual viewshed (and therefore mean activity rate per area) will be accurate.
- 9.54 In summary, it can be concluded that the potential limitations relating to flight activity surveys raised by SNH and RSPB and outlined above will not affect the robustness of the analysis, because the flight activity data collected over two years is extensive and sufficiently representative of mean bird distribution and activity rates across the Development Area as a whole (which is how the collision risk model uses the data – i.e. one mean collision risk value is provided for the Development as a whole).

Survey Effort

- 9.55 Poor visibility due to low cloud was a recurrent issue during flight activity surveys, and during the 2015 breeding season in particular. Follow-up surveys later in the same season were required to complete enough “good” hours (visibility of 1km or more) to meet SNH’s minimum 36 hour per VP survey effort recommendation. **Technical Appendix 9.1** provides a detailed breakdown of survey effort per VP per season. The minimum survey effort was met in all cases apart from at three VPs during the 2015 breeding season, where between 35 and 36 hours of “good” hours were surveyed. This slight reduction in survey effort at three VPs does not affect the robustness of collision modelling results.

Survey coverage

- 9.56 No survey access was available to the east of the Development Area boundary (see **Figure 9.2**). Surveyors were however able to scan across a large area outside of the Development Area from the boundary, and record any target species’ breeding activity at least 500m from the boundary. Historic breeding raptor data for the wider local area was provided by the DGRSG, which is considered sufficient for analysis purposes.
- 9.57 Whilst some information limitations have been identified, it is considered that the extensive survey work carried out between 2014 and 2016, and the availability of a robust dataset of historic breeding records, is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental effects on ornithological receptors, including those within the context of the HRA process.

Existing Conditions

- 9.58 This section describes the existing conditions within the ornithological study area comprising:
- Statutory nature conservation designated sites for birds within 20km of the Development;
 - Birds recorded during baseline ornithology surveys (for full details see Appendix 9.1); and
 - Historic breeding records provided by the D&GRSG.

Statutory Nature Conservation Designations

- 9.59 There are no statutory nature conservation designations with an ornithological interest within the Development Area. The only designated site with an ornithological interest within 20km of the Development is the Muirkirk and North Lowther Uplands SPA (underpinned by the North Lowther Uplands SSSI and the Muirkirk Uplands SSSI), which is just to the north-west of the Development Area. Details of the features and status of the designated features of these sites are listed in **Table 9.6**.

Table 9.6: Summary of qualifying features of Muirkirk and North Lowther Uplands SPA and component SSSIs.

| Feature | Status | Notes |
|--|--|--|
| Golden plover, breeding | June 2015: Unfavourable, declining | Breeding population of European importance. Minimum of 154 pairs (1999), 0.7% of the UK population. |
| Hen harrier, breeding** | July 2008: Unfavourable, declining | Breeding population of European importance. Average of 29.2 breeding females (1994-96), 6% of the UK population. |
| Hen harrier, non-breeding* | December 2004: Unfavourable, declining | Wintering population of European importance. Average of 12 individuals (1991-95), 2% of the UK population. |
| Merlin, breeding | July 2009: Unfavourable, no change | Breeding population of European importance. Average of 9 breeding pairs (1989-98), 0.7% of the UK population. |
| Peregrine falcon, breeding | August 2004: Unfavourable, no change | Breeding population of European importance. Average of 6 breeding pairs (1992-96), 0.5% of the UK population. |
| Short-eared owl, breeding* | July 1998: Favourable, maintained | Breeding population of European importance. Average of 26 breeding pairs (1997-98), 3% of the UK population. |
| Muirkirk Uplands: Breeding bird assemblage | August 2008: Favourable, maintained | Upland moorland assemblage of national importance, Includes teal, hen harrier, buzzard, merlin, peregrine, short-eared owl, red grouse, golden plover, dunlin, snipe, curlew, redshank, whinchat, stonechat, wheatear, and ring ouzel. |
| North Lowther Uplands SSSI: Breeding bird assemblage | May 2015: Unfavourable, no change | Upland moorland assemblage of national importance, Includes hen harrier, short-eared owl, merlin, peregrine, golden plover, red grouse, raven, dunlin, snipe, teal, curlew, redshank, whinchat and wheatear. |

* = qualifying interest of Muirkirk Uplands SSSI; ** = qualifying interest of Muirkirk Uplands and North Lowther Uplands SSSIs.

9.60 In addition, the non-statutory designated site Airds Moss RSPB reserve is 18.1km to the north-west and is managed for wintering hen harrier and breeding waders.

Birds Recorded During Desk and Field Surveys

9.61 The following paragraphs summarise the baseline ornithological field survey results, and historic data obtained during the desk study. Full details can be found within **Technical Appendix 9.1, Annex D** and **Figures 9.5 to 9.20** and **Confidential Annex Figures CA1 to CA7**.

Wildfowl (Swans and Geese)

9.62 There was no evidence during any survey that geese or swans utilise the Development Area for feeding, roosting or breeding, and in general habitats are unsuitable for these species. **Pink-footed goose** skeins were recorded flying across the Development Area during winter months in 2014/15 (27 skeins during flight activity surveys), with flock size reaching up to 480 individuals (**Figure 9.5**). A total of 14 skeins were recorded during the 2015/16 non-breeding season flight activity surveys (up to around 210 individuals) (**Figure 9.6**), with an additional ten flocks recorded during winter walkovers.

9.63 Less common was **greylag goose** (three skeins, up to 76 individuals in 2014/15, absent in 2015/16), **whooper swan** (four flocks, up to 10 individuals in 2014/15, absent in 2015/16), **barnacle goose** (two skeins of 60 and 65 individuals in 2014/15) and **white-fronted goose** (three skeins of up to 51 individuals recorded during winter walkovers in 2014/15).

Black Grouse

9.64 Results from specific black grouse surveys in 2014 and 2015, and records from all other surveys, indicated that there are five main lekking areas within the Development Area (assuming all leks further than 1.5km apart are separate entities). These areas, with associated maximum counts, are summarised in **Table 9.7** and shown in **Confidential Figure CA7**. In 2014, a maximum total count of 13 males and four females were present. In 2015, 15 males plus six females were present at the five leks.

9.65 Although overall local numbers were similar between years, maximum counts at individual lekking areas were different at Blairy Burn and Coupland Knowe in particular, indicating that there is inter-annual variation of distribution and lek connectivity across the Development Area.

9.66 Small numbers of black grouse were also recorded during the non-breeding seasons.

Table 9.7: Black Grouse Records, 2014 and 2015

| Lek ID | Location | 2014 Max. males | 2014 Max. females | 2015 Max. males | 2015 Max. females |
|--------|------------------|--------------------|----------------------|--------------------|----------------------|
| A | Blairy Burn | 8 | 0 | 2 | 2 |
| B | Chapman's Cleuch | 2 | 2 | 3 | 3 |
| C | Coupland Knowe | 1 | 0 | 6 | 5 |
| D | Criagnorth Hill | 1 | 1 | 2 | 1 |
| E | Cogshead | 1 | 1 | 2 | 0 |
| | TOTALS | 13 | 4 | 15 | 6 |

Hen Harrier

9.67 Hen harriers bred within the study area in 2014 (two pairs, both successful), 2015 (four pairs, at least three successful) and 2016 (three pairs, at least two successful). According to the DGRSG data provided, the locations of these pairs are consistent with the local breeding distribution over the previous 12 years. Further details are presented in **Confidential Technical Appendix 9.2** and **Confidential Figures CA2 to CA4 and CA6**. Breeding success has generally been low since the earliest records provided by the DGRSG in 2004 (with no young fledged in some years), although the baseline survey period 2014–2016, coincided with a general upturn in breeding success within the study area.

9.68 Recorded flight activity during the breeding season was largely confined to the vicinity of breeding areas (within approximately 1.5km of nest sites), although birds were occasionally observed foraging

throughout the Development Area, and in particular around Glenrae Dod and Slough Hill in the north, where there is likely to be an abundance of prey items.

9.69 Hen harriers were also present throughout the 2014/15 winter and on one occasion in October 2014 five female/juvenile ringtails were recorded moving through the Development Area. During a winter walkover, two adult males and two ringtails were spotted together. Adult males and females, and juveniles were observed widely across the Development Area, although there again appeared to be a concentration of flight activity in the northernmost area around Glenrae Dod and Slough Hill. No evidence of roosting was observed.

9.70 Fewer flights, and a lower number of records were recorded during the 2015/16 flight activity and winter walkover surveys, despite a greater survey effort. This may be linked to the prolonged period of time during the winter when the Development Area had a consistent snow cover, thus rendering it unsuitable for foraging or roosting. No roosting individuals were recorded, despite an intensive survey effort in winter 2015/16.

9.71 Breeding hen harriers have been absent from the closest part of the Muirkirk and North Lowther Uplands SPA, to the north of the Development Area, from 2004 until 2012, when a successful pair was recorded (exact locations unknown). Numbers of pairs within the SPA increased to three in 2013 and four in 2014, but there were no pairs recorded in 2015. Additionally, three breeding pairs were recorded in 2015, outwith the SPA and north-east of the Development Area, but within potential foraging range.

Merlin

9.72 Baseline surveys showed that merlin bred successfully within the study area in 2015 (two pairs), and the DGRSG provided details of two other merlin nests. There was no confirmed breeding in 2014, but individuals were present, and juveniles were present within the Development Area in September and October, indicating that breeding may have occurred. Two territories were present in 2016, with one confirmed breeding attempt. Further details are presented in **Confidential Technical Appendix 9.2** and **Confidential Figures CA2 to CA4 and CA6**.

9.73 Longer term DGRSG data have shown that there are usually two to four known breeding merlin pairs within the Development Area, largely in similar areas to those recorded in 2014 to 2016, over 2km from the SPA boundary. In addition, there is a regular breeding pair north of the Development Area, but no detailed data are held by the DGRSG.

9.74 In 2014, juveniles were present within the Development Area between September and October, but no further records occurred after that month, apart from occasional merlin sightings during winter walkovers. A similar pattern of sightings occurred in the 2015/16 non-breeding season (only one record after November) suggesting the Development Area is relatively unimportant for the species in winter.

Goshawk

9.75 In 2014 a goshawk pair within the study area failed, despite apparently good conditions. A possible nest was located in forestry at a second location, but no further breeding evidence was found. At a third location calling was heard in May 2014, but again no further breeding activity was recorded.

9.76 In 2015, two or possibly three pairs were recorded breeding, at different locations to those in 2014. A nest was located but hatching/fledging success could not be confirmed. At a second location a pair was present early in the breeding season, and may be the same pair that was subsequently found nesting at a third location, where one chick fledged.

9.77 In 2016 it was possible that up to three territories were present within the study area, with birds observed in suitable habitat on a number of occasions. No breeding was however confirmed during surveys.

9.78 Further details are presented in **Confidential Technical Appendix 9.2** and **Confidential Figures CA2 to CA4**.

9.79 No goshawk data were provided by the DGRSG (it is assumed that no survey records are available for this species).

9.80 Goshawk flight activity was recorded all year round in 2014/15, with a concentration of observations within and near the plantation forestry in the centre of the Development Area around Tongue Hill. Flight activity was infrequent in 2015/16, with observations only occurring on three survey days.

Short-eared Owl

- 9.81 Three nests recorded by surveyors successfully fledged a total of eight juveniles in 2014, all within a similar part of the survey area. The DGRSG recorded four pairs present in 2014, but no information on breeding success was obtained.
- 9.82 No short-eared owl nesting was recorded in 2015, although three territories were held in eastern locations, but birds disappeared early in the breeding season - possibly due to late snow. The DGRSG did not record any pairs.
- 9.83 Short-eared owls were recorded throughout the year in 2014 and 2015, but largely present during the breeding seasons, when most flight records were observed within approximately 1km of known territories. There have been no records since June 2015.
- 9.84 Further details are presented in **Confidential Technical Appendix 9.2** and **Confidential Figures CA2 to CA4**.
- 9.85 No long term systematic monitoring of this species has been undertaken by the DGRSG in the local area, or indeed within the Muirkirk and North Lowther Uplands SPA. The information provided was therefore not systematically recorded and included only sporadic information on breeding recorded by local raptor workers. The lack of information for any given year should not be taken to mean there were no breeding pairs, or even that those present were recorded.
- 9.86 According to the DGRSG, the species is known to breed at particular areas within the Development Area, especially in good vole years.

Peregrine

- 9.87 Peregrine was recorded infrequently during baseline surveys and no breeding was recorded within the study area. The DGRSG reported one formerly regular breeding site to the north of the study area, which has become irregular in recent years with a high turnover of birds. This location is within the SPA.
- 9.88 Through the 1980s, 1990s and up until at least 2004, peregrines attempted to breed within the Development Area at various locations on Wanlock Water. During this period they fledged young on very few occasions. These locations are beyond 2km from the SPA boundary.

Barn Owl

- 9.89 A total of 12 locations within the survey area were checked for barn owl signs during the baseline survey period (see **Confidential Technical Appendix 9.2** and **Confidential Figure CA5** for details). Surveys during the 2014 breeding season recorded breeding evidence at five locations, on lower ground. The closest of these locations (Location 1) was at a distance of just under 500m from a turbine location. At a further location a barn owl was observed roosting.
- 9.90 During the 2014-15 non-breeding season, roost checks found barn owls present at three locations, with some signs of nest box use at a fourth. Only one other record was made, during a winter walkover.
- 9.91 In 2015, no successful breeding attempts were confirmed (one probable attempt at Location 1) despite a similar range of breeding sites monitored as in 2014. It is not known why there was such a difference between years, although poorer weather and lower vole numbers are likely to have played a part.
- 9.92 In the 2015/16 non-breeding season roosting took place at four locations.
- 9.93 The 2016 breeding season was again apparently unproductive for barn owl, with no signs of breeding, and an adult present only at Location 1.

Other Raptors

- 9.94 **Red kites** were recorded regularly in flight across the survey area, but there was no indication that birds attempted to breed within, or nearby the study area. It is likely that individuals are from the expanding Dumfries & Galloway population.
- 9.95 **Golden eagle** was recorded in flight on two consecutive days during the 2014-15 non-breeding season. A single bird was also recorded in July 2016. There was no indication of any breeding within the wider area.
- 9.96 A juvenile **rough-legged buzzard** was recorded over a period of around a week in November 2014. In the same month, a juvenile **white-tailed eagle** was also recorded.

- 9.97 Non-target secondary species **buzzard, kestrel** and **sparrowhawk** were regularly recorded during surveys.

Waders

- 9.98 Breeding bird surveys were conducted in April to July 2015 and 2016. Breeding wader species of higher nature conservation importance (listed in Annex I, Schedule 1, or the BoCC Red List) were: **curlew, golden plover, lapwing and woodcock**. In addition, Amber-listed waders present were **common sandpiper, oystercatcher, redshank and snipe**.
- 9.99 **Figures 9.17 and 9.18** show the distribution of records across the Development Area, which during the breeding seasons, is considered to be sufficiently representative of breeding distribution. Approximate numbers of territories, and distribution, are presented in **Table 9.8**.

Table 9.8: Breeding Bird Surveys 2015 and 2016

| Species | Number of Territories 2015 | Number of Territories 2016 | Distribution |
|------------------|----------------------------|----------------------------|---|
| Curlew | <17 | >12 | Concentrated in north around Glenrae Dod in particular, plus west around Conrig Hill. Not as abundant in south and east. |
| Dotterel | 0 | 0 | One record in 2015, no breeding evidence |
| Golden plover | 0-1 | 0 | Pair recorded around Stood Hill in 2015. |
| Lapwing | c.9 | c.9 | Predominantly enclosed land around Glenrae Dod (north-east) and south-west of Development Area, plus Wedder Dod. Less frequent in south and east. |
| Woodcock | 0 | 0 | In flight and additional sightings only. |
| Common sandpiper | 3-4 | 6-7 | Along Wanlock Water and Crawick water. |
| Oystercatcher | 6-8 | 4-5 | Along Wanlock Water, Crawick Water and Mennock Water. |
| Redshank | 1 | 1 | Pair at Spango Bridge area. |
| Snipe | c. 15 | 13-14 | Mainly around Glenrae Dod, Well Hill in north-east, Bogs Burn in west. Less frequent in south and east. |

- 9.100 During flight activity surveys, curlew, lapwing and snipe were regularly recorded in the breeding season, with infrequent golden plover, oystercatcher and woodcock flights. All species were recorded during winter months, although curlew (flock size up to six) and lapwing (flock size up to 120) were largely absent prior to March. Golden plover was spread more through winter months, comprising eight flocks of up to 48 individuals. Winter walkover surveys recorded small numbers of golden plover, curlew, lapwing and oystercatcher.

Other Species

- 9.101 Small numbers of **herring gull, great black-backed gull** and **common gull** were regularly present within the survey area, but no signs of breeding were observed. **Lesser black-backed gull** was also a regular presence, in flocks of up to 31 birds.
- 9.102 A number of BoCC Red-listed species were recorded during surveys, including **ring ouzel, cuckoo, fieldfare**, and **mistle thrush**.

The 'Do Nothing' Scenario

- 9.103 In the absence of the Development, management activities across the Development Area would likely remain similar to the present day, involving a combination of moorland management for sheep grazing and sporting activities, and commercial forestry.
- 9.104 Habitat conditions for target species are considered to be mixed across the study area, with areas that are more heavily grazed than others generally supporting smaller populations of target species. This situation and associated distribution of habitats would likely continue relatively unchanged over the long-term, and so species' populations within the Development Area would remain broadly similar (subject to wider population changes).

NLEI Design Considerations

- 9.105 Breeding locations and key foraging locations of target species were taken into consideration from the early stages of the Development design process, to minimise the risk of disturbance, displacement and collision effects. This included the results of baseline surveys as well as longer-term datasets gathered from the DGRSG and other sources.
- 9.106 In summary, the following steps have been taken in the infrastructure design process to minimise the risk of significant effects:
- Avoidance of all recorded historic nesting locations of hen harrier and merlin by at least 500m.
 - Avoidance of central location of black grouse leks by at least 500m and deletion of turbines from the more important areas of the Development Area for black grouse.
 - Avoidance of areas of highest flight activity rates of target species, including key foraging areas.
 - Consideration of larger turbine types with greater airspace between ground level and lower rotor top height, to minimise collision risks.
- 9.107 Specific modifications to the turbine layout are as follows:
- Layout modified from 53 to 42 turbines after consideration of 2014 breeding bird survey results;
 - Two turbines deleted due to proximity to hen harrier nest and black grouse lek. Six turbines relocated to ensure distance of >500m from black grouse lek and hen harrier nests. Five turbines relocated to avoid area of high hen harrier flight activity rates.
 - One turbine moved to account for hen harrier nest site, one moved for black grouse lek and hen harrier nest, and one turbine moved for goshawk nest.
 - Movement of two turbines to avoid merlin nest. Movement of one turbine to avoid hen harrier nest.

Micrositing

- 9.108 Any micrositing of infrastructure will take into consideration the distances from known nest sites of Schedule 1 breeding species and black grouse lek sites. It is planned that no micrositing of infrastructure will encroach into species-specific disturbance-displacement buffers outlined in this chapter (following the recommended procedures of a Breeding Bird Protection Plan, BBPP).

Assessment of Effects

- 9.109 The assessment of effects is based on the project description as outlined in **Chapter 4: Scheme Description**. Unless otherwise stated, potential effects identified are considered to be negative. Effects are initially assessed prior to any relevant mitigation measures being considered.
- 9.110 An assessment of residual effects then takes into consideration planned measures such as those outlined in **Appendix 8.6**, which includes the following:
- Restoration and enhancement of the blanket bog and wet modified bog resource within the Development Area;
 - Enhancement of foraging and nesting habitat for hen harrier within dry heath areas of the Development Area;
 - Enhancement of foraging habitat and cover for black grouse and hen harrier by planting of native woodland within the Development Area.

Scoped in Valued Ornithological Receptors

- 9.111 The assessment is applied to those 'scoped-in' VORs of Medium or High nature conservation importance (see Table 9.2) that are known to be present within the Development Area or wider study area (as confirmed through survey results and consultations outlined above). These comprise: **black grouse,**

hen harrier, merlin, goshawk, peregrine, short-eared owl, golden plover, curlew and lapwing (Table 9.9).

- 9.112 Based on the *Methodology for Assessing Adverse Effect on the Integrity of an SPA* procedure outlined above, the Development is not directly connected to or necessary for the management of any SPA (Step 1). It is concluded that a Likely Significant Effect (Step 2) cannot be discounted at this stage for the hen harrier, merlin, peregrine, short-eared owl and golden plover populations of the **Muirkirk and North Lowther Uplands SPA**, due to potential ranging distance of these species, as advocated by SNH (2016^{xl}). This also comprises the component **North Lowther Uplands** and **Murkirk Uplands SSSIs** where hen harrier is a qualifying interest, and other species are part of the breeding bird assemblage, and will therefore be considered alongside the assessment of the SPA in the *Information to Inform an Appropriate Assessment* section. For the purposes of the EIA, SPA qualifying interests are therefore considered to be of High Nature Conservation Importance (Table 9.9) as connectivity cannot be ruled out, particularly during the non-breeding season when birds may range more widely.

Table 9.9: Nature Conservation Importance of Recorded Bird Populations

| Species | Nature Conservation Importance | Reason |
|-----------------|--------------------------------|--|
| Black grouse | Medium | BoCC Red-listed; sensitive to Windfarm effects (SNH, 2006 ⁱ) |
| Hen harrier | High | Qualifying interest of the Muirkirk and North Lowther Uplands SPA; Annex I, Schedule 1 and BoCC Red-listed |
| Merlin | High | Qualifying interest of the Muirkirk and North Lowther Uplands SPA; Annex I, Schedule 1 |
| Peregrine | High | Qualifying interest of the Muirkirk and North Lowther Uplands SPA; Annex I, Schedule 1 |
| Short-eared owl | High | Qualifying interest of the Muirkirk and North Lowther Uplands SPA; Annex I |
| Golden plover | High | Qualifying interest of the Muirkirk and North Lowther Uplands SPA; Annex I |
| Goshawk | Medium | Schedule 1 |
| Curlew | Medium | Red-listed, part of SSSI breeding bird assemblage |
| Lapwing | Medium | Red-listed |

- 9.113 In addition, it is necessary to consider the species' conservation status when assessing the likely effects. Relevant conservation status information for the 'scoped in' VORs is detailed within **Table 9.10**.

Table 9.10: Conservation Status of Scoped In VORs

| Species | Conservation Status | Conservation Status Information |
|--------------|--|--|
| Black grouse | BoCC Red List (HD, BDP ¹ , BDP ² , BDMr ²) | Black grouse is Red-listed due to an historical decline in the UK between 1800 and 1995, without substantial recent recovery. It also qualifies due to a severe decline in the UK breeding population size of >50% over 25 years. Breeding numbers in the UK declined by 80% between 1991 and 2004. Sim <i>et al.</i> (2008 ^{viii}) estimated there to be 5,078 male black grouse in the UK in 2005, with approximately two-thirds of these occurring in Scotland. However, Forrester <i>et al.</i> (2007 ^{ix}) estimate that in Scotland there are around 3,550 to 5,750 lekking males, representing about 71% of the British population. In Scotland the breeding range is contracting and numbers are declining, though the rate of decline varies regionally, being highest in southern Scotland, suggesting that the national and regional populations are in unfavourable conservation status . The NHZ 19 (Western Southern Uplands and Solway) population was estimated by Wilson <i>et al.</i> (2015 ^x) to be 121 (range 71-168) displaying males. |
| Hen harrier | BoCC Red List (HD) | Hen harrier is Red-listed due to an historical decline in the UK between 1800 and 1995, without substantial recent recovery. The UK and Isle of Man hen harrier population was estimated at 662 territorial pairs in 2010, which is a decline of 18% since 2004. Scotland holds the bulk (76%) of the population (505 territorial pairs, where a decline of 20% since the previous survey was observed (Hayhow <i>et al.</i> |

| Species | Conservation Status | Conservation Status Information |
|-----------------|--|--|
| | | 2013) ^{xi} . Thus the national population is considered to be in unfavourable conservation status . The regional NHZ 19 (Western Southern Uplands and Solway) population was considered by Fielding <i>et al.</i> (2011) ^{xii} to be in unfavourable conservation status due to persecution and low productivity. The NHZ 19 population was estimated by Wilson <i>et al.</i> (2015) ^x to be 18 (range 15-20) pairs in 2011, and 39 breeding attempts in South Strathclyde were monitored by the Scottish Raptor Study Group in 2014. |
| Merlin | BoCC Red List (HD) | The last national merlin survey carried out in 2008 suggested a national breeding population of around 1,159 breeding pairs with about 733 pairs in Scotland (Ewing <i>et al.</i> 2011 ^{xiii}). Comparison with the previous 1993-94 survey suggests an overall stable population, albeit with regional differences in success. There is relatively poor monitoring coverage in the South Strathclyde region, and the national survey did not focus on this region. It was apparent however that estimates of change were more negative for regional populations at southern latitudes than more northerly populations, and so the regional/NHZ population is likely to be in unfavourable conservation status. The NHZ 19 population was estimated by Wilson <i>et al.</i> (2015) to be 12 (range 7-18) pairs in 2008, and nine breeding attempts in South Strathclyde were monitored by the Scottish Raptor Study Group in 2014. |
| Peregrine | BoCC Green List | Preliminary analysis of the data from the 2014 Peregrine Survey, carried out in the UK and the Isle of Man, estimates the overall number of breeding pairs at 1,505 ^{xiv} . Although this is similar to the estimate from the previous survey in 2002, the regional estimates are more divergent, with the Scottish population declining since 2002 (-11%). The NHZ19 population was estimated by Wilson <i>et al.</i> (2015) ^x to be 34 pairs in 2014, and 44 breeding attempts in South Strathclyde were monitored by the Scottish Raptor Study Group in 2014. Whereas the national population is likely to be stable , the regional/NHZ population is considered to be in unfavourable conservation status. |
| Short-eared owl | BoCC Amber list (BDMr ¹ , BDMr ²) | The Scottish breeding population is estimated as ranging from 125-1,250 pairs, with high densities in the Southern Uplands (Forrester <i>et al.</i> 2007 ^{ix}). The population is essentially nomadic, linked to cyclic populations of field voles, and so difficult to monitor. The national and regional population trends are therefore unknown . The NHZ19 population was estimated by Wilson <i>et al.</i> (2015) to be 35 (range 7-67) pairs in 2013, and one breeding attempt in South Strathclyde was monitored by the Scottish Raptor Study Group in 2014. |
| Golden plover | BoCC Green List | The UK golden plover breeding population is estimated to be 38,000-59,000 pairs ^{xv} , although Forrester <i>et al.</i> (2007) give a Scottish breeding population estimate of 15,000 pairs, stating that this represents 80% of the British breeding population. The NHZ 19 population was estimated by Wilson <i>et al.</i> (2015) ^x to be 778 (range 716-839) pairs in 2005. The BTO BirdTrends website ^{xvi} states that the national population is in probable decline. The Muirkirk and North Lowther Uplands SPA population was considered to be in unfavourable conservation status, declining condition when monitored in 2015, and this is likely to reflect the regional/NHZ and national populations. |
| Goshawk | BoCC Green List | There are an estimated 400 pairs in Britain (Musgrove <i>et al.</i> 2013 ^{xvii}). The NHZ19 population was estimated by Wilson <i>et al.</i> (2015) ^x to be 31 (range 17-41) pairs in 2013. Five breeding attempts in South Strathclyde were monitored by the Scottish Raptor Study Group in 2014. The goshawk population appears to be expanding in range in Scotland (Forrester <i>et al.</i> 2007) and as the species is BoCC Green-listed, the national and regional/NHZ populations are likely to be in favourable conservation status. |
| Curlew | BoCC Red List (BDMP ¹ , BDp ²) | The national curlew population was most recently estimated to be 68,000 pairs in 2009 (BTO BirdTrends ^{xviii}) but it was reported there has been a notable contraction of range in south-west Scotland. The recent inclusion of the species on the BoCC Red-list suggests that the national and NHZ/regional populations are in unfavourable conservation status. |

| Species | Conservation Status | Conservation Status Information |
|---------|--|--|
| | | The NHZ 19 population was estimated by Wilson <i>et al.</i> (2015) ^x to be 4,284 (3,851-4,717) pairs in 2005. |
| Lapwing | BoCC Red List (BDp ¹ , BDp ²) | The national lapwing population was estimated to be 130,000 pairs in 2009 (BTO BirdFacts ^{xviii}) and the Scottish population is estimated to be between 71,500 and 105,600 pairs (Forrester <i>et al.</i> 2007). The BTO BirdTrends ^{xvi} programme has reported a national decline by 43% across the UK, and 57% in Scotland between 1995 and 2014. The BTO's map of change in relative density between 1994-96 and 2007-09 indicates that decreases have been strongest in lowland regions and the south and that some increase may have occurred in some upland and northern regions of Britain. The NHZ trend is unknown but the regional and national populations are likely to be in unfavourable conservation status. |

BoCC criteria (Eaton *et al.* 2015ⁱⁱⁱ):

HD Historical Decline. A severe decline in the UK between 1800 and 1995, without substantial recent recovery.

BDp Breeding Population Decline. Severe decline in the UK breeding population size, of >50%, over 25 years (BDp¹) or the entire period used for assessments since the first BoCC review, starting in 1969 ("longer-term") (BDp²)

BDMp Breeding Population Decline. Moderate decline in the UK breeding population size, of more than 25%, over 25 years (BDMp¹) or the entire period used for assessments since the first BoCC review, starting in 1969 ("longer-term") (BDMp²).

BDMr¹ Breeding Range Decline. Moderate decline (by more than 25% but less than 50%) in the last 25 years (BDMr¹) or over longer term BDMr²).

Scoped Out Designated Sites and Species

- 9.114 Based on listed qualifying interests, distance from the Development Area and foraging ranges of these species during the breeding season (Pendlebury *et al.* 2011^{xix}; SNH, 2016^{xx}), all other designated sites (i.e. excluding those scoped in above) have been scoped out of the assessment due to a lack of likely connectivity.
- 9.115 Due to the lack, or low numbers of "at-risk" flights or breeding activity recorded during baseline surveys, and lack of habitat suitability within the Development Area, the following target species have been scoped out:
- Pink-footed goose (one collision every 3.6 to 11.1 years, average every 5.4 years predicted – see Appendix 9.1);
 - Greylag goose (one collision every 0.0 to 9.9 years, average one every 20 years);
 - Barnacle goose (one collision every 0.0 to 21.7 years, average one every 43 years);
 - White-fronted goose (zero collisions);
 - Whooper swan (one collision every 12.0 to 33.5 years, average one every 18 years);
 - Red kite (one collision every 6.4 to 33.3 years, average one every 10.7 years, no breeding evidence, non-breeders present, population in favourable conservation status);
 - Golden eagle (zero collisions);
 - Rough-legged buzzard (zero collisions);
 - White-tailed eagle (zero collisions);
 - Herring gull (one collision every 68.9 to 729 years, average one every 70 years) and all other gull species;
 - Barn owl (closest occupied site is beyond maximum disturbance distance for turbine construction activities (up to 175m, as recommended in Shawyer, 2011^{xxi}), and no flight activity recorded during baseline surveys (zero collision risk); and
 - All passerine species, as per SNH (2006i; 2014iv) guidance. This includes ring ouzel, which although likely to be breeding within the Development Area, is found in steep cleuchs well away from proposed turbine locations, and therefore unlikely to be subjected to disturbance.

- 9.116 All wader species, except for curlew and lapwing, were scoped out of the assessment due to the low levels of breeding activity within 500m of the turbine areas. The potential displacement of small numbers of breeding pairs within this distance is not likely to be significant at a regional level for any population.

Construction Effects

Predicted Construction Effects

- 9.117 The main potential effects of construction activities across the Development Area are the displacement and disruption of breeding and foraging birds as a result of noise and general disturbance over a short-term period (either the duration of a particular construction activity within working hours, or the duration of the whole construction period).
- 9.118 Effects on breeding birds would be confined to areas in the locality of temporary construction compounds, turbines, tracks and other infrastructure. Relevant information has been consulted for the purposes of this assessment, and although much of the scientific evidence on the effects of birds in relation to construction activities have produced inconsistent conclusions, as a broad generalisation, larger bird species such as raptors, or those that feed in flocks in the open tend to be more susceptible to disturbance than small birds living in structurally complex habitats (such as woodland, scrub and hedgerow) (Hill *et al.* 1997^{vi}).
- 9.119 Direct habitat loss will also occur due to the Development's construction, which will be both short-term (e.g. temporary compounds, laydown areas) and long-term (access tracks and turbines, forestry removal). This may impact on breeding or foraging individuals.

Black Grouse

- 9.120 **Effect:** Lekking and foraging black grouse may be displaced from the Development Area during construction, either by disturbance or direct habitat loss, thereby potentially adversely affecting breeding productivity and survival rates of the NHZ population.
- 9.121 **Sensitivity:** Due to its Red-list conservation status and sensitivity to Windfarms, the species is classified as Medium nature conservation importance (**Table 9.9**). The regional/NHZ and national populations are considered to be in unfavourable conservation status. The species' sensitivity is therefore **Medium-High**.
- 9.122 Construction activities may temporarily displace black grouse from existing lekking, nesting or foraging areas and this could lead to effects on productivity and survival. If the current population of black grouse is limited by habitat then any displacement of foraging grouse from the areas presently used may have a material effect on its viability.
- 9.123 According to an expert survey by Ruddock and Whitfield (2007^{vii}) leks may be actively disturbed at 300–500m from varied disturbance sources, and SNH has more recently advocated during consultations specifically for windfarm developments, that a buffer of up to 750m should be applied to avoid all disturbance during the construction phase of windfarm developments (from more recent information in Zwart *et al.* 2015^{xxii}). For the purposes of this assessment, an upper disturbance limit of 750m is therefore considered sufficiently precautionary.
- 9.124 **Confidential Figure CA7** shows that no central lek locations are within 500m of a turbine, but four are within 750m of infrastructure. The maximum total number of males recorded across these four lek sites was 12 (in 2014), and this is taken to be the maximum number potentially affected.
- 9.125 The NHZ 19 population is estimated to be 121 lekking males, and so unmitigated, the possible loss of up to 12 lekking males would therefore represent around 10% of the NHZ population, and may also contribute to increased fragmentation of habitat for movements of birds between lek sites further afield. Because of the likely alternative habitat available within the local area however (for example, birds seemed to move between leks and shift exact lek sites between and within years) a shift away from a disturbance source (whilst remaining within the Development Area), and a continuation of lekking behaviour is more likely than a loss to the population.
- 9.126 However, as a maximum-case, unmitigated, the magnitude of effect of construction disturbance on the regional (NHZ 19) black grouse population is considered to be **Medium** and **Short-term** temporal.
- 9.127 **Significance of Effect:** The unmitigated effect from construction is classified as **Moderate adverse** and is therefore potentially **Significant** in the context of the EIA Regulations.

Proposed Mitigation

- 9.128 To reduce the significance of effect, NLEI Ltd will undertake the following mitigation.
- 9.129 Surveys for lekking black grouse following the methodology detailed within Gilbert *et al.* (1998^{xxiii}) and SNH (2014^{iv}) will be completed in March, April and May in the season preceding construction commencing. Should any leks be identified within 750m from any infrastructure, a suitable disturbance-free buffer distance of up to 750m will be established, with exact distance based on local topography and existing screening, as well as nature of activities occurring at that locality. No activity should occur in this area during the periods prior to 9am and after 6pm within the black grouse breeding season, April to July. The Ecological Clerk of Works (ECoW) should oversee the implementation of the above measures, regularly monitor the success of such restrictions, and recommend any alterations as required, to ensure continuation of undisturbed lekking.
- 9.130 To minimise the possibility of disturbance to any leks within 750m of access tracks, a maximum speed limit of 15 mph will be enforced, and personnel will remain within vehicles wherever possible. Any construction activity (e.g. track widening) required along access tracks should take place outside of the black grouse breeding season where practicable, or if not, at least 750m from lek sites and/or outside of the daily lekking period as described above. Where possible, gates within 750m of lek sites will remain open after first arrival, therefore avoiding every subsequent entry to open and close the gate and the associated potential disturbance to the lek due to pedestrian activity.
- 9.131 The Forest Design Plan (see **Appendix 4.2** for further details) provides details on the replanting and restructuring of the woodland throughout the lifetime of the Development. Restocking proposals will diversify the age classes of both commercial and native woodland within the Development Area. The restocking plan will therefore continue to provide some suitable habitat for species including black grouse within the Development Area.

Residual Construction Effects

- 9.132 The proposed mitigation is likely to result in the continuation of lekking and foraging activity and reduce the effect from Moderate adverse to at worst, **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Hen Harrier

- 9.133 As well as the wider countryside hen harrier population (including the North Lowther Uplands and Muirkirk Uplands SSSI population) which is considered via the EIA process below, hen harrier effects require consideration within the context of the Muirkirk and North Lowther Uplands SPA via the HRA process. The information relating to the HRA process is presented later in the *Information to Inform an Appropriate Assessment* section.
- 9.134 **Effect:** breeding or foraging hen harriers may be displaced from the Development Area during construction, either by disturbance or direct habitat loss.
- 9.135 **Sensitivity:** as an Annex I and Schedule 1 listed species, with potential connectivity to an SPA, hen harrier is classified as High Nature Conservation Importance. Both the national and regional/NHZ populations are considered to be in unfavourable conservation status. The species' sensitivity is therefore **High**.
- 9.136 **Magnitude of Effect:** up to four pairs bred successfully within the study area during baseline surveys in 2014-16, and this represented an upturn in numbers compared to the previous decade. There is however some inter-annual variation in numbers in the Development Area and wider study area. Hen harriers have attempted to breed within similar areas of the study area over the last decade or so, and so the baseline results are reflective of a longer-term past, and probable future situation. Surveys aimed at recording flight distribution have shown that, as would be expected, much hen harrier activity during the breeding season was recorded around nest sites, although it does appear that there are favoured foraging areas in the north-east of the Development Area, used in both breeding and non-breeding seasons.
- 9.137 The layout design process considered the locations of historic hen harrier nests when finalising turbine locations, and as such no turbines are to be constructed within 500m of any known historic nest site. On this basis, due to the location of planned infrastructure in relation to established nesting areas, habitat loss will not directly affect hen harrier nesting, although some foraging habitat may become unavailable during the construction period.

- 9.138 There is however one small section of proposed track that is within 500m of a 2014 nesting area (nest HH2 – see **Confidential Figure CA2**), meaning that potentially one pair may be disturbed by construction activities, e.g. track creation or vehicular movements, based on likely disturbance distances outlined in Ruddock and Whitfield (2007^{vii}).
- 9.139 The location of nest HH2 is on the other side of a slope from where the section of access track is planned, and so it is possible that construction activities may be screened by the topography, and birds would not be adversely affected. However, as a worst-case, the loss of one pair to the NHZ 19 population (18 pairs) over the short-term construction period would result in an effect of **Medium** and **Short-term** magnitude.
- 9.140 Hen harriers regularly use the Development Area in winter months, and up to five birds were recorded simultaneously. No roost sites are known to exist within the study area, and with construction likely to be localised to particular areas on Development Area birds are likely to be able to continue to forage elsewhere within the Development Area.
- 9.141 **Significance of Effect:** The unmitigated effect on breeding hen harrier (high sensitivity VOR) from construction (Medium, Short-term magnitude) is classified as **Moderate adverse** and is therefore potentially **Significant** in the context of the EIA Regulations.
- Proposed Mitigation*
- 9.142 A BBPP will be produced to ensure that disturbance to breeding birds within the Development Area is avoided. The aim of the BBPP is to ensure all reasonable precautions are taken to protect birds' nests, eggs, and dependent young during construction of the Development.
- 9.143 The aim will be fulfilled by adopting the following objectives throughout the construction phase of the Development:
- Implementation of a bird monitoring plan;
 - Following an approved procedure if an active nest is found;
 - Implementing measures prior to the breeding season to discourage birds from breeding on those areas of the Development to be worked during construction; and
 - Ensure adequate education and awareness of site personnel.
- 9.144 Pre-construction surveys carried out by a suitably qualified ornithologist will determine whether any hen harrier breeding activity is taking place within 500m. If breeding does occur within this potential disturbance zone (exact distance would be agreed with SNH) then any construction activity that is considered to be potentially disturbing will be avoided in that area so defined until chicks are fledged.
- 9.145 To minimise the possibility of disturbance to any nests within 500m of existing access tracks, a maximum speed limit of 15 mph will be enforced, and personnel will remain within vehicles wherever possible. Any construction activity (e.g. track widening) required along access tracks within 500m will take place outside of the hen harrier breeding season (April to July) where practicable, or if not, at least 500m from nest sites. Where possible, gates within 500m of nest sites will remain open after first arrival, therefore avoiding every subsequent entry to open and close the gate and the associated potential disturbance to the nest due to pedestrian activity.
- Residual Effects*
- 9.146 When considering the above mitigation, the residual effects of construction disturbance on hen harrier can be reduced to at worst, **Minor adverse** and therefore **not significant** in the context of the EIA Regulations. The residual effects on the North Lowther and Muirkirk SSSIs are considered to be **Negligible** and therefore **not significant** in the context of the EIA Regulations.
- Merlin*
- 9.147 As well as the wider countryside merlin population (including the North Lowther Uplands and Muirkirk Uplands SSSI population) which is considered via the EIA process below, merlin effects require consideration within the context of the Muirkirk and North Lowther Uplands SPA via the HRA process. The information relating to the HRA process is presented later in the Information to Inform an Appropriate Assessment section.
- 9.148 **Effect:** breeding or foraging merlins may be displaced from the Development Area during construction, either by disturbance or direct habitat loss.
- 9.149 **Sensitivity:** as an Annex I and Schedule 1 listed species, and with potential connectivity to the Muirkirk and North Lowther Uplands SPA population, merlin is classified as High Nature Conservation Importance.
- 9.150 The national population is likely to be stable, but the regional/NHZ19 population is in unfavourable conservation status. The species' sensitivity is therefore **High**.
- 9.151 **Magnitude of Effect:** historic and baseline survey data indicates that the Development Area usually holds between two and four merlin breeding pairs each year. Merlins have attempted to breed within similar areas of the study area over the last decade or so, and so the baseline results are reflective of a longer-term past, and probable future situation.
- 9.152 The design layout process considered the locations of historic merlin nests when finalising turbine locations, and due to the location of planned infrastructure in relation to established nesting areas, habitat loss will not directly affect merlin nesting, although some foraging habitat may become unavailable during the construction period.
- 9.153 An area of new access track may be within 500m of a historic merlin territory (occupied in 2015 – see **Confidential Figure CA6**), although the grid reference received from the DGRSG was imprecise, and the exact nesting site is unknown. Potentially therefore, one pair may be therefore disturbed by construction activities, e.g. track creation or vehicular movements, based on likely disturbance distances outlined in Ruddock and Whitfield (2007^{vii}). Based on the location of nests in other years however, the local merlin pair has tended to nest on the opposite slope from where the access track would be located (see **Confidential Figures CA2 to CA4 and CA6**), and so the likelihood of construction activities causing the short-term abandonment of a territory is considered to be reduced because of the possibility of screening by topography.
- 9.154 However, based on a worst-case scenario, the loss of one pair to the NHZ 19 population (12 pairs) over the short-term construction period (probably one breeding season) would result in an effect of **Medium** and **Short-term** magnitude.
- 9.155 **Significance of Effect:** The unmitigated effect from construction (Medium, short-term magnitude) on merlin (high sensitivity) is classified as **Moderate adverse** and is therefore potentially **Significant** in the context of the EIA Regulations.
- Proposed Mitigation*
- 9.156 As outlined in paragraph 9.142, a BBPP will be produced, and will be approved by the planning authority in consultation with SNH prior to implementation. The BBPP will detail the procedures to be followed to ensure reasonable precautions are taken to avoid disturbance to breeding birds on the site. Measures outlined for hen harrier will also be applicable for avoiding disturbance to breeding merlins.
- Residual Effects*
- 9.157 With mitigation measures (BBPP), the residual effects of construction disturbance on merlin will be at worst, **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.
- Peregrine*
- 9.158 As well as the wider countryside peregrine population (including the North Lowther Uplands and Muirkirk Uplands SSSI population) which is considered via the EIA process below, peregrine effects require consideration within the context of the Muirkirk and North Lowther Uplands SPA via the HRA process. The information relating to the HRA process is presented later in the Information to Inform an Appropriate Assessment section.
- 9.159 **Effect:** breeding or foraging peregrine may be displaced from the Development Area during construction, either by disturbance or direct habitat loss.
- 9.160 **Sensitivity:** as an Annex I and Schedule 1 listed species, and with potential connectivity to the Muirkirk and North Lowther Uplands SPA population, peregrine is classified as High Nature Conservation Importance. The national population is likely to be stable, but the regional/NHZ19 population is in unfavourable conservation status. The species' sensitivity is therefore **High**.
- 9.161 **Magnitude of Effect:** it is likely that peregrines have not attempted to breed within the Development Area for around a decade, and the nearest nest location within the 2km buffer appears to have become irregularly used in recent years. The species was recorded in flight infrequently during baseline surveys. Given this, habitat loss and construction disturbance is considered to be of **Negligible** and **Short-term** magnitude.

9.162 **Significance of Effect:** The unmitigated effect from construction on peregrine (High sensitivity) is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.163 No mitigation is required. However, as outlined in paragraph 9.142, a BBPP will be produced, and will be approved by the planning authority in consultation with SNH prior to implementation. This would ensure that breeding peregrines within up to 500m of any construction activities are not disturbed.

Residual Effects

9.164 The residual effects of construction disturbance on peregrine will be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Short-eared owl

9.165 As well as the wider countryside short-eared owl population (including the North Lowther Uplands and Muirkirk Uplands SSSI population) which is considered via the EIA process below, short-eared owl effects require consideration within the context of the Muirkirk and North Lowther Uplands SPA via the HRA process. The information relating to the HRA process is presented later in the Information to Inform an Appropriate Assessment section.

9.166 **Effect:** breeding or foraging short-eared owl may be displaced from the Development Area during construction, either by disturbance or direct habitat loss.

9.167 **Sensitivity:** as an Annex I listed species, and with potential connectivity to the Muirkirk and North Lowther Uplands SPA population, short-eared owl is classified as High Nature Conservation Importance. The conservation status of the national and regional/NHZ populations is uncertain, but an unfavourable status is most likely. The species' sensitivity is therefore **High**.

9.168 **Magnitude of Effect:** short-eared owl presence within the Development Area has fluctuated during the baseline surveys, with three breeding attempts in 2014 followed by none in 2015, with the species entirely absent in 2016. Although the species has not been systematically monitored by the Raptor Study Group, it was reported by them that particular parts of the Development Area have historically hosted breeding pairs in years with good populations of field voles (dates unknown).

9.169 The layout design process considered the locations of historic short-eared owl nesting areas when finalising turbine locations, and this has resulted in only one historic nest site within 500m (SE2 in 2014 – see **Confidential Figure CA2** which was located 200m from a proposed turbine location). Short-eared owls are generally nomadic breeders and breeding density and productivity are strongly linked to cyclic populations of field voles. Therefore although it appears that general areas have been repeatedly used for breeding within the Development Area, it is unlikely that birds would return to nest at exactly the same nest site as in 2014, particularly as ongoing forestry management and maturation of crop at that location will make it unsuitable in future years.

9.170 Nevertheless, as a worst-case, the loss of one territory to the regional breeding population is considered to result in an effect of **Medium** and **Short-term** magnitude.

9.171 **Significance of Effect:** The unmitigated effect from construction on short-eared owl (High sensitivity) is classified as **Moderate adverse** and is therefore potentially **Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.172 As outlined above, a BBPP will be produced, and will be approved by the planning authority in consultation with SNH prior to implementation. The BBPP will detail the procedures to be followed to ensure reasonable precautions are taken to avoid disturbance to breeding birds on the Development Area. Measures outlined for hen harrier will also be applicable for avoiding disturbance to breeding short-eared owls.

Residual Effects

9.173 With mitigation measures, the residual effects of construction disturbance on short-eared owl will be at worst, **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Golden Plover

9.174 As well as the wider countryside golden plover population (including the North Lowther Uplands and Muirkirk Uplands SSSI population) which is considered via the EIA process below, golden plover effects

require consideration within the context of the Muirkirk and North Lowther Uplands SPA via the HRA process. The information relating to the HRA process is presented later in the Information to Inform an Appropriate Assessment section.

9.175 **Effect:** breeding or feeding golden plovers may be displaced from the Development Area during construction, either by disturbance or direct habitat loss.

9.176 **Sensitivity:** as an Annex I listed species, and with potential connectivity to the Muirkirk and North Lowther Uplands SPA population, golden plover is classified as being of High Nature Conservation Importance. The national and regional/NHZ19 populations are in unfavourable conservation status. The species' sensitivity is therefore **High**.

9.177 **Magnitude of Effect:** Golden plover is likely to breed in low numbers within the Development Area (possibly one pair in 2015), with the majority of records on the higher plateaux within the southern parts. The species is also present on occasion during winter months, and also feeds on grassy areas around Glenrae Dod in the north of the Development Area.

9.178 The layout design process considered the locations of foraging and breeding habitat for golden plover and other wader species when finalising turbine locations, and no turbines are planned within areas likely to be favoured by golden plover for breeding or foraging during baseline surveys. Some foraging habitat may however become unavailable during the construction period due to the construction of access tracks around Glenrae Dod. It is possible that feeding birds may be disturbed during construction activities. It is also possible that at least one pair of breeding golden plover may be disturbed by access track construction, around Stood Hill and Green Hill in particular.

9.179 The loss of one pair from an NHZ population of 778 pairs is considered to be of **Negligible** and **Short-term** magnitude.

9.180 The Scotland wintering golden plover population is estimated to be 25,000-35,000 individuals, with the spring passage numbers being 10,000-30,000 (Forrester *et al.*, 2007). During the non-breeding season up to 74 birds were recorded using fields at Glenrae Dod. The loss of this habitat during the construction phase would therefore potentially affect up to a maximum worst-case of 0.74% of the Scottish non-breeding population, although it is likely that birds would continue to use suitable grass fields to the north of the Development Area at Spango Farm if displaced. The magnitude of effect is therefore considered to be of **Negligible** and **Short-term** magnitude.

9.181 **Significance of Effect:** The unmitigated effect from construction on golden plover (High sensitivity) is classified as **Negligible** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.182 No mitigation is required. However, as outlined in paragraph 9.142, a BBPP will be produced, and will be approved by the planning authority in consultation with SNH prior to implementation. This would seek to ensure that any breeding golden plovers, or their nest, eggs or young are not affected by construction activities.

Residual Effects

9.183 The residual effects of construction disturbance on golden plover will be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Goshawk

9.184 **Effect:** breeding or foraging goshawks may be displaced from the Development Area during construction, either by disturbance or direct habitat loss.

9.185 **Sensitivity:** as a Schedule 1 listed species, goshawk is classified as being of Medium Nature Conservation Importance. The national and regional/NHZ19 populations are in favourable conservation status. The species' sensitivity is therefore **Medium**.

9.186 **Magnitude of Effect:** baseline survey data indicates that the Development Area may hold up to three territories. There is inter-annual variation in nest site location due to ongoing commercial forestry activities within the Development Area: either clear-felling of potential or historic nesting areas, or ongoing forestry activities dissuading birds from attempting to nest within a particular location. Under the "do-nothing" scenario, this pattern of variability of nest site distribution, if not numbers, is likely to continue over the long-term period.

9.187 The Forest Design Plan (see **Appendix 4.1** for further details) provides details on the replanting and restructuring of the woodland throughout the lifetime of the Development. For the purposes of the Development, a total of 36ha of commercial forestry, predominantly Sitka spruce, will be felled across the Development Area, without replanting, although some riparian planting of native woodland will take place – see **Appendix 8.6**. Although this may slightly reduce the amount of nesting and foraging habitat available over the long-term, the viability of any territories are unlikely to be notably compromised and numbers are likely to remain consistent with those under the “do-nothing” scenario. Some felling locations may provide further opportunities for nesting or foraging due to the opening up of forestry and provision of better vantage points for birds. Habitat loss is therefore considered to be of **Negligible** spatial and **Long-term** temporal magnitude.

9.188 During the construction period, any breeding attempts within 500m of construction activity may be subject to disturbance pressures (Ruddock and Whitfield, 2007^{vii}). Based on survey results, up to three territories may be affected if construction activities are concurrent across the Development Area. Surveys have shown that goshawks within the Development Area have nested in a variety of locations, possibly in response to ongoing forest management and associated activities. A continuation of breeding within the Development Area or nearby is therefore more likely than abandonment of territories, The magnitude of effect due to construction disturbance is therefore considered to be **Low** spatial and **Short-term** temporal on the NHZ population.

9.189 **Significance of Effect:** The unmitigated effect from construction on goshawk (Medium sensitivity) is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.190 No mitigation is required. However, as outlined in paragraph 9.142, a BBPP will be produced, and will be approved by the planning authority in consultation with SNH prior to implementation. This would seek to ensure that any breeding goshawk, or their nest, eggs or young are not affected by construction activities within up to 500m.

Residual Effects

9.191 The residual effects of construction disturbance on goshawk will be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Curlew and Lapwing

9.192 **Effect:** breeding or feeding birds may be displaced from the Development Area during construction, either by disturbance or direct habitat loss.

9.193 **Sensitivity:** as Red-listed species due to long-term declines in breeding populations, curlew and lapwing are classified as being of Medium Nature Conservation Importance. The national and regional/NHZ19 populations are in unfavourable conservation status. The species’ sensitivity is therefore **Medium**.

9.194 **Magnitude of Effect:** The approximate number of curlew territories within the study area is 12-17, and these are concentrated in the north around Glenrae Dod in particular, plus further west around Conrig Hill. Approximately half of these territories may be within 500m of proposed turbine locations, and therefore subject to loss of nesting or foraging habitat, or disturbance. The NHZ19 population is estimated to be 4,284 pairs, and the loss of around 6-9 territories would result in an effect of **Low** and **Short-term** magnitude.

9.195 Approximately nine lapwing territories are within the study area, with around six likely to be within 500m of proposed turbine locations. The NHZ population is unknown, but based on the Scottish population estimate of between 71,500 and 105,600 pairs, a minimum of 5,000 pairs are likely to be within the NHZ. The loss of six territories would therefore result in an effect of **Low** and **Short-term** magnitude.

9.196 **Significance of Effect:** The unmitigated effect from construction on curlew and lapwing (Medium sensitivity) is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.197 No mitigation is required. However, as outlined in paragraph 9.142, a BBPP will be produced, and will be approved by the planning authority in consultation with SNH prior to implementation. This would seek to ensure that any breeding waders, or their nest, eggs or young are not directly affected by construction activities.

Residual Effects

9.198 The residual effects of construction disturbance on NHZ curlew and lapwing populations will be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Operational Effects: Displacement

9.199 The displacement of nesting and foraging birds from the Development Area has the potential to extend beyond the construction phase, as described above, and to occur during the operational phase.

9.200 Displacement away from operational turbines has been found to occur in a number of individual Windfarm studies, although the effects vary considerably between sites and species. Considering a range of breeding bird species but predominantly waders and passerines at upland Windfarms, Pearce-Higgins *et al.* (2012^{xxiv}) showed that there were no displacement effects on any bird species from Windfarms during the operational phase other than those that had already occurred during construction, and for some species the effects during construction were reversed during operation with numbers returning to pre-construction numbers. More recently Sansom *et al.* (2016^{xxv}) have shown information to suggest that breeding golden plovers may be affected by operational turbines up to 400m away.

9.201 It is recognised that disturbance may occur due to maintenance activities throughout the operational phase, although since these are likely to be of shorter duration and smaller extent than construction activities, effects will be lower than those predicted for construction effects (see previous section).

9.202 An additional consideration is the displacement of birds from larger areas where the turbines act as a barrier to bird movement. The likelihood of this effect occurring tends to increase with Windfarm size, where large turbine arrays can force birds to alter their regular flight-paths, resulting in an increase in distance flown and so energy expended. However, a review of the literature suggests that none of the barrier effects identified so far have significant effects on populations (Drewitt and Langston, 2006^{xxvi}). This was also the conclusion from modelling of energy costs to those bird species most likely to be sensitive to barrier effects (large and long-lived breeding birds such as seabirds) by Masden *et al.* (2010^{xxvii}).

9.203 Pearce-Higgins *et al.* (2009^{xxviii}) observed certain species experiencing localised population increases with proximity to Windfarm infrastructure installations, so while some birds may be displaced locally, others may benefit from the introduction of new structures into the habitat, or some other consequence of construction. This finding was further supported by Pearce-Higgins *et al.* (2012^{xxiv}) who reported significant increases in breeding numbers of skylarks and stonechats at Windfarms.

Black Grouse

9.204 **Effect:** Black grouse are recognised as a species being potentially sensitive to the presence of Windfarms (e.g. SNH, 2006ⁱ), and Windfarm operation may cause some displacement of breeding and foraging black grouse from areas close to turbines and other infrastructure.

9.205 **Sensitivity:** Medium-High.

9.206 **Magnitude of Effect:** Evidence presented from Austria has suggested that leks may be adversely affected by windfarms, although it is not clear what the exact causes may be: potentially combination of turbine noise, maintenance activities or collisions (Zieler and Grünschachner-Berger, 2009^{xxix}). At the operational Griffin Windfarm, early indications were that there were no obvious effects of the turbines on the closest lek approximately 500-600m from a turbine (Ross, 2012^{xxx}).

9.207 Although some vehicular movement along the access route may be required for maintenance activities through the lifespan of the Development, this is likely to be of negligible frequency and duration compared to the construction phase, and birds are unlikely to be affected out to similar distances as those recommended for construction activities.

9.208 Based on evidence above, predicted disturbance distances in Ruddock and Whitfield (2007^{vii}) and low frequency of maintenance activities, no displacement of any lek sites are likely to occur during the operational period (all being over 500m from proposed turbine locations, which is taken as the likely upper limit of displacement effects). Some breeding or feeding habitat may be lost due to displacement effects, although this is unlikely to directly result in the reduction of numbers within the local population. It is possible that the movement between leks for some females may be made more difficult due to the presence of turbines, but overall the magnitude of effect is considered **Low Spatial** and **Long Term Temporal** within the context of the NHZ population.

9.209 **Significance of Effect:** The effect is classified as **Minor adverse** and is therefore **Not significant** in the context of the EIA Regulations.

Proposed Mitigation

9.210 Measures outlined in **Appendix 8.6** are designed to increase the quality of habitat available for black grouse within the Development Area throughout the lifespan of the Development. This will help offset any loss of habitat due to displacement from turbines. Measures include woodland planting and moorland management, which will benefit breeding, lekking and foraging birds.

Residual Operational Effects

9.211 The residual effects of operational displacement on black grouse will be **Negligible** and therefore **not significant** in the context of the EIA Regulations.

Hen Harrier

9.212 **Effect:** foraging or breeding hen harriers may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

9.213 **Sensitivity:** High.

9.214 **Magnitude of Effect:** no proposed turbine locations are within 500m of historic hen harrier nest sites, and so direct displacement of breeding birds is considered unlikely. There may be a reduction in available foraging habitat for some birds, although Whitfield and Madders (2006^{xxxi}) concluded from a review of previous studies that if displacement of foraging hen harriers occurs then it will likely be limited to within 100m of wind turbines, if it occurs at all. Fernández-Bellon *et al.* (2015^{xxxi}) found that when recording productivity of hen harrier nests in Ireland, no statistically significant relationships were found between any breeding parameters recorded and distance of the nest from the nearest wind turbine. However, lower nest success within 1km of wind turbines than at greater distances was sufficiently close to statistical significance, so there may be some small effect on productivity of any pairs within 1km of turbines. Nevertheless, at a NHZ level, this is unlikely to be more than a **Low Spatial** and **Long Term Temporal** effect.

9.215 **Significance of Effect:** The effect is classified as **Minor adverse** and is therefore **Not significant** in the context of the EIA Regulations.

Proposed Mitigation

9.216 No mitigation is required. However, habitat management measures provided by NLEI Ltd., outlined in paragraph 9.110 and in **Appendix 8.6** will seek to ensure an increase in quality and extent of hen harrier foraging and nesting habitat (bog, dry heath and native woodland planting) within the Development Area, thereby providing opportunities for successful breeding without a reduction in productivity due to the presence of turbines.

9.217 In addition to the above mitigation, NLEI Ltd. is proposing enhancement measures in the form of a Regional Hen Harrier Conservation Management Plan (RHHCMP), which will aim to improve the conservation status of hen harriers in south Scotland. Details are provided in the *Further Survey Requirements, Monitoring and Enhancement Measures* section, and in **Appendix 8.6**.

Residual Effects

9.218 The residual effects of operational displacement on hen harrier are **Negligible** and therefore **Not Significant** in the context of the EIA Regulations. The residual effects on the component SSSIs are considered to be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations. It is difficult to quantify the full benefit of the RHHCMP over the life of the project, however it is expected that this could allow the Development to deliver a net benefit to the regional hen harrier population.

Merlin

9.219 **Effect:** foraging or breeding merlins may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

9.220 **Sensitivity:** High.

9.221 **Magnitude of Effect:** historic and baseline survey data indicates that the Development Area usually holds between two and four merlin breeding pairs each year. No proposed turbine location was within 500m of a historic merlin territory, and based on likely disturbance distances outlined in Ruddock and

Whitfield (2007^{vii}), no territories are likely to be significantly affected by the presence of operational turbines.

9.222 The variability in nest site locations between years suggests that alternative nest sites exist within the Development Area, and that birds would be able to continue to forage away from turbines. However a small area of foraging habitat may be lost due to displacement around turbines, and an effect of **Low spatial** and **Long-term** temporal magnitude is predicted.

9.223 **Significance of Effect:** The unmitigated effect from displacement is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.224 The habitat management measures outlined in **Appendix 8.6** will seek to ensure an increase in quality and extent of nesting merlin foraging and nesting habitat, thereby providing opportunities for successful breeding within the Development Area despite any possible displacement effects due to the presence of turbines.

Residual Effects

9.225 The residual effects of operational displacement on merlin are judged to be **Negligible** and therefore **not significant** in the context of the EIA Regulations.

Peregrine

9.226 **Effect:** foraging peregrines may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

9.227 **Sensitivity:** High.

9.228 **Magnitude of Effect:** it is likely that peregrines have not attempted to breed within the Development Area for around a decade, and the nearest nest location within the 2km study area buffer appears to have become irregularly used in recent years. The species was recorded in flight infrequently during baseline surveys and so the Development Area is unlikely to be important to any breeding birds. Given this, displacement effects are considered to be of **Negligible** and **Long-term** magnitude.

9.229 **Significance of Effect:** The unmitigated effect from operational displacement is classified as **Negligible** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.230 The habitat management measures outlined in **Appendix 8.6** will aim to provide increase in quality and extent of foraging habitat for peregrine, by providing suitable habitat for prey items such as waders, despite any possible displacement effects due to the presence of turbines.

Residual Effects

9.231 The residual effects of operational displacement on peregrine are judged to be **Negligible** and therefore **not significant** in the context of the EIA Regulations.

Short-eared owl

9.232 **Effect:** nesting or foraging short-eared owls may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

9.233 **Sensitivity:** High.

9.234 **Magnitude of Effect:** short-eared owl presence within the Development Area fluctuates between years, although particular parts of the Development Area have historically hosted breeding pairs in good vole years. One historic nest site (in 2014) was located approximately 500m from a proposed turbine location.

9.235 However, because of their nomadic nature, it is unlikely that birds would return to nest in exactly the same nest site as in 2014, particularly as ongoing forestry management and maturation of crop at that location will make it unsuitable in future years. Alternative nesting locations are therefore likely to be available.

9.236 Nevertheless, as a worst-case, the loss of one territory to the regional breeding population is considered to result in an effect of **Low spatial** and **Long-term** temporal magnitude.

9.237 **Significance of Effect:** The unmitigated effect from operational displacement is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.238 The habitat management measures outlined in **Appendix 8.6** will aim to provide increase in quality and extent of foraging habitat for short-eared owls, by providing suitable habitat for prey items, despite any possible displacement effects due to the presence of turbines.

Residual Effects

9.239 The residual effects of operational displacement on short-eared owl are judged to be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Golden Plover

9.240 **Effect:** nesting or foraging golden plovers may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

9.241 **Sensitivity:** High.

9.242 **Magnitude of Effect:** Golden plover is likely to breed in low numbers within the Development Area, with the majority of records on the higher plateaux within the southern parts. The species also feeds in numbers on grassy areas around Glenrae Dod in the north of the Development Area. Some foraging habitat may therefore be lost due to infrastructure around Glenrae Dod and around breeding areas, although it is considered unlikely that birds will be displaced by the presence of an access track at Glenrae Dod, and so no effects on wintering birds are predicted. The loss of at most one breeding pair from an NHZ population of 778 pairs is considered to be of **Negligible** and **Long-term** magnitude.

9.243 **Significance of Effect:** The unmitigated effect from operational displacement is classified as **Negligible** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.244 The habitat management measures outlined in **Appendix 8.6** will aim to provide increase in quality and extent of breeding and foraging habitat for golden plover, despite any possible displacement effects due to the presence of turbines.

Residual Effects

9.245 The residual effects of operational displacement on golden plover are judged to be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Goshawk

9.246 **Effect:** nesting or foraging goshawks may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

9.247 **Sensitivity:** Medium.

9.248 **Magnitude of Effect:** baseline survey data indicates that the Development Area may hold up to three territories, with inter-annual variation in numbers and distribution likely to occur each year under the "do-nothing" scenario as a result of ongoing commercial forestry activities within the Development Area.

9.249 As a predominantly woodland species, it is unlikely that goshawks will be subject to displacement around operational turbines compared to some open moorland species for example. Some localised loss of foraging or nesting habitat in close proximity to operational turbines may occur, but this is unlikely to result in a significant effect on the viability of any territory, with sufficient woodland habitat still likely to exist.

9.250 The effect of displacement on the goshawk NHZ population is considered to result in an effect of **Negligible** and **Long-term** magnitude.

Proposed Mitigation

9.251 None required.

Residual Effects

9.252 The residual effects of operational displacement on goshawk are judged to be **Negligible** and therefore **not significant** in the context of the EIA Regulations.

Curlew and Lapwing

9.253 **Effect:** nesting or foraging curlew or lapwing may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

9.254 **Sensitivity:** Medium.

9.255 **Magnitude of Effect:** Approximately 6-9 curlew territories may be within 500m of proposed turbine locations, and therefore subject to displacement from nesting or foraging habitat. The NHZ19 population is estimated to be 4,284 pairs, and the loss of around 6-9 territories would result in an effect of **Low** and **Long-term** magnitude.

9.256 Approximately six lapwing territories are likely to be within 500m of proposed turbine locations. The NHZ population is unknown, but based on the Scottish population estimate of between 71,500 and 105,600 pairs, a minimum of 5,000 pairs are likely to be within the NHZ. The loss of six territories would therefore result in an effect of **Low** and **Long-term** magnitude.

9.257 **Significance of Effect:** The unmitigated effect from operational displacement on curlew and lapwing is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

9.258 The habitat management measures outlined in the **Appendix 8.6**, although not targeted specifically for waders, will have an indirect effect by providing increased quality and extent of breeding and foraging habitat, despite any possible displacement effects due to the presence of turbines.

Residual Effects

9.259 The residual effects of operational displacement on curlew and lapwing are judged to be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Operational Effects: Collision Risk

9.260 Birds that utilise the airspace within the turbine area at potential collision heights during the lifetime of the Development will be at risk of collision with turbines. The risk of collision with moving wind turbine blades is presumed to be related (although not necessarily linearly) to the amount of flight activity over the Development Area, the topography of the Development Area, the species' behaviour, and the ability of birds to detect and manoeuvre around rotating turbine blades. On this basis, it is clear that collision rates are likely to increase with a windfarm's proximity to large concentrations of birds, whether this is breeding and foraging birds, wintering birds, or those utilising specific areas for local or large-scale migration (Gill *et al.* 1996^{xxxiii}).

9.261 The majority of studies of bird collisions with onshore wind turbines have recorded very low levels of mortality. This is perhaps largely a reflection of the fact that many windfarms are located away from large concentrations of birds. It is however important to note that many records are based only on finding corpses, with no correction for corpses that are overlooked or are removed by scavengers. It does also reflect the fact that birds have been found by direct observation to be very efficient at avoiding wind turbines.

9.262 Band *et al.* (2007^{xxxiv}) describe a method of quantifying potential bird collisions with onshore turbines, in which: (i) the activity rate per unit area per season is extrapolated; (ii) the likelihood of a collision with a blade for a bird passing through the rotor swept area is calculated; and (iii) an 'avoidance rate' is applied to account for behavioural adaptation of birds to the presence of turbines. This results in a figure for the likely mortality rate at the windfarm which is then assessed within the context of the species' relevant populations to determine the significance of any losses. Collision Risk Modelling (CRM) results are presented below in **Table 9.11** and detailed in the accompanying **Appendix 9.1, Annex E**.

Table 9.11: Collision Risk Modelling Results

| Species | Avoidance Rate | 2014 BR | 2014-15 NBR | 2015 BR | 2015-16 NBR | Annual 2014-15 | Annual 2015-16 | Mean Annual |
|--------------|----------------|---------|-------------|---------|-------------|----------------|----------------|-------------|
| black grouse | 98% | 0.0000 | 0.0003 | 0.0000 | 0.0000 | 0.0003 | 0.0000 | 0.0001 |
| hen harrier | 99% | 0.0243 | 0.0410 | 0.0184 | 0.0002 | 0.065 | 0.019 | 0.042 |
| merlin | 98% | 0.0122 | 0.0121 | 0.0000 | 0.0097 | 0.024 | 0.010 | 0.017 |
| peregrine | 98% | 0.0000 | 0.0021 | 0.0000 | 0.0014 | 0.002 | 0.001 | 0.002 |

| Species | Avoidance Rate | 2014 BR | 2014-15 NBR | 2015 BR | 2015-16 NBR | Annual 2014-15 | Annual 2015-16 | Mean Annual |
|-----------------|----------------|---------|-------------|---------|-------------|----------------|----------------|-------------|
| short-eared owl | 98% | 0.0000 | 0.0000 | 0.0003 | 0.0000 | 0.000 | 0.0003 | 0.0002 |
| golden plover | 98% | 0.0000 | 0.3959 | 0.0000 | 0.0011 | 0.396 | 0.001 | 0.199 |
| goshawk | 98% | 0.0410 | 0.0100 | 0.0061 | 0.0009 | 0.051 | 0.007 | 0.029 |
| curlew | 98% | 0.4659 | 0.0462 | 0.2857 | 0.0160 | 0.512 | 0.302 | 0.407 |
| lapwing | 98% | 0.2865 | 0.1247 | 0.0071 | 0.0200 | 0.411 | 0.027 | 0.219 |

Values shown are rates of collision per season. BR = breeding season; NBR = non-breeding season. Annual rates are combined breeding and non-breeding season rates.

Black Grouse

- 9.263 **Effect:** Birds flying within the Development Area may be subject to a collision risk with turbines, thereby potentially affecting survival rates at a population level. Black grouse are known to be at risk of colliding with structures close to ground level, such as fences and wires; deer fencing has proved to be a particular hazard for this species. Zeiler and Grünsachner-Berger (2009^{xxix}) reported cases of black grouse mortality resulting from collisions with various structures close to ground level, and they report strong declines in black grouse numbers in local populations in areas where three windfarms were constructed in the Alpine zone in Austria.
- 9.264 **Sensitivity:** Medium-High.
- 9.265 **Magnitude of Effect:** During flight activity surveys, 11 black grouse flights were recorded, with flights occurring in the breeding season and in winter. Most flights were of single birds, although there were two records of two birds, one of four birds, and in January 2015, 13 birds were recorded in flight together. All but two of these flights were recorded at heights <20m which would be below turbine rotor height, and only one of the flights (within the southern turbine area) was considered to be within the Collision Risk Analysis Area (CRAA - turbine area plus a buffer of 500m). Collision modelling predicted a collision rate during the non-breeding season of one bird every 3,643 years.
- 9.266 It is acknowledged that forestry removal for windfarm infrastructure will create open areas of habitat close to turbines, which may be more suitable for black grouse (albeit only over a short-term period before next generation planted trees mature). However, the risk of collisions for this species is likely to remain low as typical flight behaviour suggests that the large majority of flights would be below rotor height.
- 9.267 There is potentially some risk to black grouse from any structures such as railings of the steps associated with wind turbines. However, based on the distribution of lekking black grouse within and around the Development Area, the likelihood of this occurring is very low.
- 9.268 The **Magnitude of Effect** of collision on black grouse is therefore considered to be **Low** spatial and **Long-Term** temporal on the regional population.
- 9.269 **Significance of Effect:** The effect is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

- 9.270 None required.

Residual Effects

- 9.271 The residual effects of collision risk on black grouse will be **Minor adverse** and therefore **Not significant** in the context of the EIA Regulations.

Hen Harrier

- 9.272 **Effect:** Hen harriers flying within the Development Area may be subject to a collision risk with turbines, thereby potentially affecting survival rates at a population level.
- 9.273 **Sensitivity:** High.
- 9.274 **Magnitude of Effect:** Hen harrier flights were regularly recorded across the Development Area throughout the year. Around one third of these flights were judged to be at potential risk heights (>20m). In general, hen harriers forage by quartering low across open moorland, and so this relatively low proportion of "at-risk" flight activity is likely to be representative of behaviour onsite.

- 9.275 At-risk flights were recorded within the north, central and southern turbine areas, producing a range of predicted annual collision rates of 0.019 to 0.065 (mean of 0.042) (**Table 9.11**), which equates to one collision every 15 to 54 years (mean of 24 years). Based on an NHZ breeding population of 18 pairs, and a background adult mortality rate of 0.19 (BTO BirdFacts^{xxxv}), this would represent an increase in mortality rate by 0.3 to 0.9% on the NHZ population, which, acknowledging that the population is in unfavourable conservation status, is considered to be of **Low** spatial and **Long-Term** temporal magnitude.

- 9.276 **Significance of Effect:** The overall effect on the NHZ hen harrier population is therefore assessed as **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

- 9.277 None required. The OCMP, implemented by NLEI Ltd. and presented in **Appendix 8.6** will however seek to improve foraging and nesting habitat quality across the Development Area, thus enabling birds to find sufficient food resources without having to forage or nest in close proximity to turbines, or resulting in a net reduction in productivity within the Development Area. The RHHCMP will also aim to improve the conservation status of the species' population at a wider, south Scotland level.

Residual Effects

- 9.278 The residual effects of collision mortality on hen harrier are **Minor adverse** and therefore **not significant** in the context of the EIA Regulations. The residual effects on the SSSIs are considered to be **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Merlin

- 9.279 **Effect:** Merlins flying within the Development Area may be subject to a collision risk with turbines, thereby potentially affecting survival rates at a population level.

- 9.280 **Sensitivity:** High.

- 9.281 **Magnitude of Effect:** merlin flights were recorded across the Development Area throughout the year. Around 50% of these flights were judged to be at potential risk heights (>20m). At-risk flights were recorded within the central and southern turbine areas, producing a range of predicted annual collision rates of 0.010 to 0.024 (mean of 0.017) (**Table 9.11**), which equates to one collision every 41 to 103 years (mean of 59 years). Based on an NHZ breeding population of 12 pairs, and a background adult mortality rate of 0.38 (BTO BirdFacts^{xxxvi}), this would represent an increase in mortality rate by 0.01 to 0.3% on the NHZ population, which, whilst acknowledging that the population is in unfavourable conservation status, is considered to be of **Negligible** Spatial and **Long-Term** temporal magnitude.

- 9.282 **Significance of Effect:** The overall effect on the NHZ merlin population is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

- 9.283 None required. The OCMP will seek to improve foraging and nesting habitat quality across the Development Area, thus enabling birds to find sufficient food resources away from turbines without having to forage or nest in close proximity to them.

- 9.284 In addition to the above mitigation, NLEI Ltd. is proposing enhancement measures in the form of a Regional Hen Harrier Conservation Management Plan (RHHCMP), which will aim to improve the conservation status of hen harriers in south Scotland. Details are provided in the *Further Survey Requirements, Monitoring and Enhancement Measures* section, and in **Appendix 8.6**

Residual Effects

- 9.285 The residual effects of collision mortality on merlin are **Negligible** and therefore **not significant** in the context of the EIA Regulations. It is difficult to quantify the full benefit of the RHHCMP over the life of the project, however it is expected that this could allow the Development to deliver a net benefit to the regional hen harrier population.

Peregrine

- 9.286 **Effect:** Peregrines flying within the Development Area may be subject to a collision risk with turbines, thereby potentially affecting survival rates at a population level.

- 9.287 **Sensitivity:** High.

- 9.288 **Magnitude of Effect:** Peregrine flights were mainly recorded during the 2014-15 non-breeding season, with two flights during the 2014 breeding season, and one flight during the 2015-16 non-breeding season. Around two thirds of these flights were judged to be at potential risk heights (>20m). At-risk flights were recorded within the northern and southern turbine areas, producing a range of predicted annual collision rates of 0.001 to 0.002 (mean of 0.002) (**Table 9.11**), which equates to one collision every 488 to 708 years (mean of 578 years). This increase in baseline mortality is considered to be of **Negligible** spatial and **Long-term** temporal magnitude.
- 9.289 **Significance of Effect:** The overall effect on the NHZ peregrine population is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.
- Proposed Mitigation*
- 9.290 None required. The OCMP will seek to improve foraging habitat quality across the Development Area, thus enabling birds to find sufficient food resources away from turbines without having to forage or nest in close proximity to them.
- Residual Effects*
- 9.291 The residual effects of collision mortality on peregrine are **Negligible** and therefore **not significant** in the context of the EIA Regulations.
- Short-eared Owl*
- 9.292 **Effect:** Short-eared owls flying within the Development Area may be subject to a collision risk with turbines, thereby potentially affecting survival rates at a population level.
- 9.293 **Sensitivity:** High.
- 9.294 **Magnitude of Effect:** Only two short-eared owl flights were recorded at potential collision height, reflecting the low, quartering foraging behaviour exhibited by this species. Resultant collision modelling predicted very low collision rates, with <0.001 collisions per year predicted. This increase in baseline mortality is considered to be of **Negligible** Spatial and **Long-Term** temporal magnitude.
- 9.295 **Significance of Effect:** The overall effect on the NHZ short-eared owl population is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.
- Proposed Mitigation*
- 9.296 None required. The OCMP will seek to improve foraging habitat quality across the Development Area, thus enabling birds to find sufficient food resources away from turbines without having to forage or nest in close proximity to them.
- Residual Effects*
- 9.297 The residual effects of collision mortality on short-eared owl are **Negligible** and therefore **not significant** in the context of the EIA Regulations.
- Golden Plover*
- 9.298 **Effect:** Golden plovers flying within the Development Area may be subject to a collision risk with turbines or other infrastructure, thereby potentially affecting survival rates at a population level.
- 9.299 **Sensitivity:** High.
- 9.300 **Magnitude of Effect:** A small number of individual golden plover flights were recorded during the 2014 breeding season, with the other eight flights occurring during winter periods, when flocks of up to 48 birds were recorded. Around two thirds of these flights were judged to be at potential risk heights (>20m).
- 9.301 At-risk flights were recorded within the northern and southern turbine areas, producing a range of predicted annual collision rates of 0.001 to 0.396 (mean of 0.199) (**Table 9.11**), which equates to one collision every 2.5 to 895 years (mean of 5.0 years). This large variation between years can be explained by the inclusion of a flock of 48 individuals flying "at-risk" in March 2015 within the southern turbine area increasing the collision rate for 2014-15.
- 9.302 On average, one collision every five years would result in an increase in mortality within the Scottish spring passage population (10,000-30,000 according to Forrester *et al.* 2007) by up to 0.007% (assuming a baseline adult mortality rate of 0.27, BTO BirdFacts^{xxxvii}).
- 9.303 This increase in baseline mortality is considered to be of **Negligible** Spatial and **Long-Term** temporal magnitude.
- 9.304 **Significance of Effect:** The overall effect on the NHZ golden plover population is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.
- Proposed Mitigation*
- 9.305 None required. The OCMP will seek to improve breeding and foraging habitat quality across the Development Area, thus enabling birds to find sufficient food resources away from turbines without having to forage or nest in close proximity to them.
- Residual Effects*
- 9.306 The residual effects of collision mortality on golden plover are **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.
- Goshawk*
- 9.307 **Effect:** goshawks flying within the Development Area may be subject to a collision risk with turbines or other infrastructure, thereby potentially affecting survival rates at a population level.
- 9.308 **Sensitivity:** Medium.
- 9.309 **Magnitude of Effect:** Goshawk flights were recorded throughout the year, with around 80% of these at potential collision heights. Collision modelling for this species is likely to be misleading since forestry within the vicinity of turbines is likely to be removed or altered prior to operation, and so habitat and goshawk activity levels will differ compared to the baseline period. The results therefore potentially overestimate the collision rate.
- 9.310 Collision modelling predicted an annual mortality range of 0.007 to 0.051 collisions per year, or one collision every 19.6 to 144 years. With the regional population likely to be in favourable conservation status, this additional mortality is considered to be of **Negligible** Spatial and **Long-term** temporal magnitude.
- 9.311 **Significance of Effect:** The overall effect on the NHZ goshawk population is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.
- Proposed Mitigation*
- 9.312 None required.
- Residual Effects*
- 9.313 The residual effects of collision mortality on goshawk are **Negligible** and therefore **not significant** in the context of the EIA Regulations.
- Curlew and Lapwing*
- 9.314 **Effect:** curlew and lapwing flying within the Development Area may be subject to a collision risk with turbines or other infrastructure, thereby potentially affecting survival rates at a population level.
- 9.315 **Sensitivity:** Medium.
- 9.316 **Magnitude of Effect:** Curlews were regularly recorded during the breeding seasons, and tended to be absent from the Development Area after summer until the following March. Distribution was largely associated with breeding territories and around two thirds of flights were at potential collision heights. Highest concentrations of breeding territories were located over 500m from turbines and this is reflected in the relatively low collision rates predicted across the Development Area: a range of 0.30 to 0.51 collisions per year, or one every 2.0 to 3.3 years. The NHZ19 population is estimated to be 4,284 pairs, and the additional mortality due to collisions would be an increase over the baseline mortality rate (0.264, BTO BirdFacts^{xxxviii}) by up to 0.04%.
- 9.317 Lapwing showed a similar spatial and temporal distribution to curlew, with around 58% of flights at potential collision height. Again much breeding activity was concentrated away from the turbine areas, and predicted collision rates ranged from 0.027 to 0.411 per year, or one bird every 2.4 to 36.9 years.
- 9.318 The NHZ population is unknown, but based on the Scottish population estimate, a minimum of 5,000 pairs are likely to be within the NHZ. The additional collision mortality would result in an increase over baseline mortality (0.295, BTO BirdFacts^{xxxix}) by 0.01%.

- 9.319 The increase in baseline mortality for both species is considered to be of **Negligible** Spatial and **Long-Term** temporal magnitude.
- 9.320 **Significance of Effect:** The overall effect on the NHZ curlew and lapwing populations is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.
- Proposed Mitigation*
- 9.321 None required. The OCMP will seek to improve foraging habitat quality across the Development Area, thus enabling birds to find sufficient food resources away from turbines without having to forage or nest in close proximity to them.
- Residual Effects*
- 9.322 The residual effects of collision mortality on curlew and lapwing are **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.
- Information to Inform an Appropriate Assessment**
- 9.323 The Muirkirk and North Lowther Uplands SPA qualifies under Article 4.1 by supporting populations of European importance of hen harrier, merlin, peregrine, short-eared owl and golden plover.
- 9.324 With regards to the HRA method detailed in paragraph 9.21, the Development is not directly connected to, or necessary for, the management of the SPA (Step 1); Step 2 requires an assessment of whether there is potential for a Likely Significant Effect, either alone or in combination, on the SPA. If there is potential for a Likely Significant Effect, Step 3 would require an Appropriate Assessment to be undertaken by the competent authority of the implications for the SPA in view of the conservation objectives.
- 9.325 To establish the effect of the Development on the integrity of an SPA, it is necessary to consider the relevant conservation objectives which may be affected. The conservation objectives for the SPA (as well as all Scottish SPAs) are as follows:
- (1) To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
 - (2) To ensure for the qualifying species that the following are maintained in the long term:
 - (a) Population of the species as a viable component of the SPA;
 - (b) Distribution of the species within site (scoped out);
 - (c) Distribution and extent of habitats supporting the species (scoped out);
 - (d) Structure, function and supporting processes of habitats supporting the species (scoped out); and
 - (e) No significant disturbance of the species.
- 9.326 In light of the Development Area's relative proximity to the SPA (adjacent to the north-west), conservation objectives 1, 2a and 2e are considered relevant. Conservation objectives 2b, 2c and 2d are not relevant and are therefore scoped out of the HRA.
- Hen Harrier*
- 9.327 The Muirkirk and North Lowther Uplands SPA breeding hen harrier population (at citation, an average of 29.2 breeding females between 1994 and 1998, 6% of GB population), is considered to currently be in unfavourable, declining condition. The non-breeding SPA population (at citation, an average of 12 individuals between 1991 and 1995, 2% of GB population), is also considered to be in unfavourable, declining condition.
- 9.328 Breeding hen harriers have been absent from the closest part of the Muirkirk and North Lowther Uplands SPA, to the north of the Development Area, from 2004 until 2012, when a successful pair was recorded (exact locations unknown). Numbers of pairs within the SPA increased to three in 2013 and four in 2014, but there were no pairs recorded in 2015.
- 9.329 Historically, the areas within the study area where hen harriers have regularly attempted to breed are beyond 2km from the North Lowther and Muirkirk Uplands SPA, and so pairs are unlikely to be directly connected to the SPA population (SNH, 2016^{x1}).
- 9.330 In the non-breeding season, birds from the SPA are likely to range more widely, so it is possible that some individuals recorded within the Development Area are from the SPA population. As outlined above,

birds are likely to be able to continue to forage widely within the Development Area away from construction activities, or operational turbines, without any significant reductions in survival rates.

- 9.331 As hen harriers present during the breeding season are unlikely to be part of the Muirkirk & North Lowther Uplands SPA breeding population due to the distances involved, the collision rate for SPA birds during this period is effectively zero.
- 9.332 During the non-breeding season, birds present within the Development Area may be from the SPA population as they range more widely, and therefore a potential collision risk exists to SPA birds. From results in Table 9.11, non-breeding season collision rates range from 0.0002 to 0.0410, or one bird every 24 to 5,000 non-breeding seasons. The considerably lower estimate from winter 2015-16 is likely to be due to the prolonged period of time during this winter when there was extensive snow cover, thus rendering habitat largely unsuitable for foraging hen harriers. The current wintering SPA population is unknown (the cited SPA population is 12 individuals), but these collision rates are unlikely to significantly affect the population, even in a worst-case scenario where all mortality could be attributed to SPA birds.
- 9.333 As outlined above, conservation management measures detailed in **Appendix 8.6** include the RHHCMP, with a full-time Project Officer role that would, among other aims, seek to increase hen harrier numbers within the SPA as well as the wider regional population. Habitat management measures within the Development Area may provide increased quality foraging habitat should any SPA birds be found there, particularly in winter months. When considering these measures within the context of the SPA Conservation Objectives, it can be reasonably concluded that the Development will **not adversely affect the integrity** of the Muirkirk and North Lowther Uplands SPA hen harrier breeding or non-breeding populations.
- Merlin*
- 9.334 The SPA qualifies under Article 4.1 by regularly supporting a merlin population of European importance (average of 9 breeding pairs between 1989 and 1998, 0.7% of GB population). The population is considered to be in "Unfavourable, no change" condition.
- 9.335 Historic merlin nest sites within the Development Area are located over 5km from the SPA, which according to SNH (2016^{xx}) guidance, is the distance within which connectivity is most commonly limited to. Merlin pairs within the Development Area are therefore not considered to be part of the SPA population, and any SPA pairs are unlikely to use the Development Area. Within the context of the Conservation Objectives of the SPA it is considered that it is considered that the Development will not adversely affect the integrity of the Muirkirk and North Lowther Uplands SPA population during the construction or operational phases.
- 9.336 As merlins present during the breeding season are unlikely to be part of the Muirkirk & North Lowther Uplands SPA breeding population due to the distances involved, the collision rate for SPA birds during this period is effectively zero. During the non-breeding season, birds present within the Development Area may be from the SPA population as they range more widely, and therefore a potential collision risk exists to SPA birds. From results in Table 9.11, non-breeding season collision rates range from 0.0097 to 0.0121, or one bird every 83 to 103 non-breeding seasons.
- 9.337 As outlined above, habitat management measures detailed in the OCMP, **Appendix 8.6** include a hen harrier conservation officer role that would aim to increase hen harrier numbers within the SPA, which may also aid merlin. When considering these measures and low collision rates predicted, it can be reasonably concluded that in the context of the Conservation Objectives the Development will **not adversely affect the integrity** of the Muirkirk and North Lowther Uplands SPA population.
- Peregrine*
- 9.338 The SPA qualifies under Article 4.1 by regularly supporting a peregrine population of European importance (average of 6 pairs between 1992 and 1996, 0.5% of GB population). The population is considered to be in "Unfavourable, no change" condition.
- 9.339 The closest historic peregrine nest site within the SPA is within 1km of the Development Area boundary, 2.0km from the closest proposed turbine location, and 1.0km from the closest access track. According to SNH (2013^{xx}) guidance, core foraging range, and therefore connectivity with an SPA, is most commonly limited to 2km, and so a pair breeding at the historic nest site may forage within the Development Area. Habitat loss is however considered to be negligible for any breeding birds, with no turbines located within the core foraging range, although some new stretches of access track within 2km require construction. Disturbance is likely to be confined to 500m from source at most.

9.340 From results in Table 9.11, collision risk is considered to be negligible for any breeding birds, and so it is considered that in the context of the Conservation Objectives the Development will **not adversely affect the integrity** of the Muirkirk and North Lowther Uplands SPA population during the construction or operational phases.

Short-eared Owl

9.341 The SPA qualifies under Article 4.1 by regularly supporting a short-eared owl population of European importance (average of 26 breeding pairs between 1997 and 1998, 3% of GB population). The SPA population is considered to be in "Favourable, maintained" condition.

9.342 Historic short-eared owl nest sites within the Development Area are located over 2km from the SPA, which according to SNH (2016^{xx}) guidance, is the distance within which connectivity is most commonly limited to. Short-eared owl pairs within the Development Area are therefore not considered to be part of the SPA population, and any SPA pairs are unlikely to use the Development Area.

9.343 With negligible collision rates predicted, it is considered that in the context of the Conservation Objectives the Development will **not adversely affect the integrity** of the Muirkirk and North Lowther Uplands SPA population during the construction or operational phases.

Golden Plover

9.344 The SPA qualifies under Article 4.1 by regularly supporting a golden plover population of European importance (an estimated minimum of 154 pairs in 1999, 0.7% of GB population). The population is considered to be in "Unfavourable, declining" condition.

9.345 Historic golden plover nest sites within the Development Area are located over 3km from the SPA, which according to SNH (2016^{xx}) guidance, is the distance within which connectivity is most commonly limited to. Golden plover pairs within the Development Area are therefore not considered to be part of the SPA population, and any SPA pairs are unlikely to use the Development Area.

9.346 During the spring and autumn passage periods, SPA birds will range more widely and may pass through the Development Area en route to and from wintering grounds. It is therefore possible that flocks of up to 74 birds recorded in grassy areas may belong to the SPA breeding population. Based on the SPA citation, the breeding population is at least 308 individuals, and a flock of 74 birds would represent 25% of this. As outlined above, there may be some disturbance of birds utilising fields around Glenrae Dod during construction activities (particularly access track creation) but with alternative habitat available at Spango Farm to the north, the loss of occasionally used habitat should not affect the fitness of individuals.

9.347 The current golden plover SPA population is unknown, but based on the SPA citation, the breeding population is at least 308 individuals. If in a worst-case scenario, it is assumed that all birds present within the Development Area outside of the breeding season are SPA birds, then an increase in annual baseline mortality rate by 0.2% would occur, which is unlikely to significantly alter the trajectory of the SPA population over the long-term. It is therefore considered that in the context of the Conservation Objectives the Development will **not adversely affect the integrity** of the Muirkirk and North Lowther Uplands SPA population during the construction or operational phases.

Overall Conclusion on the SPA as a Whole

9.348 In general, the main factor that minimises the risk of an adverse effect on the integrity on the SPA is the distance of the SPA from the Development Area and the shorter core foraging distances of breeding qualifying interests, meaning that birds present within the Development Area are unlikely to be part of the SPA population, particularly during the breeding season. Although birds can range more widely in winter, meaning that some individuals present may be part of the SPA breeding population (or in the case of hen harrier, part of the SPA non-breeding population), the Development is unlikely to significantly affect foraging ability and survival rates of any of the SPA qualifying interests' populations.

9.349 Based on the information presented above for all SPA qualifying interests, and even when potential likely significant effects are combined (e.g. construction disturbance and operational displacement, collision risk – see also below the *Interrelationship Between Effects* section which describes the non-additive interaction between displacement and collision risk) it can be reasonably concluded that in the context of the Conservation Objectives the Development will **not adversely affect the integrity** of the Muirkirk and North Lowther Uplands SPA. It also follows that within an EIA context, there will be **No Significant Effects** on the component Muirkirk Uplands and North Lowther Uplands SSSIs.

Cumulative Effects

9.350 This section presents information about the potential cumulative effects of the Development combined with other nearby existing or proposed projects or activities that are subject to an EIA process.

9.351 SNH (2012^{xii}) has provided guidance on assessing the cumulative effects on birds. This assessment follows the principles set out in that guidance. According to SNH "The key principle for all cumulative impact assessments is to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process".

9.352 Cumulative effects may include cumulative disturbance-displacement, collision mortality, habitat loss or barrier effects. Some cumulative effects, such as collision risk may be summed quantitatively, but according to SNH (2012^{xii}) "In practice some effects, such as levels of disturbance or the barrier effect, may need considerable additional research work to assess impacts quantitatively. A more qualitative process may need to be applied until this quantitative information is available, e.g. from post-construction monitoring or research".

9.353 In this cumulative assessment, a sub-NHZ level assessment, focussing on a 20km study area, is considered practical and appropriate for breeding species of wider countryside interest. NHZ19 encompasses a large area and a variety of habitat types, and focussing on other projects within 20km of the Development site means that similar bird assemblages, and discrete populations, are more likely to be found in each project's development site and a closer comparison of cumulative effects can be made.

9.354 The main projects likely to cause similar effects to those associated with the Development are other operational Windfarms, or those under construction, consented, or in the planning process (**Table 9.12** and **Figure 9.21**). As requested by RSPB (**Table 9.1**), the possible cumulative effects of other projects and activities have also been considered, but it was concluded that no non-windfarm projects/activities within 20km have the potential to significantly affect bird populations above the long-established baseline level.

9.355 Windfarm projects at scoping stage have been scoped out of the cumulative assessment because they generally do not have sufficient information on potential effects to be included, as the baseline survey period is ongoing, or results have not been published. Projects that have been refused or withdrawn have also been scoped out.

9.356 Small projects with three or fewer turbines have also been excluded from the cumulative assessment as often these projects are not subject to the same level of detail of ornithological assessment, and so there are no directly comparable data. Because of the small scale of such projects, effects are likely to be negligible on the VORs assessed here. Other small-scale renewable projects such as micro hydro schemes have also been scoped out for similar reasons. A summary of other windfarm projects within the study area is presented in Table 9.12 below. The presence of each VOR during baseline surveys, and consideration in the respective project's ES is highlighted. Cumulative construction and operation effects on each VOR are considered in turn below.

9.357 In the *Information to Inform an Appropriate Assessment* section above, for the Development alone, it was concluded that no effects will affect the integrity of the Muirkirk and North Lowther Uplands SPA's Conservation Objectives, due to the distance of breeding locations from the SPA, and lack of connectivity in general. As such, in-combination effects on the SPA as part of the HRA process have not been considered further.

Table 9.12: Other NHZ 19 Projects within 20km of Development Considered Within the Cumulative Assessment

| Project | Status | Number of Turbines | Black Grouse | Hen harrier | Merlin | Peregrine | Short-eared owl | Golden plover | Goshawk | Curlew | Lapwing |
|--|----------|--------------------|--------------|-------------|--------|-----------|-----------------|---------------|---------|--------|---------|
| Existing and In-construction Projects | | | | | | | | | | | |
| Andershaw | Existing | 14 | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ |
| Galawhistle | Existing | 22 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |

| Project | Status | Number of Turbines | Bird Species | | | | | | | | | |
|-------------------------------|--------------|--------------------|-------------------|-------------|--------|-----------|-----------------|---------------|---------|--------|---------|--|
| | | | Black Grouse | Hen harrier | Merlin | Peregrine | Short-eared owl | Golden plover | Goshawk | Curlew | Lapwing | |
| Nutberry | Existing | 6 | No info available | | | | | | | | | |
| Clyde | Existing | 152 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | |
| Hare Hill | Existing | 20 | No info available | | | | | | | | | |
| Sanquhar | Construction | 9 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| Whiteside | Construction | 10 | No info available | | | | | | | | | |
| Middle Muir | Construction | 15 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Consented Projects | | | | | | | | | | | | |
| Crookedstane | Consented | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | |
| Hare Hill Extension 2 | Consented | 39 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| Lion Hill | Consented | 4 | ✓ | | | ✓ | ✓ | | | ✓ | | |
| Penbreck | Consented | 9 | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | |
| Twentyshillig Hill | Consented | 9 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | |
| Sanquhar Six | Consented | 6 | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| Glenmuckloch | Consented | 8 | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | |
| Kennoxhead | Consented | 19 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Sandy Knowe | Consented | 24 | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | |
| Application and Appeal | | | | | | | | | | | | |
| Glentagart | Application | 5 | ✓ | ✓ | ✓ | | | | | | | |
| Lethans | Application | 22 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| Lorg | Application | 15 | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Poniel | Application | 3 | | | ✓ | | | | | ✓ | ✓ | |
| Ulzieside | Application | 12 | No info available | | | | | | | | | |
| Garleffan | Appeal | 6 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Harryburn | Application | 17 | No info available | | | | | | | | | |

Black Grouse: Disturbance and Displacement

- 9.358 The majority of other windfarm projects recorded black grouse and considered the species as part of their assessment (Table 9.12). Of these, five projects are either existing or in-construction and so the likelihood of cumulative effects is highest with these sites.
- 9.359 A further seven projects are approved, and a further three projects are in planning, and a potential for both construction and operational phase overlap therefore exists with these projects.

Table 9.13: Predicted Effects on Black Grouse from other Projects within 20km of the Development.

| Project | Disturbance-displacement | Collision Risk |
|--|--|-------------------|
| Existing and In-construction Projects | | |
| Andershaw | No leks within 4.5km | No CRM undertaken |
| Galawhistle | No leks within 1.5km | No CRM undertaken |
| Clyde | No birds recorded within 1.5km – lek of 9 males on southern boundary of study area, and further single male. | No info provided |
| Sanquhar | Lek of 2 birds 300m from access road | No CRM undertaken |

| Project | Disturbance-displacement | Collision Risk |
|-------------------------------|---|---|
| Middle Muir | Up to two males lek onsite, >750m from turbines but closer to access track and compound. | No CRM undertaken |
| Consented Projects | | |
| Crookedstane | Up to 10 males recorded, uncertainty whether any leks are present | No CRM undertaken |
| Hare Hill Extension 2 | Small breeding population of black grouse (at least four males) associated with forest habitats adjacent to the site. Individuals occasionally forage within the site, mainly in winter. No leks within 1km. | No CRM undertaken. One brief flight at risk height out of 8 flights |
| Lion Hill | Two leks. A peak of 13 males was reported using the main lek site and a peak of eight males was recorded using the second lek site. Birds were not recorded using both lek sites simultaneously, therefore they were considered to be alternative sites. Main lek 200m from turbines. Mitigation and habitat management proposed. | No CRM undertaken |
| Twentyshillig Hill | Five leks, two of which within site. Up to 4 males present on any day. | No at risk flights No CRM undertaken |
| Sanquhar Six | No leks within 1km. | No CRM undertaken |
| Glenmuckloch | Single males but no evidence of lekking | No CRM undertaken |
| Kennoxhead | Four leks of up to 10 males within survey area, of which two leks comprising six males were within 500m of turbines. | No CRM undertaken |
| Sandy Knowe | Two leks comprising a single displaying male at each. One approximately 100 m from the development. The second lek was located within the development site boundary | No CRM undertaken |
| Application and Appeal | | |
| Lorg | A single male lekking 1.4km from turbine. Individuals foraging to north and south of site | No CRM undertaken |
| Lethans | Four males lekking within 1.5 km of site boundary, one within site boundary, one within 500m buffer | No CRM undertaken |
| Glentagart | Two male black grouse were recorded in May 2009 and a single male in April 2010. | No CRM undertaken |

- 9.360 Of the five existing and in-construction projects, lekking black grouse have had the potential to be affected by disturbance/ displacement at Middle Muir and Sanquhar, if unmitigated (Table 9.13). Existing projects are unlikely to have affected lekking activity based on survey results.
- 9.361 Although the likelihood is lower, an opportunity exists for consented projects' construction phases to overlap with that of the Development. When considering the eight consented projects alongside the Development, a reasonably large proportion of the NHZ population (perhaps up to 25%) may be affected if no mitigation measures are considered, although there is some uncertainty over how many individuals may actually be within potential disturbance zones due to limited available information.
- 9.362 When accounting for the application and appeal projects further lekking males may be affected by cumulative construction and operational activities. Again it is not clear exactly how many males were found within potential disturbance-displacement distances.
- 9.363 Paragraphs 9.128 to 9.131 outline the spatial and temporal mitigation measures for black grouse during construction of the Development, and paragraph 9.210 outlines the habitat management mitigation for black grouse during the operational phase. Measures such as these are standard practice for mitigating for any potential significant effects on black grouse caused by windfarm projects, and are likely to be consent conditions at the majority of projects considered in this cumulative assessment where black grouse is a potential issue.
- 9.364 Although a large proportion of the NHZ black grouse population was recorded within the respective survey areas of projects considered in the cumulative assessment, when considering the mitigation measures likely to be implemented during the construction phase of projects, and the various mitigation and habitat management measures during the operational phase (including the Development), there is a low likelihood that a widespread loss of lekking males to the NHZ population would occur. Nevertheless,

an adverse effect on the NHZ population would likely occur if all projects became operational, through fragmentation of habitat or cumulative effects on productivity over a long-term period. The likelihood of all application and appeal projects becoming operational is however low, and so a **Minor adverse** and therefore **Not Significant** effect on the NHZ population is concluded.

Black Grouse: Collision Risk

9.365 Collision mortality was considered for the Development to be of Low magnitude. The risk to black grouse at all other projects is evidently very low, with no collision modelling undertaken as a result of few, if any at-risk flights being recorded. The residual cumulative effects on black grouse remain **Minor adverse** and therefore **not significant** in the context of the EIA Regulations.

Hen Harrier: Disturbance and Displacement

9.366 Hen harrier activity was observed at the majority of projects within 20km of the Development Area. Breeding activity was however much less commonly recorded.

9.367 Of the five existing or in-construction projects where hen harrier was present, only at Clyde were breeding pairs potentially affected (two pairs, Table 9.14).

Table 9.14: Predicted Effects on Hen Harrier from other Projects within 20km of the Development.

| Project | Disturbance-displacement | Collision Risk |
|--|--|------------------------------------|
| Existing and In-construction Projects | | |
| Andershaw | No breeding within 5km. Two flights during VP surveys | No CRM undertaken |
| Galawhistle | No breeding attempts within 2km, generally unsuitable habitat within site | 0.008 collisions per year |
| Sanquhar | Present hunting | 0.001 collisions per year |
| Clyde | Up to 2 pairs in 2004 but no pairs recorded in 2009 or 2010 | No CRM undertaken |
| Middle Muir | Nest approx. 2km from site and roost c.1km from turbines | No CRM undertaken |
| Consented Projects | | |
| Crookedstane | 8 flights recorded in winter | No CRM undertaken |
| Hare Hill Extension 2 | Site is used occasionally by foraging birds in winter. | No CRM undertaken |
| Penbreck | 1 breeding pair beyond 3km from nearest turbine. | 0.009 to 0.016 collisions per year |
| Twentysilling Hill | Regular flight activity 26 flights. One or two birds using site as a satellite roost in winter. No breeding activity recorded. | No at-risk flights |
| Kennoxhead | Present but no evidence of breeding within 2km. Possible territory close to access route | 0.0068 collisions per year |
| Sanquhar Six | Present, breeding status unknown | 0.001 collisions per year |
| Glenmuckloch | Present but no evidence of breeding | 0.025 collisions per year |
| Sandy Knowe | 17 flights | No CRM undertaken |
| Application and Appeal | | |
| Lethans | Little use made of conifer plantation site. Breeding >1.5km from the site. No CRM undertaken for any species. | No CRM undertaken |
| Lorg | 4 flights recorded | No CRM undertaken |
| Glentaggart | Historical breeding area | No CRM undertaken |
| Garleffan | Only historic nest sites, all over 1km from turbines | 0.0035 collisions per year |

9.368 Of the consented projects, no breeding activity was recorded within the hen harrier’s 2km core foraging range of any project site. Some suitable foraging or roosting habitat may be lost due to the presence of projects however.

9.369 Judging by the evidence of hen harrier activity recorded at the application and appeal project sites, no breeding pairs are likely to be adversely affected by these projects, albeit some foraging habitat may be lost.

9.370 For the Development, the BBPP outlined above is considered to be required to avoid significant effects on hen harrier during the construction phase. For the operational phase the OCMP will seek to ensure that the breeding population is not adversely affected by the Development by increasing the quality of nesting and foraging habitats within the Development Area (see **Appendix 8.6**).

9.371 As a Schedule 1 species, hen harrier is afforded increased legal protection from disturbance, which includes construction activities. It is therefore standard practice for a BBPP or similar to be implemented for the construction of windfarms, and it is likely that a consent condition would exist for all other consented projects for disturbance to breeding Schedule 1 species to be avoided. For a project’s operational phase, habitat management measures are likely to be required as a consent condition should a potential unmitigated significant effect be predicted.

9.372 Avoidance of disturbance to Schedule 1 breeding birds is a legal requirement to be enforced during the construction (and operation) of windfarm projects. It is acknowledged that some breeding or foraging habitat within the NHZ will be lost due to operational projects, but overall, the extent of this is likely to be of Low magnitude within an NHZ context, particularly if habitat management measures are considered for projects where a potential unmitigated significant effect is predicted.

9.373 Overall, if all projects considered in this cumulative assessment become operational, when mitigation measures are implemented, an adverse effect on the NHZ population is predicted, largely due to cumulative loss of foraging habitat via displacement due to windfarms, resulting in potential declines in breeding numbers and/or productivity. The likelihood of all application and appeal projects becoming operational is however low, and so a **Minor adverse** and therefore **Not Significant** effect on the NHZ population is concluded.

Hen Harrier: Collision Risk

9.374 The hen harrier collision rate associated with the Development was predicted to be on average 0.042 per year. When considering the predicted collision rate from other projects, a cumulative collision rate of 0.1035 collisions per year, or one every 9.7 years is predicted.

9.375 Within a NHZ breeding population context (18 pairs), the additional mortality associated with other projects, plus the Development, would result in an additional mortality rate of 1.5%, which is of **Low** spatial and **Long-term** temporal magnitude. The residual cumulative effect therefore is **Minor adverse** and **Not Significant**.

Merlin: Disturbance and Displacement

9.376 Merlin was recorded at the majority of projects within 20km of the Development Area, albeit often infrequently. Breeding activity was uncommon.

Of the five existing or in-construction projects where merlin was recorded, only Clyde registered a breeding pair that were located close to turbines that may be affected by disturbance/ displacement.

9.377 There were no recorded incidences of breeding merlin within 1km of the turbines of any other projects, and so disturbance-displacement effects are likely to be minimal.

9.378 Merlin is a Schedule 1 species, and so the requirement of a BBPP or similar, as outlined for hen harrier, will be a requirement for all consented projects to avoid significant effects during construction. Where required, habitat measures designed for hen harrier, or ground-nesting raptors in general, will aim to ensure that no significant displacement effects occur on the NHZ population during the operational phase of projects, including the Development.

9.379 Overall, if all projects considered in this cumulative assessment become operational, when mitigation measures are implemented, residual cumulative effects on merlin remain **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Table 9.15: Predicted Effects on Merlin from other Projects within 20km of the Development.

| Project | Disturbance-displacement | Collision Risk |
|--|---|---------------------------|
| Existing and In-construction Projects | | |
| Andershaw | No breeding within 5km | No CRM undertaken |
| Galawhistle | No breeding attempts within 2km, but occasional presence noted | No CRM undertaken |
| Clyde | One breeding pair within 250m of turbine location | No CRM undertaken |
| Sanquhar | Probably nesting/hunting in wider area. Little activity recorded. | No CRM undertaken |
| Middle Muir | Present and likely to have bred in surrounding area | No CRM undertaken |
| Consented Projects | | |
| Crookedstane | 3 sightings in late summer | No CRM undertaken |
| Hare Hill Extension 2 | No evidence that merlins have bred in the vicinity of the proposed development in recent times and habitat within the nearest historical breeding area no longer appears suitable for nesting. Single flight across site. | No CRM undertaken |
| Penbreck | One breeding pair beyond 2.5km from nearest turbine. | No CRM undertaken |
| Twentysilling Hill | 9 flights all below collision heights, no breeding | No CRM undertaken |
| Glenmuckloch | Present but no evidence of breeding | 0.023 collisions per year |
| Kennoxhead | Breeding pair at edge of 2km survey buffer | No at-risk flights |
| Sanquhar Six | Present, breeding status unknown | No CRM undertaken |
| Application and Appeal | | |
| Glentaggart | No merlin breeding activity recorded in the area since 2005. Area is only utilised on an infrequent basis. | No CRM undertaken |
| Lethans | Bred >1km from nearest turbines | No CRM undertaken |
| Lorg | Three flights recorded | No CRM undertaken |
| Poniel | One record | No CRM undertaken |
| Sandy Knowe | 2 flights below PCH | No CRM undertaken |
| Garleffan | No historic nest sites within 2km | No at-risk flights |

Merlin: Collision Risk

9.380 The merlin collision rate associated with the Development was predicted to be on average 0.017 per year. The only other project where merlin activity rates were sufficiently high to allow collision modelling to be undertaken was Glenmuckloch, where 0.023 collisions per year were predicted, to give a combined collision rate of 0.040 per year, or one collision every 25 years. This is considered to be no more than a **Low** spatial and **Long-term** temporal magnitude on the NHZ population. The cumulative effect is therefore **Minor adverse** and **Not Significant**.

Peregrine: Disturbance and Displacement

- 9.381 Peregrine activity was observed at most projects within 20km of the Development Area, but mainly restricted to occasional foraging or commuting flights. Breeding activity was uncommon.
- 9.382 Of the four existing and in-construction projects where peregrine was recorded, potential disturbance-displacement may have been a factor for one pair at Clyde (Table 9.16).
- 9.383 No breeding pairs were recorded within 2km during surveys for any other projects. Effects are therefore likely to be minimal.
- 9.384 The BBPP outlined above is considered to be required to avoid significant effects on peregrine during the construction phase of the Development.

- 9.385 As a Schedule 1 species, peregrine is afforded increased legal protection from disturbance, which includes construction activities. It is therefore standard practice for a BBPP or similar to be implemented for the construction of windfarms, and it is likely that a consent condition would exist for all other consented projects for disturbance to breeding Schedule 1 species to be avoided.
- 9.386 For the Development, no peregrine pairs are likely to be significantly affected by disturbance-displacement. Avoidance of disturbance to Schedule 1 breeding birds is a legal requirement to be enforced during the construction (and operation) of windfarm projects. It is acknowledged that some foraging habitat within the NHZ will be lost due to operational projects, but overall, the extent of this is likely to be of Low magnitude within an NHZ context, particularly if habitat management measures are considered for projects where a potential unmitigated significant effect on raptors (or waders, which are prey items) is predicted.
- 9.387 Overall, if in the unlikely scenario that all application and appeal projects considered in this cumulative assessment become operational, when mitigation measures are implemented, a **Low** Spatial and **Long-term** temporal effect on the NHZ population is predicted. The predicted cumulative effect is classified as at most, **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Table 9.16: Predicted Effects on Peregrine from other Projects within 20km of the Development.

| Project | Disturbance-displacement | Collision Risk |
|--|--|---|
| Existing and In-construction Projects | | |
| Galawhistle | Pair present within 2km but likely to be outside of disturbance zone | 0.031 collisions per year |
| Clyde | Two breeding pairs within survey area. One nest beyond 600m from infrastructure, the other 300m, at a poor quality breeding site. | No CRM undertaken |
| Sanquhar | Present hunting | No CRM undertaken |
| Middle Muir | Present but no evidence of breeding | No CRM undertaken |
| Consented Projects | | |
| Crookedstane | Four records during winter. Single at-risk flight | No CRM undertaken |
| Hare Hill Extension 2 | two regularly occupied breeding territories are located within approximately 3 km of the development site, and birds forage with and around site. Three flights recorded across extension. | No CRM undertaken |
| Lion Hill | Single record | No CRM undertaken |
| Twentysilling Hill | 3 flights all below risk height | No CRM undertaken |
| Kennoxhead | Present but no evidence of breeding within 2km | No CRM undertaken |
| Penbreck | 1 breeding pair beyond 2.2km from nearest turbine. | 0.006 collisions per year |
| Sandy Knowe | One flight | No CRM undertaken |
| Application and Appeal | | |
| Lorg | 7 flights, historic nest within site, nearest active nest >2km away | No CRM undertaken |
| Glenmuckloch | Present but no evidence of breeding | 0.283 collisions per year |
| Garleffan | No historic nest sites within 2km. Possible nest site 950m from turbines. | 0.01 collisions per year (revised turbine layout) |

Peregrine: Collision Risk

9.388 The peregrine collision rate associated with the Development was predicted to be on average 0.002 per year. The only other operational project where peregrine activity rates were sufficiently high to warrant collision modelling to be undertaken was Galawhistle where 0.031 collisions per year were predicted. When considering all projects, collision rate of 0.332 or one every 3.0 years was predicted.

- 9.389 When considering the additional mortality on the NHZ population (34 pairs), a collision rate of 0.322 would equate to an increase in baseline mortality by 2.4% (assuming an adult survival rate of 0.800, BTO BirdFacts). This is considered to be no more than a **Low** spatial and **Long-term** temporal magnitude on the NHZ population.
- 9.390 The residual cumulative effects on peregrine remain **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.
- Short-eared Owl: Disturbance and Displacement*
- 9.391 Short-eared owl presence was recorded within a minority of projects' survey areas, although breeding activity was observed at a number of these survey areas where birds were recorded.
- 9.392 Of the four operational or in-construction projects where short-eared owl was recorded, potential disturbance-displacement may have been a factor at Clyde, with two territories recorded (Table 9.17), although based on that project's impact assessment, the magnitude of impact on breeding pairs was considered to be "Very Low", suggesting that no nests were present within proximity to infrastructure.
- 9.393 Of the other projects, breeding was possible/probable within a 2km survey area at three of the project sites. However there is no suggestion that breeding pairs were recorded within likely disturbance-displacement distances from infrastructure, apart from one possible pair at Kennoxhead which was in proximity to the access track, and may therefore be affected by construction activity.
- 9.394 For the Development, the BBPP outlined above is considered to be required to avoid significant effects on short-eared owl during the construction phase.
- 9.395 As a Schedule 1 species, short-eared owl is afforded increased legal protection from disturbance, which includes construction activities. It is therefore standard practice for a BBPP or similar to be implemented for the construction of windfarms, and it is likely that a consent condition would exist for all other consented projects for disturbance to breeding Schedule 1 species to be avoided.
- 9.396 Where required, habitat measures designed for hen harrier, or ground-nesting raptors in general, will aim to ensure that no significant displacement effects occur on the NHZ population during the operational phase of projects, including the Development.
- 9.397 Avoidance of disturbance to Schedule 1 breeding birds is a legal requirement to be enforced during the construction (and operation) of windfarm projects. It is acknowledged that some potential nesting or foraging habitat within the NHZ will be lost due to operational projects, including the Development, but overall, the extent of this is likely to be of Low magnitude within an NHZ context, particularly if habitat management measures are considered for projects where a potential unmitigated significant effect on raptors (or waders, which are prey items) is predicted.
- 9.398 Overall, if in the unlikely scenario that all application and appeal projects considered in this cumulative assessment become operational, when mitigation measures are implemented, a **Low Spatial** and **Long-term** temporal effect on the NHZ population is predicted. The predicted cumulative effect is classified as at most, **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Table 9.17: Predicted Effects on Short-eared Owl from other Projects within 20km of the Development.

| Project | Disturbance-displacement | Collision Risk |
|--|---|-------------------|
| Existing and In-construction Projects | | |
| Andershaw | Occasional usage but no evidence of breeding within 2km | No CRM undertaken |
| Clyde | Two breeding pairs within study area | No CRM undertaken |
| Galawhistle | No breeding attempts within 2km, but occasional presence recorded | No CRM undertaken |
| Middle Muir | Breeding attempt c.1km from turbines. Occasional roosting within survey area | No CRM undertaken |
| Consented Projects | | |
| Crookedstane | Probable breeding pair within 2km (location unknown) | No CRM undertaken |
| Lion Hill | Possible breeding pair within 2km (location unknown). 18 flight lines, up to 3 individuals present, including | No CRM undertaken |

| Project | Disturbance-displacement | Collision Risk |
|-------------------------------|--|--------------------|
| | flights in winter. | |
| Penbreck | No breeding evidence | No CRM undertaken |
| Twentyshilling Hill | no breeding but possible roost site away from turbines. One at risk flight | No CRM undertaken |
| Kennoxhead | Probable nest within 2km survey buffer near access track | No at-risk flights |
| Application and Appeal | | |
| Garleffan | Historic nest site within 3km. | No CRM undertaken |

Short-eared Owl: Collision Risk

- 9.399 The short-eared owl collision rate associated with the Development was predicted to be on average 0.0002 per year (one every 5,000 years). No other projects undertook collision risk modelling for this species due to the lack of at-risk flights recorded. Collision risk is therefore considered to be a **Negligible** spatial and **Long-term** temporal magnitude on the NHZ population. The cumulative effect is therefore **Negligible** and **Not Significant**.

Goshawk: Disturbance and Displacement

- 9.400 Goshawk was observed at seven projects considered within the cumulative assessment. Evidence of possible breeding activity was recorded at three of these locations.
- 9.401 Of the two operational or in-construction projects where goshawk was recorded, potential disturbance-displacement may have occurred at Sanquhar, although breeding was not confirmed at this site (Table 9.18).
- 9.402 Breeding was also possible/probable within a 2km survey area at Kennoxhead, but it was unlikely that birds would be affected as the species was scoped out of the assessment. It is possible that a breeding pair may be disturbed at Lethans due to forestry clearance associated with that project. The breeding location could not be confirmed.
- 9.403 For the Development, the BBPP outlined above is considered to be required to avoid significant effects on goshawk during the construction phase.
- 9.404 As a Schedule 1 species, goshawk is afforded increased legal protection from disturbance, which includes construction activities. It is therefore standard practice for a BBPP or similar to be implemented for the construction of windfarms, and it is likely that a consent condition would exist for all other consented projects for disturbance to breeding Schedule 1 species to be avoided.
- 9.405 Avoidance of disturbance to Schedule 1 breeding birds is a legal requirement to be enforced during the construction (and operation) of windfarm projects. It is acknowledged that some potential nesting or foraging habitat within the NHZ will be lost due to operational projects, including the Development, but overall, the extent of this is likely to be of Low magnitude within an NHZ context, where suitable habitat is widespread.
- 9.406 Overall, if in the unlikely scenario that all projects considered in this cumulative assessment become operational, when mitigation measures are implemented, a **Low Spatial** and **Long-term** temporal effect on the NHZ population is predicted. The predicted cumulative effect is classified as at most, **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Table 9.18: Predicted Effects on Goshawk from other Projects within 20km of the Development.

| Project | Disturbance-displacement | Collision Risk |
|--|--------------------------------------|---------------------------|
| Existing and In-construction Projects | | |
| Sanquhar | Present displaying. | 0.024 collisions per year |
| Middle Muir | Closest nest site over 2km from site | No CRM undertaken |
| Consented Projects | | |
| Hare Hill Extension 2 | Single record | No CRM undertaken |

| Project | Disturbance-displacement | Collision Risk |
|-------------------------------|--|--|
| Kennoxhead | Two breeding pairs within 2km buffer | 1.1 collisions over lifespan of windfarm |
| Glenmuckloch | Present but no evidence of breeding | 0.012 collisions per year |
| Sanquhar Six | Present, breeding status unknown | No CRM undertaken |
| Application and Appeal | | |
| Lethans | Possible nest within disturbance distance of forestry activities | No CRM undertaken |

Goshawk: Collision Risk

- 9.407 The goshawk collision rate associated with the Development was predicted to be on average 0.029 per year. When other projects that conducted modelling were considered, a combined collision rate of 0.109 or one collision every 9.2 years is predicted.
- 9.408 When considering the additional mortality on the NHZ population (31 pairs), a collision rate of 0.109 would equate to an increase in baseline mortality by 1.0% (assuming an adult survival rate of 0.830, BTO BirdFacts). This is considered to be no more than a **Low** spatial and **Long-term** temporal magnitude on the NHZ population. The cumulative effect is therefore **Minor adverse** and **Not Significant**.

Golden Plover: Disturbance and Displacement

- 9.409 Golden plover was recorded at a number of project sites during baseline surveys, with breeding observed at some of these locations, with others hosting flocks during the non-breeding season only. Within the Development Area up to one pair may be affected by disturbance-displacement.
- 9.410 Of the four operational or in-construction projects where golden plover was recorded, potential disturbance-displacement may have been a factor for four pairs at Clyde, and possibly one pair at Middle Muir (Table 9.19).
- 9.411 Of the other projects, breeding birds have the potential to be affected at Hare Hill Extension 2, although non-breeding birds were also recorded at other sites.
- 9.412 The BBPP outlined above will attempt to ensure that direct destruction of golden plover nest sites during the construction phase of the Development is avoided. It is likely that a consent condition would exist for all other consented projects for nest site destruction to be avoided. Habitat management measures during the operation period at the Development, and at other projects, will likely benefit golden plover due to enhanced bog and wet heath conditions.
- 9.413 It is acknowledged that some foraging and nesting habitat within the NHZ may be lost due to operational projects, including the Development. Overall, the extent of this is likely to be of Negligible magnitude within an NHZ context, particularly if habitat management measures are considered for projects where a potential unmitigated significant effect on raptors (or other waders) is predicted.
- 9.414 Overall, if in the unlikely scenario that all application and appeal projects considered in this cumulative assessment become operational, when mitigation measures are implemented, a **Negligible** Spatial and **Long-term** temporal effect on the NHZ population is predicted. The predicted cumulative effect is classified as **Negligible** and is therefore **Not Significant** in the context of the EIA Regulations.

Table 9.19: Predicted Effects on Golden Plover from other Projects within 20km of the Development.

| Project | Disturbance-displacement | Collision Risk |
|--|--|---------------------------|
| Existing and In-construction Projects | | |
| Galawhistle | Present but likely non-breeder | 0.12 collisions per annum |
| Sanquhar | Present | 1.007 collisions per year |
| Middle Muir | One territory within survey area. Flocks of up to 150 birds in flight in winter. | No CRM undertaken |
| Clyde | Four breeding pairs | No CRM undertaken |
| Consented Projects | | |

| Project | Disturbance-displacement | Collision Risk |
|-------------------------------|---|---------------------------|
| Crookedstane | Recorded foraging and in flight but no breeding | No CRM undertaken |
| Hare Hill Extension 2 | The site is occupied by a small population (2-3 pairs) of breeding birds and is used by larger numbers on migration in spring and autumn. | 1 pair per year |
| Penbreck | 10 breeding pairs beyond 500m from nearest turbine. | 0.015 collisions per year |
| Twentysilling Hill | No golden plover flights within site boundary at risk height. No breeding evidence. | No CRM undertaken |
| Kennoxhead | Present in non-breeding season only | No at-risk flights |
| Sandy Knowe | Ten golden plover flights recorded involving a total of 170 individuals. | No CRM undertaken |
| Sanquhar Six | Present in non-breeding season only | No CRM undertaken |
| Application and Appeal | | |
| Lethans | Areas used beyond disturbance distances | No CRM undertaken |
| Garleffan | No breeding pairs within 1km of turbines | 0.65 collisions per year |

Golden Plover: Collision Risk

- 9.415 The golden plover collision rate associated with the Development was predicted to be on average 0.199 per year. The combined collision rate when considering all other projects is predicted to be 3.995 per year.
- 9.416 When considering the additional mortality on the NHZ population (778 pairs), a collision rate of 3.995 would equate to an increase in baseline mortality by 0.9% (assuming an adult survival rate of 0.730, BTO BirdFacts). This is considered to be no more than a **Low** spatial and **Long-term** temporal magnitude on the NHZ population. The cumulative effect is therefore **Minor adverse** and **Not Significant**.

Curlew: Disturbance and Displacement

- 9.417 Curlew was observed at the large majority of projects, with breeding common, although the species was not always taken forward for assessment and so information provided is often limited.
- 9.418 Around eight curlew pairs were identified as having the potential to be affected by disturbance-displacement due to the Development.
- 9.419 Of the operational or consented projects where curlew was recorded, potential disturbance-displacement may have occurred to a large number of pairs (up to 125), particularly at Clyde, although it is highly unlikely that all 106 pairs recorded there will have been affected. From the consented projects, up to 46 additional pairs may be affected, and up to four additional pairs may be affected from the application or appeal projects.
- 9.420 The BBPP outlined above will attempt to ensure that direct destruction of curlew nest sites during the construction phase of the Development is avoided. It is likely that a consent condition would exist for all other consented projects for nest site destruction to be avoided. Habitat management measures during the operation period at the Development, and at some other projects, will likely benefit curlew due to enhanced habitat conditions (e.g. bog and heath management).
- 9.421 It is acknowledged that some potential nesting or foraging habitat within the NHZ will be lost due to operational projects, and that numbers are more likely than not to decline due to windfarm projects. However, within an NHZ context (4,284 pairs), and when considering mitigation measures, the extent of this is likely to be of Low magnitude within an NHZ context.
- 9.422 Overall, if in the unlikely scenario that all application and appeal projects considered in this cumulative assessment become operational, when mitigation measures are implemented, a **Low** Spatial and **Long-term** temporal effect on the NHZ population is predicted. The predicted cumulative effect is classified as at most, **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Table 9.20: Predicted Effects on Curlew from other Projects within 20km of the Development.

| Project | Disturbance-displacement | Collision Risk |
|--|--|--|
| Existing and In-construction Projects | | |
| Andershaw | 3 territories within study area | No CRM undertaken |
| Sanquhar | No details | 0.008 per year |
| Galawhistle | Up to 3 territories within site | 18-19 collisions during lifespan of windfarm (95% avoidance). Equals 0.296 collisions per year at 98% avoidance. |
| Clyde | 106 pairs within study area | No CRM undertaken |
| Middle Muir | 13 territories within survey area | No CRM undertaken |
| Consented Projects | | |
| Crookedstane | 3 pairs within site boundary. Single at-risk flight | No CRM undertaken |
| Hare Hill Extension 2 | One pair bred within site | No CRM undertaken |
| Lion Hill | 10 pairs within 1km from site. | 0.15 per year |
| Penbreck | 7 breeding pairs beyond 1km from nearest turbine | No CRM undertaken |
| Twentyshillling Hill | 6-10 curlew pairs, 3 of which at risk. | 0.02 to 0.05 collisions per year |
| Sanquhar Six | Three pairs within site | 0.00062 collisions per year |
| Glenmuckloch | Up to three territories | No CRM undertaken |
| Kennoxhead | Up to 14 territories within site and 500m survey buffer | 11.4 collisions over lifespan of windfarm |
| Sandy Knowe | Two probable pairs of curlew were recorded within the Proposed Development | No CRM undertaken |
| Application and Appeal | | |
| Poniel | Present but no evidence of breeding. | 0.007 per year |
| Lethans | Pair within potential disturbance distances | No CRM undertaken |
| Garleffan | Three pairs outside of site boundary | 2.08 collisions per year at 95% avoidance rate (0.832 at 98% avoidance). |

Curlew: Collision Risk

9.423 The curlew collision rate associated with the Development was predicted to be on average 0.407 per year. When combined with other projects that undertook collision modelling, a combined collision rate is predicted to be 2.207 per year. When considering the additional mortality on the NHZ population (4,284 pairs), this would equate to an increase in baseline mortality by 0.1% (assuming an adult survival rate of 0.736, BTO BirdFacts). This is considered to be a **Negligible** spatial and **Long-term** temporal magnitude on the NHZ population. The cumulative effect is therefore **Negligible** and **Not Significant**.

Lapwing: Disturbance and Displacement

9.424 Lapwing was observed at a relatively small number of projects within the study area, with many projects being located within habitat generally unsuitable for the species. Breeding activity was observed at a number of these sites. The species was not always taken forward for assessment and so information available is limited. Within the Development Area, up to six pairs may be affected by disturbance-displacement.

9.425 Of the operational or in-construction projects where lapwing was recorded, potential disturbance-displacement may have occurred to a large number of pairs (up to 60), particularly at Clyde, although it is highly unlikely that all 56 pairs recorded there will have been affected (Table 9.21). A further pair at Lion Hill may be affected.

9.426 The BBPP outlined above will attempt to ensure that direct destruction of lapwing nest sites during the construction phase of the Development is avoided. It is likely that a consent condition would exist for all other consented projects for nest site destruction to be avoided. Habitat management measures during the operation period at the Development, and at some other projects, will likely benefit lapwing due to enhanced habitat conditions (e.g. heath management, grazing restrictions).

9.427 It is acknowledged that some potential nesting or foraging habitat within the NHZ will be lost due to operational projects, and that numbers are more likely than not to decline due to windfarm projects. However, within an NHZ context, and when considering mitigation measures, the extent of this is likely to be of Low magnitude within an NHZ context (minimum of 5,000 pairs).

9.428 Overall, if in the unlikely scenario that all application and appeal projects considered in this cumulative assessment become operational, when mitigation measures are implemented, a **Low** Spatial and **Long-term** temporal effect on the NHZ population is predicted. The predicted cumulative effect is classified as at most, **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Table 9.21: Predicted Effects on Lapwing from other Projects within 20km of the Development.

| Project | Disturbance-displacement | Collision Risk |
|--|---|--|
| Existing and In-construction Projects | | |
| Andershaw | 1 territory within study area | No CRM undertaken |
| Galawhistle | Present but no evidence of breeding | One collision every 23 years (95% avoidance rate). |
| Clyde | 56 pairs within study area | No CRM undertaken |
| Middle Muir | Three territories within survey area | No CRM undertaken |
| Consented Projects | | |
| Crookedstane | Low numbers recorded. Single at-risk flight | No CRM undertaken |
| Lion Hill | one pair and 13 flight lines | No CRM undertaken |
| Twentyshillling Hill | One flight of 2 individuals | No CRM undertaken |
| Application and Appeal | | |
| Poniel | Present in buffer zone. | No CRM undertaken |
| Garleffan | One pair outside of site boundary | No CRM undertaken |

Lapwing: Collision Risk

9.429 The lapwing collision rate associated with the Development was predicted to be on average 0.219 per year. Combined with annual mortality rate at Galawhistle of 0.017 per year (the only other project where collision modelling was undertaken), this equates to an annual collision rate of 0.236. Within a NHZ context of at least 5,000 pairs, this is considered to be a **Negligible** spatial and **Long-term** temporal magnitude on the NHZ population. The cumulative effect is therefore **Negligible** and **Not Significant**.

Interrelationship between Effects

9.430 The potential effects of the Development are considered above in terms of effects on ornithology as a discrete environmental topic. Indirect and secondary effects resulting from the interaction of direct effects arising both within a topic area and interrelated with other topics areas are also possible.

9.431 The potential interrelationship between displacement and collision risk is accounted for in the collision model. It is assumed via the incorporation of an "avoidance rate" that a proportion of bird activity within the vicinity of proposed turbine locations will be reduced compared to the baseline survey period, as birds avoid turbines or the Development as a whole. Therefore, no additional interrelated displacement, collision or barrier effects are likely. The effects of habitat loss are likely to be diffuse and this has been considered via the assessment of disturbance and displacement effects.

9.432 Of the other topics with potential to affect ornithological receptors, those effects identified in **Chapter 7: Hydrology, Hydrogeology, Geology and Soils**, and **Chapter 8: Ecology** are most likely to produce a

measurable effect. Interrelated effects could potentially occur due to loss or reduction in quality of suitable habitats for breeding, or indirect effects on foraging due to the changes in conditions for prey items. Direct habitat loss effects have been considered in the Construction Effects section, and although indirect effects on prey items have not been considered above, these are unlikely to be significant for any VOR, with none having specific feeding requirements that would be materially altered.

Further Survey Requirements, Monitoring and Enhancement Measures

Surveys and Monitoring

- 9.433 Pre-construction breeding bird surveys will be undertaken by a suitably qualified ornithologist as part of the BBPP.
- 9.434 Breeding raptor, wader and black grouse lek surveys will be completed during construction and years 1, 2, 3, 5, 10 and 15 during the operational period.
- 9.435 Monitoring of blanket bog, heath and woodland will be undertaken every three years from the first year of management, as outlined in **Appendix 8.6**, to investigate any benefits on raptor, wader and black grouse populations.

Enhancement Measures

- 9.436 Over and above mitigation the measures outlined above in the *Assessment of Effects* section, enhancement measures will be implemented and will take the form of the RHHCMP, which will include the provision of a fund and management assistance to enhance the conservation of breeding hen harriers within NHZs 19 and 17. A full-time Project Officer position will be funded entirely by NLEI Ltd for a period of 25 years. The primary aims of this RHHCMP are to review the current status of the hen harrier population breeding in the region, to provide context to the constraints operating in this landscape and, where possible, to undertake practical conservation management actions to enhance the hen harrier population by increasing its size and productivity. Breeding attempts within the Development Area will be monitored annually with results fed into ongoing work established as part of the RHHCMP. Further details are provided in **Appendix 8.6**.

Summary of Significant Effects

- 9.437 **Table 9.22** below summarises the predicted significant effects of the Development on ornithology prior to the implementation of the proposed mitigation measures. Following the application of the proposed mitigation measures, and the implementation of the proposed enhancement measures (i.e. the RHHCMP Project Officer), there will be no significant residual ornithology effects within an EIA context. It is difficult to quantify the full benefit of the RHHCMP over the life of the project, however it is expected that this could allow the Development to deliver a net benefit to the regional hen harrier population. Information presented in order to inform an Appropriate Assessment as part of the HRA process concludes that the integrity of the Muirkirk and North Lowther Uplands SPA, and all other Natura 2000 designated sites will be unaffected by the Development.

Table 9.22: Summary of Significant Effects

| Predicted Effect | Significance | Mitigation | Significance of Residual Effect |
|---------------------|------------------|--|---|
| Construction | | | |
| Black grouse | Moderate adverse | Pre-construction surveys; 750m construction buffer from leks during particular times; Best-practice construction (pedestrian restrictions, speed limits) | Minor adverse and Not Significant |
| Hen harrier | Moderate adverse | Breeding Bird Protection Plan; Pre-construction surveys; 500m construction buffer from active | EIA: Minor adverse and Not Significant |

| Predicted Effect | Significance | Mitigation | Significance of Residual Effect |
|------------------|------------------|--|--|
| | | nests during particular times; Best-practice construction (pedestrian restrictions, speed limits) | HRA: No Likely Significant Effects |
| Merlin | Moderate adverse | Breeding Bird Protection Plan; Pre-construction surveys; 500m construction buffer from active nests during particular times; Best-practice construction (pedestrian restrictions, speed limits) | EIA: Minor adverse and Not Significant HRA: No Likely Significant Effects |
| Short-eared owl | Moderate adverse | Breeding Bird Protection Plan; Pre-construction surveys; 500m construction buffer from active nests during particular times; Best-practice construction (pedestrian restrictions, speed limits) | EIA: Minor adverse and Not Significant HRA: No Likely Significant Effects |

- ⁱ Scottish Natural Heritage (2006) Assessing significance of impacts from onshore Windfarms on birds outwith designated areas.
- ⁱⁱ Council Directive 2009/147/EC on the conservation of wild birds (the Birds Directive)
- ⁱⁱⁱ Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds* 108, 708-746.
- ^{iv} SNH (2014). Recommended bird survey methods to inform impact assessment of onshore Windfarms. Scottish Natural Heritage, May 2014.
- ^v Bright, J. A., Langston, R. H. W., Bullman, R., Evans, R. J., Gardner, S., Pearce-Higgins, J. & Wilson, E. (2006). Bird Sensitivity Map to provide locational guidance for onshore Windfarms in Scotland. Royal Society for the Protection of Birds.
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- ^{vii} Ruddock, M. & Whitfield, D. P. (2007). A Review of Disturbance Distances in Selected Bird Species, A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.
- ^{viii} Sim, I.M.W., Eaton, M.A., Setchfield, R.P., Warren, P.K. and Lindley, P. (2008). Abundance of male black grouse Tetrao tetrix in Britain in 2005, and change since 1995-96. *Bird Study* 55: 304-313.
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- ^{xii} Fielding, A., Haworth, P., Whitfield, P., McLeod, D. & Riley, H. (2011). A Conservation Framework for Hen Harriers in the United Kingdom. JNCC Report 441. Joint Nature Conservation Committee, Peterborough.
- ^{xiii} Ewing, S. R., Rebecca, G.W., Heavisides, A., Court, I.R., Lindley, P., Ruddock, M., Cohen, S. and Eaton, M.A. (2011). Breeding status of Merlins *Falco columbarius* in the UK in 2008. *Bird Study* 58: 379-389.
- ^{xiv} <https://www.bto.org/volunteer-surveys/peregrine-survey/results>
- ^{xv} Musgrove, A., Aebischer, N., Eaton, M., Hearn, H., Newson, S., Noble, D., Parsons, M., Risely, K. and Stroud, D. (2013). Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 106, pp. 64 -10.
- ^{xvi} <https://www.bto.org/about-birds/birdtrends/2016>
- ^{xvii} Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K. and Stroud, D. (2013). Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 106, 64 -100.
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