8 Ornithology

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8 Ornithology

8.1 Executive Summary

8.1.1 This chapter provides an assessment of the potential effects associated with the Revised Development on ornithological resources present, utilising relevant baseline data obtained for the Consented Development.

8.1.2 The Revised Development is based on a 13 turbine layout with a maximum tip height of 149.9 m (compared to a 15 turbine layout with a maximum tip height of 131m for the Consented Development). The Revised Development turbine layout is similar to that of the Consented Development across the northern half of the site, although now extends further south, with turbines T10 to T13 located south of previous turbine locations (Figure 8.2).

8.1.3 The main changes in assessment associated with the Revised Development relate to: changes in the area of habitat loss due to infrastructure; distance of infrastructure to nest sites or black grouse lek sites; and change in turbine type and associated collision risks. In general, conditions have remained similar to those recorded during the baseline period for the Consented Development, and so the ornithological receptors taken forward to assessment have remained consistent. These are: pink-footed goose, greylag goose, black grouse, hen harrier and the breeding wader assemblage.

8.1.4 All changes associated with the Revised Development compared to the Consented Development are considered to be minimal, and so the evaluation of significance on each receptor has remained unchanged. Therefore, no significant effects are predicted for any ornithological receptor.

8.2 Introduction

8.2.1 This chapter considers the potential effects on ornithological interests associated with the construction, operation and decommissioning of the Revised Development. The specific objectives of the chapter are to:

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

8.2.2 The chapter is supported by Appendix 8.1, which contains the following annexes:

- 8.1A - Legal Protection;
- 8.1B - Bird Survey Methodologies;
- 8.1C - Survey Effort and General Information;
- 8.1D - Survey Results (within the Confidential Annex); and
- 8.1E - Collision Risk Modelling.

8.2.3 Figures 8.1 to 8.25 within Volume 2 of this Environmental Statement (ES) are referenced in the text where relevant (Figures C8.1 to C8.3 are located within the Confidential Annex).

8.2.4 For the purposes of this chapter, the definitions used are detailed below for ease of reference:

- The 'Revised Development' refers to the Douglas West Wind Farm in general. This comprises 13 wind turbines, access tracks, hardstanding, foundations, construction compound/concrete

batching and turbine laydown area, substation and met mast (see Figure 8.2 for details). All components of the Revised Development are included in the scope of this impact assessment.

- The 'site' - this is the area within which all infrastructure associated with the Revised Development shall be contained (including the access tracks), equating to the area within the Planning Application Boundary (Figure 8.2).
- The 'Study Area' - this equates to the site plus an additional buffer of up to 2 km, depending on species group (e.g. moorland breeding birds, raptors), to record any birds that may be influenced by the presence of the Revised Development. Extents are detailed on Figure 8.2 and in paragraph 8.5.5.

Background

8.2.5 This Ornithology chapter utilises baseline data gathered for, and presented and assessed in the Ornithology ES chapter of the 2015 Application (for the Consented Development) by 3R Energy Solutions Ltd (Planning Reference: CL/15/0273). A Supplementary Environmental Information (SEI) report for the Consented Development was submitted in September 2015, and an updated Ornithology Assessment accompanied a Non-Material Variation application in March 2016 (ref. CL/15/0273/1) to increase the tip height of the Consented Development to 131m and rotor diameter to 113m Information pertinent to the Revised Development has been considered here.

8.2.6 Various ornithological surveys were carried out within and adjacent to the site during 2009 and 2010 on behalf of Community Windpower Ltd, the previous developers of this project. Under the control of Community Windpower Ltd the project was referred to as the proposed Douglas West Community Wind Farm (DWCW). Following initial baseline surveys, Community Windpower Ltd issued a Scoping Report in March 2012 which set out the scope of the proposed EIA to be undertaken for the project (Community Windpower, Douglas West Scoping Report, dated March 2012 – see Table 8.1 for further details). This report was issued to SLC, Scottish Natural Heritage (SNH) and other stakeholders. No planning submission was subsequently made for the project by Community Windpower Ltd, but the ornithology survey data have been made available to the Applicant for consideration here. This will complement the baseline survey results obtained during 2014 and 2015 for the Consented Development, as agreed with SNH (Table 8.1). A review of published ornithological survey data for neighbouring wind farm developments, the survey buffers of which cover parts of this site, has also been undertaken.

Site Description

8.2.7 The northern half of the site consists of previously worked opencast coal land which was restored in the mid-1990s and which has reverted predominantly to a rough grassland with patches of more improved grassland scattered in between. A number of standing waterbodies, including naturalised former lagoons, and streams are scattered across the site. The concrete hardstanding of the former dispatch point (DP) in the north-east corner of the site and the former coal haul road, now a tarmac road, which crosses the site in an east-west direction, are remnants of the previous opencast coal infrastructure.

8.2.8 The southern section of the site consists of unworked land that is more semi-natural in character and consists predominantly of a drained purple moor-grass *Molinia caerulea* dominated moorland with pockets of wet heath.

8.2.9 The entire site is grazed by sheep and there is a low level of informal recreational use, primarily along the former coal haul road in the centre of the site.

8.3 Legislation, Policy and Guidelines

Legislation

8.3.1 Relevant legislation and guidance documents have been reviewed and taken into account as part of this ornithological assessment. Of particular relevance are:

- 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);
- The Wildlife and Countryside Act 1981 (as amended);
- The Nature Conservation (Scotland) Act 2004 (as amended);
- Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (as amended); and
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (The Habitats Regulations).

Planning Policy

8.3.2 Chapter 5 sets out the planning policy framework that is relevant to the EIA. The policies set out below include those from the South Lanarkshire Local Development Plan (2015). This section also considers the relevant aspects of Scottish Planning Policy (SPP), Planning Advice Notes and other relevant guidance. Of relevance to the ornithological assessment presented within this chapter, regard has been had to the following policies:

Scottish Planning Policy

8.3.3 SPP was published in June 2014 and sets out national planning policies which reflect Scottish Ministers' priorities for operation of the planning system and for the development and use of land. Under the subject policy "Valuing the Natural Environment" it states that, *"the presence (or potential presence) of a legally protected species is an important consideration in decisions on planning applications. The level of protection afforded by legislation must be factored into the planning and design of development and any impacts must be fully considered prior to the determination of an application*".

South Lanarkshire Local Development Plan (2015)

- Policy 2, Climate Change. Proposals for new development must, where possible, seek to minimise and mitigate against the effects of climate change by, among other aspects, having no significant adverse impacts on the water and soils environment, air quality, biodiversity (including Natura 2000 sites and protected species) and green networks;
- Policy 4, Development management and placemaking. When assessing development proposals, the Council will ensure that there is no significant adverse impact on landscape character, built heritage, habitats or species including Natura 2000 sites, biodiversity and Protected Species nor on amenity as a result of light, noise, odours, dust or particulates;
- Policy 14 Green network and greenspace. Any development proposals should safeguard the local green network, identified on the proposals map, and identify opportunities for enhancement and/or extension which can contribute towards mitigating greenhouse gases and supporting biodiversity. Partial loss of priority greenspace will only be considered where it can be demonstrated that there is no significant adverse impact on natural and/or built heritage resources, including Natura 2000 sites and Protected Species; or compensatory provision of at least equal quality and accessibility is provided locally.
- Policy 15 Natural and historic environment. The Council will seek to protect important natural and historic sites and features from adverse impacts resulting from development, including cumulative impacts. This includes development which could affect Category 1 Natura 2000 sites which will only be permitted where an appropriate assessment of the proposal demonstrates

that it will not adversely affect the integrity of the designated site following the implementation of any mitigation measures. In Category 2 areas, development will be permitted where the objectives of the designation and the overall integrity of the area can be shown not to be compromised following the implementation of any mitigation measures. Development which will have an adverse effect on protected species following the implementation of any mitigation measures will not be permitted unless it can be justified in accordance with the relevant protected species legislation.

- Policy 19 Renewable Energy. Applications for renewable energy infrastructure developments will be supported subject to an assessment against the principles set out in the 2014 Scottish Planning Policy.

Guidance

8.3.4 Recognition has been taken of the following guidance:

- 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 (27 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;
- The South Lanarkshire Local Biodiversity Action Plan (LBAP) and Biodiversity Partnership.
- Eaton *et al*. (2015). *Birds of Conservation Concern 4*;
- Band, W., Madders, M. and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at Windfarms. In: de Lucas, M., Janss, G.F.E. and Ferrer, M. (eds.) *Birds and Windfarms: Risk Assessment and Mitigation*. Pp. 259-275. Quercus, Madrid.
- 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 (2005, revised 2010) *Survey methods for use in assessing the impacts of onshore windfarms on bird communities*;
- Scottish Natural Heritage (2013, revised 2014) *Recommended bird survey methods to inform impact assessment of onshore wind farms*;
- Scottish Natural Heritage (March 2012). *Assessing the Cumulative Impact of Onshore Wind Energy Developments*; and
- Scottish Natural Heritage (July 2016). *Assessing connectivity with Special Protection Areas*.

8.4 Consultation

8.4.1 As part of the EIA process a review of responses elicited in relation to the Revised Development, and also consultation responses to the Consented Development ES, SEI and NMV was undertaken

(a Scoping Report was issued to SNH on 18 December 2014, and an interim response to an updated plan in the SEI was provided in August 2015).

8.4.2 Consideration was also given to a 2012 Scoping Report for the DWCW project proposed for the Consented Development site by Community Windpower Ltd., and also a review of published information relating to other wind farm developments in the local area.

8.4.3 Issues identified through consultations are detailed within Table 8.1.Copies of the consultation responses can be found in Appendix 4.2 and 4.4.

Table 8.1 – Ornithology Consultation Responses

Consultee	Scoping/other consultation	Matters Raised	Response/action taken
SNH	Email response to 2014 Ornithology Scoping Report 16 February 2015	The suite of proposed surveys appears appropriate.	Noted.
		SNH agrees one year of survey (September 2014 to August 2015) is likely to be adequate. SNH should be sent interim survey results in June/ July 2015 in case anything unexpected is found.	Noted – this Chapter will provide an interim report on species identified to date.
		The site is some distance (5.5 km) from the Muirkirk and North Lowther Uplands Special Protection Area (SPA), so there is no 'likely significant effect' [within a Habitats Regulations context]	Noted – effects on European sites have been scoped out of the assessment.
		The availability of information from other nearby schemes helps give a fuller picture of the location and its likely ornithological interest.	Baseline data from 2009/10 for this project and other local projects have been utilised (see *Baseline Conditions*, Section 8.6).
		Vantage point (VP) locations look ok. VP2 appears to be only about 300 m from two turbines, and the westernmost proposed turbine is also near the limit of the 2 km max distance from VP1. It would be better sited a little further back, but SNH would not insist on this.	VP2 is now over 500 m from the closest proposed turbine location (see Figure 8.3), and according to SNH (2014) guidance is considered sufficient distance to avoid any potential disturbance effects.
		Given the number of wind farm schemes in the local area, it would be worth considering the wider functional consequences for e.g. passage species of such a large concentration of turbines.	This is considered within the *Cumulative Assessment* Section 8.10.

Consultee	Scoping/other consultation	Matters Raised	Response/action taken
SNH	Interim Response August 2015	SNH supports the general approach to habitat management set out in the submitted Outline Habitat Management Plan (OHMP).	Noted. It is intended that a detailed Habitat Management Plan will be agreed upon with SNH prior to construction and SNH's comments relating to the prescribed management measures and Management Unit 3 in particular have been acknowledged, and will be fully considered by the Applicant.
		The use of grazing livestock as a management tool will enhance the long term sustainability of the management measures.	
		SNH notes that "Management Unit 3" of the OHMP, which is for black grouse enhancement works, is relatively small and straddles the way-leave of the overhead power-line. The presence of the power-line could have implications for the proposals for tree planting which is not normally permitted below the cables. It may be advisable to consider enlarging the area within this management unit.	
		SNH recommends that all of the agreed management measures should delimited on a spatial plan, the timing and programme of work should be agreed, and all of the operations should be costed to ensure that adequate funds are allocated. This should ensure that works can be delivered and that their delivery can be monitored as the development progresses.	
SNH	Email response to project update 12 May 2017	The approach set out [in an email dated 11 May 2017] will provide an adequate basis for the assessment of the potential impacts of the Revised Development on the ecological interests at the site.	Noted. No further ornithology surveys in addition to those carried out up to August 2015 were required.

8.5 Assessment Methodology and Significance Criteria

8.5.1 The assessment method follows the process set out in the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (as amended) (the "EIA Regulations").

8.5.2 In assessing the level of effects, emphasis is given to the national and Natural Heritage Zone (NHZ)/ regional populations of the target species as appropriate (or the designated site, where relevant).

8.5.3 The evaluation for wider-countryside interests (interests unrelated to a SPA, but including a Site of Special Scientific Interest (SSSI) involves the following process:

- identification of the potential effects of the Revised 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 change (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.

Study and Survey Areas

8.5.4 The ornithological Study Area comprises the site shown in Figure 8.2, plus a buffer zone of up to 2 km, which has been applied, as recommended by SNH (2014) guidance. The 2014 to 2015 field survey areas were based on the indicative locations of a previous (larger) 15 turbine layout, and survey buffers were therefore defined by the polygon of the outermost turbines of that layout (Figure 8.2 – solid lines). This was also the case for the 2009 to 2010 surveys (see Figure 8.3, showing a 500 m buffer of a previous layout, equivalent to the 2009-10 Collision Risk Analysis Area). The survey areas therefore include all infrastructure within the site boundary associated with the Revised Development.

8.5.5 The specific Study Areas are as follows:

- Designated sites – site plus a 20 km buffer (Figure 8.1);
- Flight activity – the envelope within which turbines would be located, plus a buffer to account for possible surveyor inaccuracies, known for collision risk modelling purposes as the Collision Risk Analysis Area (CRAA). For the 2014 to 2015 flight activity surveys the CRAA represents a 250 m buffer around turbine locations, whereas for the 2009 to 2010 data, due to limited information made available, the CRAA represents a 500 m buffer of a previous turbine layout (but note that the current turbine layout has been used for all modelling - see Appendix 8.1, Annex E and Figure 8.3 for details);
- Breeding birds (general, and in particular, waders) – 500 m buffer around the site (Figure 8.2);
- Breeding raptors – 2 km buffer around the site (Figure 8.2);
- Black grouse - 1.5 km buffer around the site (Figure 8.2);
- Barn owl – 1 km buffer around the site (Figure 8.2); and

- Cumulative effects – projects or activities within the same area of influence on receptors, based on likely ranging distances of individuals of particular species (Figure 8.4).

Desk Study

8.5.6 A desk study was conducted in order to obtain ornithological information (including relevant designated sites) from a variety of online sources and consultation with conservation organisations, including as those listed below:

- SNH, including Sitelink (http://gateway.snh.gov.uk/sitelink/index.jsp);
- SLC; and
- South Strathclyde Raptor Study Group.

In addition to this standard search, it was agreed in consultation with SNH (see Table 8.1) that use should be made of the survey data collated from other local wind farms (see Figure 8.4 for locations and associated survey extents). The following developments are referred to in this chapter:

- DWCW (earlier iteration of the Revised Development): One full year of surveys completed in 2009 /2010. Scoping Report issued in 2012 and baseline data made available for this EIA;
- Dalquhandy Wind Farm: One year of surveys from September 2011 to November 2012 inclusive;
- Poniel Wind Farm: One year of surveys from November 2011 to November 2012 inclusive;
- Hagshaw Hill Extension Wind Farm: One year of surveys from April 2003 to July 2004 inclusive, with 2009-13 black grouse monitoring data made available from Scottish Power Renewables;
- Galawhistle Wind Farm: Two years of surveys from 2007 to 2009;
- Nutberry Wind Farm: Surveys from April 2004 to March 2006 (original and revised applications);
- Broken Cross Wind Farm: Surveys from April 2011 to August 2012; and
- Cumberhead Wind Farm: Surveys from April 2013 to August 2014.

8.5.7 This information includes scoping reports, ESs and data and consultation responses from relevant conservation bodies.

Field Surveys

8.5.8 All baseline surveys in 2014 to 2015 followed SNH (2014) recommended methods (see Appendix 8.1, Annex B) and the scope of surveys was considered appropriate by SNH during consultation (Table 8.1). Ornithological fieldwork commenced in September 2014 and was completed in September 2015, and comprises the following surveys (see Appendix 8.1, Annexes C and D and Figures 8.5 to 8.25 and Confidential Figures C8.1 and C8.2 for further details):

- Flight activity (Vantage Point) surveys. Fieldwork carried out from September 2014 to mid-March 2014 (non-breeding season), and from mid-March to August 2015 (breeding season) inclusive;
- Moorland Breeding Birds Surveys. Fieldwork carried out in spring-summer 2015;
- Breeding raptor surveys. Fieldwork carried out in spring-summer 2015;
- Barn owl surveys. Fieldwork carried out in spring-summer 2015; and
- Black grouse lek surveys. Fieldwork carried out in spring 2015.

8.5.9 Full use of the 2009 to 2010 survey data collected for the DWCW project within the site has been made for the assessment. This comprised the following survey effort:

- Vantage point surveys from three VPs during the breeding and non-breeding seasons (November 2009 to November 2010), following SNH (2005) guidance (see locations of VPs in Figure 8.3);
- Wader Survey; Common Bird Census of the farmland, woodland and scrub, conifer plantation edges (May to July 2010);
- Winter and spring point counts (November 2009, February and October 2010);
- Black grouse survey (May and June 2010); and
- Raptor and owl survey.

Assessment of Potential Effect Significance

8.5.10 This section defines the methods used to assess the significance of effects by the evaluation of sensitivity and magnitude of potential impacts.

8.5.11 Determination of the level of sensitivity of a receptor is based on a combination of the receptor's nature conservation value and conservation status, described in the sections below.

Methods Used to Evaluate the Nature Conservation Importance of Bird Populations

8.5.12 There are three levels of Nature Conservation Importance as detailed below in Table 8.2.

Table 8.2 – 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).
Moderate	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 Birds of Conservation Concern (BoCC) Red list that are inherently rare or at the limits of their UK range. The presence of target species noted within the South Lanarkshire LBAP. 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 site. Species present in regionally important numbers (>1% regional breeding population).
Low	All other species' populations not covered by the above categories.

8.5.13 Valued Ornithological Receptors (VORs) were taken to be those species of High and Moderate Nature Conservation Importance.

Methods Used to Evaluate Conservation Status of Bird Populations

8.5.14 As defined by SNH (2006), 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)*" (paragraph 14).

8.5.15 Conservation Status is considered "favourable" under the following circumstances (paragraph 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".*

8.5.16 SNH (2006) 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*" (paragraph 17).

8.5.17 In the case of non-designated sites, the relevant scale for breeding species is considered to be the appropriate NHZ which the Revised Development site falls within. The Revised Development falls just within the West Central Belt NHZ 17 (see Figure 8.1). This NHZ is characterised by SNH (2002) as being predominantly lowland, with a well populated, intensively managed working landscape, with some moorland plateaux. The adjacent Western Southern Uplands and Inner Solway NHZ 19 is a large rural area dominated by agriculture and forestry land uses. The uplands are grazed by sheep and cattle and home to among other species, hen harrier and black grouse.

8.5.18 Based on the habitat within the site, there is a case to be made for either NHZ being the more appropriate. However, baseline ornithology results indicate that NHZ 19 is the more reflective NHZ of the upland bird assemblage found on site, with likely greater connectivity to populations of this NHZ, than for NHZ 17. Therefore NHZ 19 will be used throughout this assessment.

8.5.19 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.

Methods Used to Evaluate the Magnitude of Change

8.5.20 An impact is defined as a change to the abundance and/or distribution of a population as a result of the Revised Development. Effects can be adverse, neutral or beneficial.

8.5.21 There can often be varying degrees of uncertainty over effects as a result of limited information. A precautionary approach is adopted where the response of a population to an impact is uncertain.

8.5.22 In determining the magnitude of change, the resilience of a population to recover from temporary adverse conditions is considered in respect of each potentially affected population.

8.5.23 The sensitivity of individual species to disturbance during relevant behaviours is considered when determining spatial and temporal magnitude of change and is assessed using guidance described by Bright *et al.* (2006), Hill *et al.* (2007) and Ruddock and Whitfield (2007).

8.5.24 Impacts are judged in terms of magnitude in space and time. There are five levels of spatial impacts and temporal impacts as detailed in Table 8.3 and Table 8.4 below respectively.

Table 8.3 – Spatial Magnitude of Change

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 8.4 – Temporal Magnitude of Change

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 Criteria

8.5.25 The predicted significance of the effect has been determined through a standard method of assessment based on professional judgement, considering both sensitivity (i.e. each species population's relative sensitivity to disturbance) and magnitude of change. The significance criteria used in this assessment are listed below in Table 8.5.

Table 8.5 – Significance Criteria

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

8.5.26 Major and Moderate effects are considered significant in accordance with the EIA Regulations.

Requirements for Mitigation

8.5.27 Where unmitigated Major or Moderate effects have been predicted on a VOR, specific mitigation measures are required to reduce the level of significance to Minor or negligible, and therefore not significant within an EIA Regulations context. No specific mitigation measures are required for Minor or negligible effects.

Assessment of Residual Effect Significance

8.5.28 The residual effect significance revises the level of significance attributed to a particular effect when mitigation measures are considered. Again, Major and Moderate effects are considered significant in accordance with the EIA Regulations.

Limitations to Assessment

8.5.29 As shown in Table 8.1, the scope of survey work was agreed with SNH, and considered sufficient to be able to describe the baseline ornithological conditions for the site, aided by the availability of an abundance of information from the previous surveys at this location and those from the local area as part of past and current wind farm applications. Surveys did however commence in September 2014 meaning that only one set of breeding and non-breeding season data are available for inclusion in this assessment. The assessment has therefore drawn upon data obtained for the DWCW surveys which date from 2009 and 2010, to help fill in any gaps. Surveys for DWCW followed a previous 2005 version of the current SNH (2014) guidance, although methods are not considered to be significantly different as to render results unusable.

8.5.30 Although the DWCW survey data for the Revised Development site are around seven years old, it is not considered that the conditions within the Revised Development site have significantly changed since collection, which suggests that site usage by VORs is unlikely to be significantly different (as shown in the baseline results for each project). This conclusion has been borne out by the 2014 to 2015 survey data, and the desk-based study results collated.

8.5.31 It is acknowledged that the nearby Nutberry Wind Farm (Figure 8.4) has been constructed and become operational in the intervening period, and this possible change in environment is taken into account in the impact assessment. Likewise, this is the case for habitat changes associated with Hagshaw Hill Extension Wind Farm, taking the form of a 12 hectares (ha) habitat enhancement area for black grouse which is adjacent to the south western site boundary (Figure 8.4). This area of land was taken into consideration during the design process for the Revised Development, with adjustments to the Revised Development site boundary.

8.5.32 The surveys conducted in 2014 and 2015 have had no limitations regarding the robustness of data collection, with all following SNH (2014) guidance, and taking place during the correct time periods in suitable conditions. The exception is that on three occasions during flight activity surveys in

February and March 2015, periods of around 30 minutes were conducted during low visibility. Such sub-optimal conditions are unlikely to influence the robustness of the baseline data collected over the non-breeding season.

8.6 Baseline Conditions

8.6.1 This section details:

- Statutory Nature Conservation Designations for birds within 20 km of the site;
- species recorded during baseline ornithology surveys (for full details see Appendix 8.1); and
- the Conservation Status of the VORs recorded during bird surveys.

Statutory Nature Conservation Designations

8.6.2 There are no statutory nature conservation designations within the Revised Development site boundary. Information pertaining to designated sites within 20 km of the site, with ornithological qualifying features, are listed in Table 8.6 and shown in Figure 8.1.

8.6.3 In addition, one National Nature Reserve (NNR) (Clyde Valley Woodlands NNR) is within 20 km of the site (Figure 8.1). Key species[1] at this reserve are: spotted flycatcher, bullfinch, song thrush, treecreeper, great-spotted woodpecker, dipper, kingfisher and willow tit.

Table 8.6 – Statutory Nature Conservation Designations within 20 km of the Revised Development

Designated Site	Distance from Revised Development site boundary	Ornithological Qualifying Features (breeding season unless stated)	Status
Muirkirk and North Lowther Uplands SPA	5.5 km	Hen harrier Short-eared owl Peregrine Golden plover Merlin Hen harrier (non-breeding)	Unfavourable Declining (2008) Favourable Maintained (1998) Unfavourable No Change (2004) Favourable Maintained (2004) Unfavourable No Change (2009) Unfavourable Declining (2004)
North Lowther Uplands SSSI	5.5 km	Hen harrier Breeding bird assemblage	Unfavourable No Change Unfavourable Declining
Muirkirk Uplands SSSI	5.8 km	Hen harrier Short-eared owl Hen harrier (non-breeding) Breeding bird assemblage	Favourable Maintained Favourable Maintained Unfavourable Declining Favourable Maintained

Species Recorded

8.6.4 In this section, the baseline bird assemblage recorded within the Study Area is outlined, separated into species groups and individual target species. The 2014 to 2015 survey results for the Revised Development are presented first (where applicable), followed by those for the previous surveys (DWCW) from 2009 to 2010, and then any other historic records, including those associated with other wind farm developments.

[1] http://www.snh.org.uk/pdfs/publications/nnr/The_Reserve_Story_for_Clyde_Valley_Woodlands_NNR.pdf

8.6.5 A summary of flight activity survey results from 2014 to 2015, and 2009 to 2010 is presented below.

Table 8.7 – Flight Activity Survey Results from 2014 to 2015

Species	2014 to 2015 Non-breeding Season		2015 Breeding Season	
	Number of flights[1]	Number of flights 'at-risk'[2]	Number of flights[1]	Number of flights 'at-risk'[2]
Whooper swan	7 (28)	4 (5)	0 (0)	0 (0)
Pink-footed goose	28 (2,378)	6 (156)	5 (303)	1 (84)
Greylag goose	33 (400)	22 (182)	16 (67)	11 (31)
Barnacle goose	1 (2)	0 (0)	0 (0)	0 (0)
Hen Harrier	45 (47)	37 (39)	2 (2)	1 (1)
Peregrine	0	0 (0)	1 (1)	0 (0)
Merlin	1 (1)	1 (1)	0 (0)	0 (0)
Barn owl	1 (1)	0 (0)	0 (0)	0 (0)
Oystercatcher	1 (1)	1 (1)	2 (3)	0 (0)
Lapwing	1 (3)	1 (3)	3 (5)	3 (5)
Snipe	5 (5)	1 (1)	6 (6)	1 (1)
Curlew	7 (8)	5 (6)	21 (26)	13 (14)
Golden plover	2 (340)	0 (0)	0 (0)	0 (0)
Common sandpiper	0 (0)	0 (0)	1 (1)	1 (1)

[1] total number of flight events during non-breeding season, with total number of individuals in parenthesis.

[2] an 'at-risk' flight is defined, for the purposes of collision risk modelling, as occurring within the CRAA, and within survey flight height bands that correspond with turbine rotor height, and within the surveyor's 2 km viewshed. For 2009-10 data, this is a 500 m buffer of a previous turbine layout (see Figure 8.3) and for 2014-15 data is a 250 m buffer of the final turbine layout.

Table 8.8 – Flight Activity Survey Results from 2009 to 2010 (breeding and non-breeding seasons)

Species	2009-10	
	Number of flights[1]	Number of flights 'at-risk'[2]
Whooper swan	0	0
Pink-footed goose	0	0
Greylag goose	2 (3)	0 (0)
Barnacle goose	0	0
Hen Harrier	8 (8)	0 (0)
Peregrine	1 (1)	1 (1)
Osprey	1 (2)	1 (2)
Merlin	2 (2)	1 (1)

Species	2009-10	
	Number of flights[1]	Number of flights 'at-risk'[2]
Barn owl	0	0
Oystercatcher	4 (7)	0 (0)
Lapwing	5 (26)	2 (4)
Snipe	2 (2)	1 (1)
Curlew	46 (69)	14 (20)
Golden plover	0	0
Common sandpiper	0	0

Wildfowl

8.6.6 Four wildfowl species have been recorded during various baseline surveys in the local area: whooper swan, pink-footed goose, greylag goose and barnacle goose, although the last species was recorded only on a single occasion in 2014 during flight activity surveys.

8.6.7 During the 2014 to 2015 non-breeding season, a total of 28 pink-footed goose flights, 33 greylag goose flights and seven whooper swan flights were recorded (Figure 8.5). In October 2014, approximately 1,500 pink-footed geese were observed leaving a probable roost site around former opencast area pools to the west of the site at Dalquhandy. Two birds were recorded heading to these pools the previous evening. Five flocks of pink-footed goose were also recorded overflying the site in April 2015.

8.6.8 Small numbers of greylag goose and whooper swan (2-3 birds) were recorded utilising the waterbody within the centre of the site on isolated occasions. Migrating greylag geese were recorded regularly during the winter, and birds which belong to the local non-migratory (non-Icelandic) population were also throughout the breeding season. Records during the breeding season were mainly of two or three birds although numbers reached up to 17 on one occasion in July. There was no evidence of breeding on-site but on the basis of a concentration of flights in the north eastern area of the site/the north eastern buffer and the mobbing of a buzzard in June, a breeding attempt is suspected somewhere in the north eastern buffer or in its vicinity.

8.6.9 No other target wildfowl species were recorded (although secondary species Canada goose, mute swan, goosander, teal, tufted duck and mallard were occasionally present in small numbers).

8.6.10 During baseline surveys for the project in 2009 to 2010, two greylag goose flights of two and one birds were recorded in flight from vantage points (Figure 8.13). Geese are known to feed within fields to the west and south adjacent to the Douglas Water.

8.6.11 In the main, whooper swan, pink-footed goose and greylag goose have been recorded in flight only during the majority of other local project surveys, although during the adjacent Dalquhandy Wind Farm baseline surveys whooper swan (up to 15 birds), pink-footed goose (up to 1,361 roosting birds), and greylag goose (up to 185 roosting birds) were recorded utilising the pools within the adjacent part of the former Dalquhandy Opencast Site.

Black Grouse

8.6.12 Black grouse have historically been present within the local area but numbers appear to have declined over the last 10-15 years, as summarised below (and shown in Confidential Figure 8.27).

8.6.13 During black grouse surveys in 2015, a single lekking male was recorded in the Hagshaw Hill Wind Farm area around 300 m from the site, and around 450 m from the closest infrastructure. A female black grouse was flushed during a breeding bird survey visit in May 2015 in the northern section of the site. No other black grouse sightings were made during either the targeted black grouse surveys or any other surveys.

8.6.14 During 2010 black grouse surveys for the project, a lek of two males was recorded at an approximately similar location to that in 2015. This lek site appears to be well established, as it formed one of the four lek sites identified by Zisman *et al.* (2009) in 2003 and 2004 that were within the 1.5 km buffer zone of the site (all others being more distant from the site). A total of 4-6 males (plus two females) were recorded lekking at the four lek sites in 2003-04. According to the Galawhistle Wind Farm ES (Infinis, 2010), by 2007 only two leks remained, each consisting of a single male. During Hagshaw Hill Extension Wind Farm construction in late April 2008, a black grouse survey found no signs of presence on site.

8.6.15 Black grouse records around the constructed Hagshaw Hill Extension from 2009 to 2013 were provided by ScottishPower Renewables (SPR). Birds were recorded mainly over 1.5 km south-west of the site, and further south-west than the 2010 record. These records were mainly males in April/May. None were of lekking birds and SPR is not aware of a lek within their site, though suspects that one may be, or may have been somewhere in the local vicinity. In 2013, a black grouse was recorded in flight around the area of tree planting (part of the Hagshaw Hill Extension management plan) adjacent to the site boundary. An ad hoc winter record (2013/14) of three male and one female birds around Burnt Rig was also provided. An additional record of a single, non-lekking male on the access track (April 2015) was also in the vicinity of the ad hoc record.

8.6.16 At Galawhistle, no leks were recorded within 2 km of the site, instead occurring over 2 km west of Galawhistle. Individual birds were recorded occasionally at Cumberhead, but no lekking activity was observed.

8.6.17 At Nutberry Hill, two leks were located within the wider area in 2004 (over 2 km west of the site), but none were present in 2005. It was reported in the Nutberry Hill ES (Nutberry Wind Energy, 2006) that stalkers and local landowners have commented that previously strong populations have declined at that site.

Raptors and Owls

8.6.18 No target raptor species have been recorded breeding within the site and 2 km buffer during baseline surveys for the Revised Development or other local projects. Discussions with the South Strathclyde Raptor Study Group between December 2014 and April 2015 backed up these findings, although it should be noted that coverage by the Raptor Study Group has been incomplete, and so historic breeding cannot be completely ruled out. The closest historic breeding records of hen harrier, merlin and short-eared owl have mainly occurred south of the Douglas Water over 4 km from the site (data provided by the South Strathclyde Raptor Study Group). Goshawk very probably bred within the 2 km buffer zone or further out during the preceding five years, but the species was not monitored on a regular basis. Goshawk was confirmed as breeding within the north of the Cumberhead 2 km survey buffer in 2013 and assessed as probably breeding within the survey buffer area in 2014.

8.6.19 Raptor surveys during the 2015 breeding season recorded flights of hen harrier, goshawk, merlin and peregrine, but no associated breeding activity (Figure 8.24).

8.6.20 A male hen harrier was recorded foraging in the north-western 2 km buffer of the site, west of Brackenside on 10 April 2015, where two days later a male was also recorded during a flight activity survey, after coming from the south western corner of the site. There were three sightings in the southern 2 km site buffer where a ringtail hen harrier was seen twice in quick succession foraging, then spiralling high and away south towards Glentaggart on 16 April 2015, and a male was seen in the southern 2 km site buffer on the Hagshaw Extension Wind Farm boundary on 26 July 2015. All five sightings were believed to be potentially associated with known territories in the Galawhistle area/Muirkirk and North Lowther SPA to the west and Weston Hill to the south.

8.6.21 There was a single goshawk sighting on 10 April 2015 on the periphery of the western 2 km site buffer and high above the plantation, with old signs of potential territorial occupancy on the periphery of the eastern buffer recorded on 22 May 2015.

8.6.22 During all surveys, male peregrines were recorded on two occasions in April, and on single occasions in May and June 2015. Three observations were made in the western 2 km buffer and one in the

northern buffer but none was in suitable breeding habitat. There is not believed to be any suitable breeding habitat on site or in the 2 km buffer but suitable habitat does exist in the wider area.

8.6.23 There was a single merlin record of an individual hunting in the northern 500 m buffer on 7 May 2015.

8.6.24 In addition to the above target species, there were a large number of sightings of secondary species buzzard, kestrel, sparrowhawk, raven, tawny owl and long-eared owl.

8.6.25 During flight activity surveys in the 2014 to 2015 non-breeding season, hen harrier was frequently recorded hunting (45 records up to the end of March), comprising at least two female/ringtails and one adult male (Figure 8.6). There were also single records of barn owl and merlin (Figure 8.7).

8.6.26 No target raptor species were recorded breeding within the Study Area in 2010. During vantage point surveys hen harrier was recorded on eight occasions, six of which were in the non-breeding season (including three flights on the same day which were likely to be the same individual) (Figures 8.13 and 8.14). Merlin was recorded on two occasions, with single observations of osprey (two birds) and peregrine. There was a single record of one long-eared owl adult and two or three juveniles, calling in the plantation (location unknown).

8.6.27 Peregrine and barn owl were recorded breeding within the Galawhistle Study Area, both over 2 km west of the Revised Development site. At Nutberry Hill in 2003 to 2004, peregrine was recorded breeding within that EIA Study Area, and goshawk was considered likely to be breeding, but no nest site was confirmed.

8.6.28 Non-breeding raptor species regularly recorded in flight during baseline surveys for other local projects were hen harrier, merlin and peregrine, with less frequent records of short-eared owl, osprey, red kite and goshawk.

Barn Owl

8.6.29 Barn owl surveys were carried out in January-February, May, June and September 2015 in suitable habitat within the site and a buffer zone of at least 1 km surrounding the then (larger) turbine envelope.

8.6.30 Due to the open nature of the site and the surrounding area being dominated by coniferous plantations, there are no mature trees with suitable cavities with barn owl nest potential within the site and few within the surrounding 1 km buffer. Moreover, the often heavily grazed moorland of the entire southern section of the site presented sub-optimal foraging habitat for barn owls.

8.6.31 No barn owl signs were recorded within the site, but signs were found in three localities near, or outside of the 1 km buffer edge (see Appendix 8.1, Confidential Annex D and Figure 8.28 for details). No evidence of breeding was recorded, and structures were likely used as temporary roost sites instead. In June 2015 dusk vantage point watches from two locations along the southern section of the access road to the site did not record any activity.

8.6.32 A desk-based study did not reveal any historic breeding records within 1 km, and the nearest known nest site occurred over 1 km from the nearest proposed turbine and thus likely outside the core barn owl range of 1 km to 1.5 km during the breeding season (Shawyer, 1990) (Figure 8.29). The resident of the farm at that location indicated that historically the species had bred there, but had not done so in recent years. Barn owls were recorded infrequently during surveys for other wind farm developments, and again no breeding was recorded.

Waders

8.6.33 Breeding bird surveys in 2015 recorded seven breeding wader species. These were curlew, lapwing, common sandpiper, snipe, redshank, oystercatcher and ringed plover. The total number of territories determined within the Study Area was 39 (see Table 8.9 and Figure 8.25).

Table 8.9 – Numbers of assumed breeding wader territories within the Study Area

Species	Assumed Occupied Territories		
	Total	Within Site	Within 500 m buffer of site
Oystercatcher	3	0	3
Lapwing	7	2	5
Ringed Plover	2	0	2
Curlew	5	2	3
Common Sandpiper	5	2	3
Redshank	4	1	3
Snipe	13	7	6
Total	**39**	**14**	**25**

8.6.34 Most territories observed were located outside of the site. There were concentrations around the ponds at the adjacent Dalquhandy site in the western and north-western buffer zones, where 13 territories were recorded, compared to only five at ponds within the site.

8.6.35 Five territories were at or near the pond in the north western section of the site and three territories were in the Alder Pond/Disposal Point (DP) area.

8.6.36 Snipe was the most common and widespread wader species, occurring more or less throughout the Study Area. Curlew was largely confined to the moorland in the southern half of the Study Area (as well as in the southern buffer), while lapwing, common sandpiper and redshank were all closely linked to ponds.

8.6.37 A similar number of territories involving the same species were recorded during wader and common bird census bird surveys for the project in 2010 (Table 8.10). Curlew and snipe territories were mainly within grassland untouched by opencast operations. Ringed plover, lapwing and redshank territories were around the main pond and around the former coal-processing site.

8.6.38 During flight activity surveys in 2009 to 2010, lapwing was recorded in the summer months, and 69 curlew individual flights were recorded during the breeding season. Low numbers of oystercatcher and snipe flights were also observed (Figure 8.17).

8.6.39 A difference between the 2015 survey and the 2010 survey (which involved only three visits and omitted the early part of the breeding season), was that the 2010 survey recorded seven to eight territories at the main pond in the centre of the site, while the 2015 survey did not record any wader territories in that locality. In 2010 the water level in that pond was described as very low with much exposed gravel, whereas due to high rainfall in April and May 2015 the water level in that pond was at its maximum for most of the breeding season with no exposed gravel or mud and thus not presenting any suitable breeding habitat for the species that bred there in 2010 (oystercatcher, lapwing, ringed plover, common sandpiper and redshank). The spread of shrubs and trees along the banks in the intervening period may also have deterred waders from breeding at this pond.

8.6.40 Another difference related to the former DP area where the 2010 survey recorded at least one common sandpiper and two redshank territories. In 2010 there were drainage ditches and lagoons at this locality but by 2015 all lagoons had been filled in and a single drainage channel remained, leading to a virtual absence of waders in that area, apart from one snipe territory.

8.6.41 A summary of breeding wader species recorded during baseline surveys for each local wind farm development is presented in Table 8.10 below. Note that there is some overlap in survey areas and so local populations are unlikely to be obtained by summing territory numbers across developments.

8.6.42 Overall a broadly similar picture emerged from all data sources, bearing in mind successional and human-induced changes that occurred between the surveys. A significant proportion of waders bred in the vicinity of ponds, particularly in the north-western section of the site and on the immediately adjacent Dalquhandy site.

8.6.43 During winter months, flocks of golden plover were recorded during baseline surveys for the Revised Development, and all other local wind farms. A flock of 180 birds was recorded in October 2014, but the species was absent on all other survey dates in 2014 to 2015. During 2009 – 2010 surveys of the site, birds were recorded during the initial scoping visit only but at the adjacent part of the former Dalquhandy opencast, up to 138 golden plover were observed during winter surveys. Curlew, snipe, oystercatcher and lapwing were also recorded on occasion in small numbers in 2014 to 2015.

Table 8.10 – Wader Species Recorded during Baseline Surveys for Wind Farm Developments (number of territories)

Development	Curlew	Snipe	Lapwing	Ringed plover	Oyster-catcher	Redshank	Common sandpiper
Consented Development 2015	4	7	4	1	2	3	4
Proposed Development 2010 (DWCW)	4	4	1	4	1	2	2
Dalquhandy	4	8	10	6	3	3	11
Hagshaw Ext	5	-	-	-	-	-	-
Poniel	P	P	-	P	P	P	P
Cumberhead	9-15	1-4	B	P	P	P	1
Galawhistle	14	6	2	4	11	-	7
Nutberry	B	B	-	-	-	-	-
Broken Cross	1	P	-	4	-	-	-

B = breeding recorded, but no numbers provided. P = present, but non-breeding within the Study Area.

8.7 Potential Effects

8.7.1 The assessment of potential effects is based upon the Revised Development description outlined in Chapter 3 and is structured as follows:

- Scoped in VORs, and all other receptors that have been scoped out;
- Construction effects;
- Operational effects;
- Decommissioning effects; and
- Cumulative effects.

Scoped in VORs

8.7.2 The assessment is applied to those 'scoped-in' VORs of Moderate or High Nature Conservation Importance that are known to be present within the Study Area (as confirmed through survey results and consultations outlined above). These comprise: pink-footed goose, greylag goose, black grouse

and hen harrier, (Table 8.11). In addition the overall breeding wader assemblage has been considered as a single VOR.

Table 8.11 – Nature Conservation Importance of Scoped In VORs

Species	Nature Conservation Importance	Reason
Pink-footed goose	Moderate	Amber-listed, regularly occurring migratory species
Greylag goose	Moderate	Amber-listed, regularly occurring migratory species
Black grouse	Moderate	BoCC Red-listed; LBAP indicator species for Upland Habitats; sensitive to wind farm impacts (SNH, 2006)
Hen harrier	Moderate	Annex I, Schedule 1 and BoCC Red-listed
Wader assemblage	Moderate	BoCC Red- and Amber-listed; Species included in LBAP's Clyde Waders Project

8.7.3 In addition, it is necessary to consider each VOR's Conservation Status when assessing the likely impacts (Table 8.12).

Table 8.12 – Conservation Status of Scoped In VORs

Species	Conservation Status Information	Conservation Status
Pink-footed goose	Amber List (WL, WI)	The Greenland/Iceland pink-footed goose population winters almost exclusively in Britain. The British estimate (Musgrove *et al.* 2013) is 360,000 individuals. The national population has shown a long-term (1988/89 – 2013/14) increase of 108 % and a ten-year (2003/04 – 2013/14) 37 % increase (Hayhow *et al.* 2017). The population is therefore in **favourable conservation status**.
Greylag goose	Amber List (WL)	The Iceland greylag goose breeds in Iceland and winters almost elusively in Britain. The British estimate (Musgrove *et al.* 2013) is 85,000 individuals. The national population has shown a slight long-term (1988/89 – 2013/14) decrease of 15 % but a ten-year (2003/04 – 2013/14) 8 % increase (Hayhow *et al.* 2017). The population is therefore in **favourable conservation status**.
Black grouse	Red List (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 *et al.* (2008) 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 *et al.* (2007) estimate that in

Species	Conservation Status Information	Conservation Status
		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. Recent lek surveys in the region showed a 64 % decline between 1989-99 and 2006-12 (Warren *et al.* 2014). In the latter period, the numbers in the Southern Uplands were 133 males attending 41 leks, down from 298 (76 leks). The national and regional populations are therefore in **unfavourable conservation status**.
Hen harrier	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 *et al.* 2013). Thus the national population is considered to be in **unfavourable conservation status**. The regional NHZ 19 (Southern Uplands and Inner Solway) population was considered by Fielding *et al.* (2011) to be in **unfavourable conservation status** due to low productivity levels, potentially related to persecution.
Wader assemblage	Lapwing: Red List (BDP[1], BDP[2], ERLOB (VU)) Curlew: Red List (BDMp[1], BDp[2], BI, ERLOB (VU)) Snipe: Amber List (BDMr[2]) Redshank: Amber List (BDMp[1], WDMp[1], BDMr[1,] BDMr[2], WI) Ringed plover: Red List (BDMp[1], WDp[1], WDMp[2], WI) Oystercatcher: Amber List (ERLOB (VU), WL, BI, WI) Common sandpiper: Amber List (BDMp[1] BDMp[2])	According to Hayhow *et al.* (2017), a number of wader species have endured a long-term national decline, including curlew (-64 %), lapwing (-63 %), and common sandpiper (-47 %). Overall the national populations of waders are considered to be in **unfavourable conservation status**. According to the South Lanarkshire Biodiversity Partnership's Clyde Waders Project, "*recent surveys across South Lanarkshire indicate serious declines in lapwing, redshank and curlew, with long term trends in snipe also showing a decline*". These species' NHZ populations are therefore considered to be in **unfavourable conservation status**.

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

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

HDrec Historical Decline – Recovery. Red listed for Historical Decline in a previous review but with substantial recent recovery (more than doubled in the last 25 years).

BR and WR Rarity. UK breeding population of less than 300 pairs (BR), or non-breeding population of less than 900 individuals (WR).

BDp Breeding Population Decline. Severe decline in the UK breeding population size, of >50%, over 25 years (BDp^1) or the entire period used for assessments since the first BoCC review, starting in 1969 ("longer-term") (BDp^2)

BDMp Breeding Population Decline. Moderate decline in the UK breeding population size, of more than 25%, over 25 years ($BDMp^1$) or the entire period used for assessments since the first BoCC review, starting in 1969 ("longer-term") ($BDMp^2$).

$BDMr^1/^2$: Moderate breeding range decline over 25 years/longer term

BI International Importance. At least 20% of the European breeding population found in the UK.

$WDMp^1/^2$: Moderate non-breeding population decline over 25 years/longer term.

WL Localisation. At least 50% of the UK non-breeding population found in 10 or fewer sites.

WI International Importance. At least 20% of the European non-breeding population found in the UK.

ERLOB Threatened in Europe. VU = Vulnerable

Scoped Out Designated Sites and Species

8.7.4 As confirmed by SNH during consultation (see Table 8.1), no likely significant effects on the qualifying interests of the Muirkirk and North Lowther Uplands SPA (plus its constituent SSSIs) are anticipated as a result of the Revised Development. There are no other internationally or nationally designated sites for ornithology within 20 km of the site. Due to the ecology of the species listed and distance from the Revised Development site, no connectivity to the Clyde Valley Woodlands NNR is predicted. As a result, all designated sites and their populations, including Muirkirk and North Lowther Uplands SPA (plus its constituent SSSIs) have been scoped out of the assessment.

8.7.5 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 site, the following target species recorded in 2014 to 2015 or 2009 to 2010 have also been scoped out:

Wildfowl:

8.7.6 Whooper swan, barnacle goose: due to the low numbers of flights and no usage of site.

Raptors and owls:

8.7.7 Merlin, peregrine, osprey, red kite and short-eared owl: due to no breeding attempts within 2 km of the Revised Development site and low numbers of flights during baseline survey periods.

8.7.8 Barn owl: due to no breeding attempts within 1 km of the Revised Development site, lack of suitable breeding habitat, and low activity levels recorded during baseline surveys (one flight during a vantage point survey).

8.7.9 Long-eared owl: probable breeding in the local area, but no habitat likely to be affected.

Construction

Predicted Effects

8.7.10 The main potential impacts of construction activities across the Revised Development site 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, around 12 months). Pearce-Higgins *et al*. (2012) found that densities of a number of bird species declined at wind farm sites during construction, but that in most cases numbers returned to previous levels once construction was complete.

8.7.11 Impacts on birds would be confined to areas in the locality of construction compounds, turbines, tracks and other infrastructure. Few attempts have been made to quantify the effects of disturbance of birds due to activities of this type, and much of the available information is inconsistent. However, 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).

8.7.12 Direct habitat loss will also occur due to the Revised Development's construction, which will be both short-term and reversible (e.g. laydown areas) and long-term and potentially permanent (access tracks and turbines). This may impact on breeding or foraging individuals. In respect of the Revised Development, it is noted that direct loss of habitats will be less than at many similarly-sized wind farms due to the existing private haul road running through the Revised Development site.

Geese

8.7.13 **Impact**: roosting and over-flying geese may be displaced from the Revised Development site and surrounding area during construction, either by disturbance or direct habitat loss.

8.7.14 **Nature Conservation Importance**: as Amber-listed, regularly occurring migratory species, pink-footed goose and greylag goose are of Moderate conservation importance (Table 8.10).

8.7.15 **Conservation Status**: The regional/NHZ and national populations are likely to be in Favourable conservation status.

8.7.16 **Magnitude of Change**: Both pink-footed goose and greylag goose were regularly recorded in flight over the site during baseline surveys.

8.7.17 During the 2014 to 2015 autumn migration, up to 1,500 pink-footed geese were recorded roosting in the local area, west of the site. Birds were observed flying within the site, up to the end of April 2015. The species was however absent in 2009 to 2010 surveys. Surveys for the adjacent Dalquhandy Wind Farm in 2011 to 2012 recorded up to 2,400 pink-footed geese, and up to 185 greylag geese roosting on ponds within the Dalquhandy Wind Farm site, again during 2012 autumn passage in particular.

8.7.18 According to the Dalquhandy Wind Farm Supplementary Environmental Information Report (2013), the observed activity during early autumn 2012 may indicate that the Dalquhandy site is being utilised as a staging post for migrating pink-footed goose. This was considered likely to be a temporal phenomenon limited to certain key periods of the migration period (i.e. autumn and early winter). That site is not recognised by SNH or other organisations as a pink-footed goose roost, and the evidence in 2009 to 2010 and 2014 to 15 suggests that site is used infrequently.

8.7.19 The main system of ponds, forming part of the previous opencast working areas, are to the north-west of the site, with the closest turbine (turbine 1 (T01)) around 500 to 600 m from the nearest pond where activity was recorded. Masden (1985) reported that pink-footed geese were disturbed by vehicle movements up to a distance of 500 m in autumn, suggesting that It is possible that roosting birds may be disturbed by construction activities associated with turbines (particularly T01). Keller (1991) however found that pink-footed geese wintering in north-east Scotland tended to avoid areas of fields only 100 m from the nearest road and fields with centres closer than 100 m from a road were not visited, showing that disturbance distances may differ depending on site-specific conditions (i.e. if the site is of particular importance to birds, there may be some tolerance to activities).

8.7.20 It should be noted that consented turbines on the adjacent Dalquhandy Wind Farm site will be closer to these ponds than any of the turbines within the Revised Development, which means that birds may already be tolerant of human activities nearby (or alternatively birds will cease to use the ponds).

8.7.21 Two or three greylag geese were recorded utilising the large waterbody within the Revised Development site on occasion during 2014 and 2015. The species was far less common during 2009 to 2010, with only two flight events, although again two individuals were recorded using the pond on one occasion (likely to be a local feral pair previously recorded breeding around Dalquhandy).

8.7.22 Direct habitat loss impacts are predicted to be of negligible spatial and temporal magnitude for both greylag and pink-footed goose.

8.7.23 In a worst-case scenario, the loss of an intermittently-used staging post for 2,400 pink-footed geese previously recorded on the neighbouring site represents around 0.7 % of the national population affected, and the 185 greylag geese represents 0.2 % of its national population. Therefore the magnitude of change on either species' population is likely to be at worst low and short-term temporal.

8.7.24 **Significance of Effect**: The unmitigated effect from construction is classified as **minor adverse** and is therefore not significant in the context of the EIA Regulations.

Black Grouse

8.7.25 **Impact**: Lekking or foraging black grouse may be displaced from the Revised Development site during construction, either by disturbance or direct habitat loss.

8.7.26 **Nature** Conservation Importance: Due to its Red-list conservation status and sensitivity to wind farms, the species is classified as Moderate Nature Conservation Importance (Table 8.10).

8.7.27 **Conservation Status**: The regional/NHZ and national populations are likely to be of Unfavourable conservation status.

8.7.28 **Magnitude of Change**: No infrastructure is planned to overlap with any lekking location, although it is possible that a small amount of habitat used occasionally for foraging or resting may be lost.

8.7.29 The site is adjacent to 12 ha of land used as part of the Hagshaw Hill Wind Farm Extension Black Grouse Management Plan (Figure C8.1). The aim of this Plan is to enhance the habitat for black grouse outwith Hagshaw Hill Extension wind farm area by maintaining lekking black grouse numbers from baseline levels of 4-6 males recorded in 2003. In the management area to the west of the southerly turbines, the management prescriptions include: strip cutting to increase abundance of flowering heads and young growth of hare's-tail cottongrass *Eriophorum vaginatum*; exclusion of grazing for dwarf shrub regeneration; bracken treatment; and fence marking where black grouse collision risk is potentially high. Native tree and shrub planting has also taken place further west along the Robshill Burn.

8.7.30 No habitat will be lost from this management area however, 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 local 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.

8.7.31 According to an expert review by Ruddock and Whitfield (2007) leks may be actively disturbed at 300 to 500 m from a disturbance source. Baseline survey results have shown that a single male lek was present in 2015, around 450 m south-west of the closest infrastructure (Figure C8.1). Historic lek sites were recorded in a similar area to this lek site.

8.7.32 There is no evidence that black grouse regularly utilise the site for any purpose. The Hagshaw Hill Wind Farm Extension management area is around 200 m from the closest turbines (T11 and T12), and so some disturbance to the management area is possible during the period of track and turbine construction for T11 and T12 in particular. From the baseline survey information obtained there is no evidence that this management area has become important for the local black grouse population, but for the purposes of this assessment, a worst-case situation would be to assume that it is utilised by the two lekking males recorded in 2010, and their behaviour would be disturbed throughout the duration of construction activity associated with T11, T12 and T13.

8.7.33 Although the NHZ population is unknown, the Southern Uplands population is an estimated 133 males, attending 41 leks (Warren *et al*. 2014). Unmitigated, the possible loss of two lekking

males would therefore represent around 1.5 % of the regional population, although may also contribute to increased fragmentation of habitat for movements of birds between lek sites further afield. Because of the likely preferable habitat available within the local area, a shift away from disturbance source, and a continuation of lekking behaviour is more likely.

8.7.34 Unmitigated, the magnitude of change of construction impacts on the current regional black grouse population is therefore considered to be low spatial, and short-term temporal. The Hagshaw Hill Wind Farm Extension Habitat Management Plan's aim is however to allow the local population to recover to 4 to 6 lekking males, Temporary impacts on this objective due to construction disturbance would result in a low spatial, and short-term temporal impact at a NHZ level.

8.7.35 **Significance of Effect:** The unmitigated effect from construction is classified as **minor adverse** and is therefore not significant in the context of the EIA Regulations.

Hen Harrier

8.7.36 **Impact:** foraging hen harriers may be displaced from the Revised Development site during construction, either by disturbance or direct habitat loss.

8.7.37 **Nature Conservation Importance:** as an Annex I and Schedule 1 listed species, but with no connectivity to any designated sites, hen harrier is classified as Moderate Nature Conservation Importance.

8.7.38 **Conservation Status:** Both the national and regional populations are in unfavourable conservation status.

8.7.39 **Magnitude of Change:** No breeding attempts have been recorded within 2 km of the site, and in 2009 to 2010 most flight activity was recorded in winter months, compared to summer months. The species was regularly recorded during the 2014 to 2015 non-breeding season, and so the site does appear to provide suitable foraging habitat during this period. It is not clear how many individuals make use of the site, but surveys in 2014 to 2015 suggest that at least three individuals have been present - a minimum of two females and an adult male. Hen harrier activity during the 2015 breeding season was infrequent, with five observations across all surveys, and the species was largely absent during the 2010 breeding season.

8.7.40 Hen harriers have been recorded on all local wind farm sites (with the exception of Poneil), indicating the wider area is likely to be similarly suitable for foraging. The consequences of short-term disturbance associated with construction activities are therefore more likely to be displacement within the local area, without any significant reductions on foraging ability or survival. The spatial impact within the context of the regional/NHZ population is assessed as being of low magnitude and the temporal effect is assessed as short term.

8.7.41 **Significance of Effect:** The effect on the regional hen harrier population during construction is therefore considered to be **minor adverse** and not significant in the context of the EIA Regulations.

Wader Assemblage

8.7.42 **Impact:** breeding, foraging or wintering waders may be displaced from the Revised Development site during construction, either by disturbance or direct habitat loss.

8.7.43 **Nature Conservation Importance:** as Red- and Amber-listed species that form key components of the South Lanarkshire LBAP's Clyde Wader Project, the assemblage is classified as Moderate Nature Conservation Importance.

8.7.44 **Conservation Status:** in general, the wader assemblage recorded within the site is considered to be in unfavourable conservation status at a national and regional/NHZ level.

8.7.45 **Magnitude of Change**: A similar range of wader species have been recorded breeding within the site in 2015 and 2010, and wider local area during other projects' baseline surveys (see Table 8.10 for summary).

8.7.46 A total of up to 14 wader territories within the Study Area may be temporarily disturbed, namely two lapwing, two curlew, two common sandpiper, one redshank, and up to seven snipe.

8.7.47 Information from other local projects shows that the wider area is also suitable for these wader species, meaning that the spatial impact within the context of the regional/NHZ populations is assessed as being of low magnitude and the temporal effect is assessed as short term. It is possible that some pairs may be displaced into the surrounding area rather than being lost to the population for the duration of construction.

8.7.48 During winter months golden plovers are occasionally present in the local area, but results for the Revised Development and other local wind farms suggest that the area is not important for the species, and so negligible impact magnitude is predicted.

8.7.49 **Significance of Effect:** The effect on the regional wader assemblage during construction is considered to be **minor adverse** and not significant in the context of the EIA Regulations.

Operation

Displacement

8.7.50 The displacement of nesting and foraging birds from the Revised Development site has the potential to extend beyond the construction phase, as described above, and to occur during the operational phase. This may occur due to displacement from wind turbines and associated infrastructure.

8.7.51 Displacement away from operational turbines has been found to occur in a number of individual wind farm studies, generally over distances of up to 100 m or 200 m from turbines, although the effects vary considerably between sites and species. Additional existing information suggests that displacement effects are minimal, with most species affected only slightly, if at all. Devereux *et al*. (2008) showed that wind farms had no, or at most a minimal effect, on the local distribution of wintering farmland birds. Considering a range of breeding bird species but predominantly waders and passerines at upland wind farms, Pearce-Higgins *et al*. (2012) showed that there were no displacement impacts on any bird species from wind farms during the operational phase other than those that had already occurred during construction, and for some species the impacts during construction were reversed during operation with numbers returning to pre-construction numbers. The overall picture from Pearce-Higgins *et al.* (2012) is that disturbance is an issue requiring consideration for the construction phase and not for wind farm operation.

8.7.52 It is recognised that disturbance may occur due to maintenance activities associated with the Revised Development throughout the operation 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 impacts (see previous section).

8.7.53 Those studies mentioned above were focused on direct displacement (i.e. avoidance of areas surrounding wind farm installations); 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 wind farm 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 had significant effects on populations (Drewitt and Langston, 2006). 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).

8.7.54 Pearce-Higgins *et al.* (2009) observed certain species experiencing localised population increases with proximity to wind farm 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) who reported significant increases in breeding numbers of skylarks and stonechats at wind farms.

Geese

8.7.55 **Impact:** commuting, foraging or roosting geese may be at risk of displacement from wind turbines, or other infrastructure, thereby impacting on survival rates.

8.7.56 **Nature Conservation Importance and relevant Conservation Status**: Moderate and favourable for pink-footed goose and greylag goose.

8.7.57 **Magnitude of Change:** as outlined in the construction section above, during 2014 to 2015 geese were recorded mainly flying over the site, and so no foraging will be affected during the operational period. Due to the relatively small, compact size of the Revised Development, plus the lack of regular daily commuting flight activity recorded, any significant barrier effects to commuting birds are considered very unlikely.

8.7.58 With the exception of ponds within the site hosting 2-3 local greylag geese on occasion, the main temporary/irregularly-used roost sites are within 500 to 600 m from the nearest turbine location (T01). Foraging barnacle geese have been reported as being displaced from as far as 600 m from wind turbines on farmland habitat in winter (Kowallik and Borbach-Jaene, 2001). However, birds from the same population feed as close as 25 m to turbines during spring staging on Gotland (Percival, 1998), where more nutritionally-valuable habitat was in close proximity to wind turbines. This indicates that displacement from less preferred areas may more readily occur than from more important ones, and at distances over 500 m, if the roost site is important to birds, displacement would not likely occur. Furthermore, it is noted that turbines on the adjacent consented Dalquhandy Wind Farm site would be closer to these ponds than any of the turbines within the Revised Development site. A negligible spatial and long-term magnitude impact is therefore predicted in relation to the national pink-footed and greylag goose populations.

8.7.59 **Significance of Effect:** The overall effect on geese is assessed as **negligible** on the national populations, and therefore not significant in the context of the EIA Regulations.

Black Grouse

8.7.60 **Impact:** Black grouse are recognised as a species being potentially sensitive to the presence of wind farms (e.g. SNH, 2006), and the operation of the Revised Development may cause some displacement of breeding and foraging black grouse from areas close to infrastructure.

8.7.61 **Nature Conservation Importance and relevant Conservation Status:** Moderate and unfavourable at a national and regional/NHZ level.

8.7.62 **Magnitude of Change:** Evidence presented from Austria has suggested that leks may be adversely affected by wind farms, 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). At the operational Griffin Wind Farm, early indications were that there were no obvious effects of the turbines on the closest lek approximately 500 to 600 m from a turbine (Ross, 2012).

8.7.63 Although some vehicular movement along the Revised Development site access route may be required for maintenance activities through the lifespan of the Revised Development, this is likely to be of negligible frequency and duration compared to the construction phase of the Revised Development.

8.7.64 The closest lek site (of one male in 2015) was approximately 450 m from the nearest turbine location, and therefore no lekking activity is predicted to be significantly affected by operational turbines or associated maintenance activities, with a localised movement away from turbines a more likely outcome. Four turbines are within 500 m of the compartment of land managed as part of the Hagshaw Hill Wind Farm Extension Black Grouse Management Plan, and it is therefore possible that feeding or other activities of black grouse within and adjacent to this compartment may be reduced by the presence of these turbines. However, it is unlikely that the NHZ population will be reduced by the presence of turbines (there were no records of lekking activity within the site and only one record of a bird in flight near the habitat compartment during Hagshaw Hill Extension monitoring), and so at a regional/NHZ level, the impact is predicted to be of low spatial, and long-term temporal magnitude.

8.7.65 **Significance of Effect:** The effect is classified as **minor adverse** and is therefore not significant in the context of the EIA Regulations.

Hen harrier

8.7.66 **Impact:** foraging hen harriers may be at risk of displacement around wind turbines or other associated infrastructure thereby resulting in a reduction in productivity or survival to the local/regional population.

8.7.67 **Nature Conservation Importance and relevant Conservation Status:** Moderate conservation importance and unfavourable conservation status at a national and regional level.

8.7.68 **Magnitude of Change:** In keeping with most other studies of raptor displacement, it appears that hen harriers have a low sensitivity to disturbance at operational wind farms. Whitfield and Madders (2006) considered that if displacement of foraging hen harrier occurs, it is likely to be within 100 m from turbines, if at all. This suggests that any avoidance of the area around turbines would be a negligible effect at the population level, with only a small amount of suitable habitat lost, particularly within the centre of the site (Figure 8.6), and alternative habitat nearby, as the species was commonly recorded in other local project surveys. With this in mind, although hen harriers may be displaced from the immediate area around turbines during the operation of the Revised Development, the magnitude of such an effect is considered to be negligible spatial, but long-term temporal.

8.7.69 **Significance of Effect:** The effect is classified as **minor adverse** and is therefore not significant in the context of the EIA Regulations.

Wader Assemblage

8.7.70 **Impact:** breeding and foraging waders may be at risk of displacement around wind turbines or other associated infrastructure, thereby resulting in a reduction in productivity or survival to the local/regional population.

8.7.71 **Nature Conservation Importance and relevant Conservation Status:** Moderate conservation importance and unfavourable conservation status at a national and regional level.

8.7.72 **Magnitude of Change:** as outlined in the Construction effects section above, a total of up to 14 wader territories are within the Study Area so are at risk of being lost to displacement impacts. At a regional/NHZ population level for each species, this impact is predicted to be of low spatial, and long-term temporal magnitude, with no more than two territories per species affected, apart from snipe. It is likely that the number lost will be lower than this worst-case however, since wader species such as common sandpiper and snipe may be less sensitive to infrastructure presence than others.

8.7.73 **Significance of Effect:** The effect is classified as **minor adverse** and is therefore not significant in the context of the EIA Regulations.

Collision Risk

8.7.74 Birds that utilise the airspace within the wind turbine area at rotor heights during the operation of the Revised 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 site, the topography of the site, the species' behaviour, and the ability of birds to detect and manoeuvre around rotating turbine blades. On this basis, it is clear that collision mortality rates are likely to increase with a wind farm'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).

8.7.75 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 wind farms 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.

8.7.76 Band *et al*. (2007) 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 wind farm which is then assessed within the context of the species' relevant populations to determine the significance of any potential losses. Collision Risk Modelling (CRM) results are detailed in the accompanying Appendix 8.1, Annex E.

8.7.77 Table 8.13 presents the results of CRM undertaken using data from the 2015 breeding season flight activity surveys, plus those from the 2014 to 2015 non-breeding season to give an annual collision estimate for each VOR (see Confidential Appendix 3.1 and Appendix 8.1 for further details on the CRM process). The results of baseline surveys in 2009 to 2010 for the DWCW project are also presented for comparison.

Table 8.13 – Estimated Collision Rates for VORs

Species	2009-10 annual	2014-15 Non-breeding	2015 breeding	2014-15 annual
Pink-footed goose	0	0.218	0.036	**0.254**
Greylag goose	0.0007	0.169	0.030	**0.198**
Black grouse	0	0	0	**0**
Hen harrier	0	0.114	0.012	**0.125**
Curlew	0.064	0.056	0.054	**0.110**
Lapwing	0.003	0.008	0.021	**0.028**
Redshank	0	0	0	**0**
Ringed plover	0	0	0	**0**
Oystercatcher	0	0.002	0.002	**0.004**
Snipe	0.0008	0.009	0.089	**0.098**
Common sandpiper	0	0.000	0.001	**0.001**
Golden plover	0	0	0	**0**

Geese

8.7.78 **Impact:** Birds flying across the site may be subject to a collision risk with turbines or other infrastructure.

8.7.79 **Nature Conservation Importance and relevant Conservation Status:** Moderate and favourable at a national and regional/NHZ scale for pink-footed goose and greylag goose.

8.7.80 **Magnitude of Change:** collision risk modelling conducted using 2014-15 data provided an estimated pink-footed goose annual collision rate of 0.254 (one collision every four years), and one greylag goose collision every five years, following Band *et al.* (2007) methods and SNH (2013) guidance on avoidance rates to use in the model (see Appendix 8.1, Annex E for details). Only one “at-risk” greylag goose flight, and no pink-footed goose flights were recorded during surveys in 2009 to 2010.

8.7.81 The loss of one pink-footed goose and one greylag goose on average around every 4-5 years is considered to be of negligible magnitude in relation to the respective national populations, for example when put into the wider context of shooting bag numbers each year across the UK and Iceland.

8.7.82 **Significance of Effect:** The effect is classified as **negligible** and is therefore not significant in the context of the EIA Regulations.

Black Grouse

8.7.83 **Impact:** Birds flying within the site may be subject to a collision risk with turbines or other infrastructure. 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 Grünschachner-Berger (2009) 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 wind farms were constructed in the Alpine zone in Austria.

8.7.84 Nature Conservation Importance and relevant Conservation Status: Moderate and unfavourable at a national and regional/NHZ scale.

8.7.85 **Magnitude of Change:** No "at-risk" black grouse flights were recorded across the site during baseline flight activity surveys in 2014 to 2015 or 2009 to 10. It is acknowledged that nearby habitat, including the Hagshaw Hill Wind Farm Extension Black Grouse Management Plan unit may be suitable for black grouse. 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.

8.7.86 There is potentially some risk to black grouse from structures such as any railings of steps associated with wind turbines. However, based on the distribution of lekking black grouse away from the site, and the relatively poor habitat within the site, the likelihood of this occurring is very low. The magnitude of change from collision with turbine infrastructure on black grouse is therefore considered to be negligible spatial and long-term temporal on the regional population.

8.7.87 **Significance of Effect:** The effect is classified as **negligible** and is therefore not significant in the context of the EIA Regulations.

Hen Harrier

8.7.88 **Impact:** Hen harriers flying within the site may be subject to a collision risk with turbines or other infrastructure, thereby almost certainly resulting in the death of the individual.

8.7.89 **Nature Conservation Importance and relevant Conservation Status:** Moderate and unfavourable at a national and regional/NHZ level.

8.7.90 **Magnitude of Change:** collision risk modelling conducted using 2014-15 data provided an annual collision rate of 0.125 birds, or one hen harrier collision every 8.0 years (see Appendix 8.1, Annex E for details). No "at-risk" flights were recorded during the 2009 to 2010 surveys.

8.7.91 Results of flight activity surveys in 2014-15 (Table 8.7) show that only two of 47 flights were recorded during the 2015 breeding season (and none in the 2010 breeding season), indicating that breeding within the NHZ will most likely be unaffected by collision mortality (with a predicted 0.012 collisions per year, or one collision every 83 years, from the results in Table 8.13). The Scottish breeding population has been estimated at 460 pairs in 2016[2], and the additional annual mortality associated with the Revised Development would represent an increase by 0.007 % (based on a background adult mortality rate of 0.19 (BTO BirdFacts[3])).

8.7.92 The Scottish non-breeding population has been estimated to be 1,050 to 1,540 individuals (Forrester *et al.* 2007) and an additional mortality of 0.114 birds per year would result in an increase to the baseline annual mortality rate by 0.06 %.

[2] https://www.rspb.org.uk/our-work/rspb-news/news/443191--uk-hen-harrier-population-suffers-decline-according-to-latest-figures

[3] http://blx1.bto.org/birdfacts/results/bob2610.htm

8.7.93 In addition, the predicted mortality rates are likely to be an overestimate, based on the flight activity height survey bands used in the field during the 2014-15 baseline surveys. The lowest height band used was 0-30 m, and with the lower rotor tip height being 20 m, all flights lower than 20 m also had to be included in collision risk calculations. In reality, many of the hen harrier flights were likely to have been at altitudes lower than 20 m and therefore would not be at risk of collision.

8.7.94 Based on the information available, the magnitude of change is predicted to be long-term and low in relation to the Scottish wintering, and NHZ/regional breeding populations.

8.7.95 **Significance of Effect:** The overall effect on the hen harrier population is therefore assessed as **minor adverse** and therefore not significant in the context of the EIA Regulations.

Wader Assemblage

8.7.96 **Impact:** waders flying within the site, either displaying, foraging or commuting, may be subject to a collision risk with turbines or other infrastructure.

8.7.97 **Nature Conservation Importance and relevant Conservation Status:** Moderate and unfavourable at a national and regional/NHZ level.

8.7.98 **Magnitude of Change:** a summary of collision rates for each species is shown in Table 8.13. The species with the most frequent annual collision rate was curlew, with 0.110 collisions per season, or one every 9.0 years. Lower mortality rates were also predicted for lapwing, oystercatcher and snipe.

8.7.99 Curlew, oystercatcher, lapwing and snipe were recorded flying "at-risk" in the 2009 to 2010 survey period, and produced relatively similar low levels of annual collision rates.

8.7.100 With two or three collisions predicted to occur during the lifetime of the Revised Development for curlew, and at most one collision for other wader species, the magnitude of change is predicted to be negligible and long-term in relation to the regional/NHZ populations.

8.7.101 **Significance of Effect:** The overall effect on the wader assemblage is therefore assessed as **negligible** and therefore not significant in the context of the EIA Regulations.

Decommissioning

8.7.102 Decommissioning impacts, because of the long timeframe until their occurrence (>25 years) are difficult to predict with any confidence. They are however considered for the purpose of this chapter to be similar to those of construction impacts in nature, but are likely to be of shorter duration. The significance of effects predicted for each VOR in the Construction Effects section are therefore considered appropriately precautionary for assessing decommissioning effects.

8.8 Mitigation

8.8.1 No unmitigated significant effects were predicted in relation to construction, operation or decommissioning of the Revised Development, and so under the terms of the EIA Regulations, no mitigation measures are required. This section however describes the voluntary mitigation relevant to ornithology that the Applicant proposes to implement in order to further reduce the likelihood of significance of any effects.

Pre-construction

8.8.2 A Construction Environmental Management Plan (CEMP) will be agreed prior to construction commencing. This will be agreed with SLC and relevant statutory consultees. The CEMP will include details of mitigation, good practice construction methods, pollution prevention measures, compliance with ecological legislation and protection of biodiversity.

8.8.3 As part of the CEMP, a Breeding Bird Protection Plan (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 Revised Development site. Likely measures may include, but will not be limited to, appropriate buffer distances from confirmed nest sites, toolbox talks and ornithological monitoring.

Construction and Decommissioning

Black Grouse

8.8.4 Surveys for lekking black grouse will be completed immediately prior to, and during the construction phase in March, April and May. Should any leks be identified within the site, a 500 m disturbance buffer will be established and no activity should occur in these areas during the periods from one hour before dawn to 09:00 and after 18:00 to one hour after dusk within the black grouse breeding season, April to July, unless otherwise agreed with SNH. An Ecological Clerk of Works (ECoW) will oversee the implementation of the above measures.

Other species

8.8.5 Based on the level of significance of effect predicted during construction and decommissioning for all other species, no specific mitigation measures are required. The BBPP outlined above will help avoid disturbance to breeding birds on the Revised Development site.

Operation

8.8.6 The Hagshaw Hill Extension Black Grouse Management Plan has aimed to increase the local population of the species by tree planting adjacent to the western boundary of the site, as well as along the Robshill Burn, plus moorland management (see paragraph 8.7.29).

8.8.7 As detailed in the assessment above, the presence of the proposed turbines could reduce the quality of two areas for black grouse management to the west of immediate south of the site. To offset this potential loss, it is proposed to increase tree and shrub planting along the watercourse beside Rob's Hill – around the existing planting for Hagshaw Hill Extension. This planting will replace the two Hagshaw areas affected by the turbines (8.65ha) and the previously proposed MU3 within the original Douglas West ES (3.15ha). This mitigation will increase the amount of habitat suitable for black grouse within the area, and also help offset any possible losses in habitat availability because of the presence of infrastructure in proximity to the Hagshaw Hill Extension management areas. Further details on the black grouse mitigation proposals are included within the Outline Habitat Management Plan (HMP) in Appendix 7.8.

8.8.8 Based on the level of significance of effect predicted during operation for all other species, no specific mitigation measures are required. However, the Applicant proposes to implement positive habitat management measures aimed at improving the habitat left by the previous opencast activity within the site for species such as black grouse, curlew, lapwing and golden plover. This will comprise managing heath habitats and grazing densities, plus creation of small ponds/scrapes to enhance invertebrate resource for feeding waders and their chicks (refer to Appendix 7.8 for further details).

8.9 Residual Effects

8.9.1 As a result of the mitigation measures outlined in section 8.8, the residual significance associated with all impacts can either be retained at **minor adverse** or reduced to **negligible**, and therefore not significant within the context of the EIA Regulations.

8.10 Cumulative Assessment

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

8.10.2 SNH (2012) has provided guidance on assessing the cumulative impacts 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*".

8.10.3 Cumulative effects may include cumulative disturbance-displacement, collision mortality, habitat loss or barrier effects. Cumulative impacts of collision risk should generally be summed quantitatively, but according to SNH (2012) "*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".

8.10.4 For a cumulative assessment, SNH generally considers an NHZ-level assessment appropriate for breeding species of wider countryside interest. NHZ 19 however, currently has over 100 wind farm projects at some stage between scoping and operational[4], and so a more manageable approach has been considered in this instance. There is a cluster of other projects in the local area (all wind farms) which have reasonably similar habitat, and from baseline survey results, a similar bird assemblage. Details of these projects are shown in Table 8.14 and on Figure 8.4. A cumulative assessment has therefore been made of these local projects combined with the Revised Development, which can then be put within the context of the wider NHZ or national populations.

Table 8.14 – Other Projects Considered Within the Cumulative Impact Assessment

Project	Status	Distance from nearest turbine	Number of Turbines	Scoped in/out
Dalquhandy	Consented	0.37 km	15	In
Hagshaw Hill & Ext.	Operational	1.59 km	26 + 20	In (extension)
Poniel	Consented	1.66 km	3	In
Cumberhead (Nutberry Extension)	Consented	2.13 km	11	In
Nutberry	Operational	2.84 km	6	In
Galawhistle	Operational	3.94 km	22 (20 in SL)	In
Broken Cross	Consented	4.45 km	7	In

8.10.5 Some projects that have been operational for a lengthy period do not have readily available information, and if they do, are generally not of a standard now required for impact assessments of wind farms. Where this is the case, projects have been excluded from the cumulative assessment (here, Hagshaw Hill original). For such projects, impacts are already likely to be incorporated into the baseline results, and so double-counting of effects would result.

Geese

Disturbance-displacement

8.10.6 As noted above in Section 8.5, pink-footed goose and greylag goose were recorded on occasion using the waterbodies within the neighbouring Dalquhandy Wind Farm site for roosting purposes, with small numbers of greylag geese using the waterbody within the site on occasion. If all local wind farm projects became operational, it is more likely than not that birds would cease to use these areas for roosting purposes, and so a staging location during autumn migration could be lost. The waterbodies on the Dalquhandy site are a legacy of the mining operations and subsequent restoration measures, and so it is unlikely that that site is an established site for geese to use each year, and baseline results from each project suggests that utilisation has been intermittent. A roost site may also be lost at Broken Cross (Table 8.14) but specific habitat management was due to be explored with SNH in order to mitigate for this loss. At Cumberhead, a small number of greylag geese, part of the local feral population, were recorded using the open ground to the north, which is also considered to be a stopover roost for a winter passage population of pink-footed goose. There

[4] According to SNH's Natural Spaces Onshore Windfarm Proposals GIS database dated 4th March 2015. http://gateway.snh.gov.uk/natural-spaces/index.jsp

were no predicted disturbance-displacement impacts on these species in the project's Environmental Statement however.

8.10.7 With the cluster of local wind farms that may become operational in future years comes a risk that the area may prove to be a barrier to movements of geese. However, results from the Revised Development and other local projects show that the area does not appear to be an important part of a daily commuting route, and that most flights are long-distance, migratory in nature. These flights are often at heights above turbine rotor heights, and even if not, the increase in flight distance and duration incurred will be negligible compared to the overall distance required to travel.

8.10.8 The overall cumulative disturbance-displacement effect on geese is assessed as **minor adverse** at worst on the national/flyway populations, and therefore not significant in the context of the EIA Regulations.

Collision Risk

8.10.9 Pink-footed and greylag geese were recorded flying over the local project sites, albeit on a relatively infrequent basis. Nevertheless, collision modelling was undertaken for the Dalquhandy, Poniel, Cumberhead, Galawhistle and Broken Cross projects, giving a total estimated mortality of up to 4.6 pink-footed goose collisions per year when including the Revised Development, and 0.67 greylag goose collisions per year when including the Revised Development. Much of the pink-footed goose collision estimate was attributed to the Broken Cross Wind Farm.

8.10.10 When considering the peak counts of roosting pink-footed goose on nearby Dalquhandy ponds (1,361 pink-footed geese and 185 greylag geese), this represents negligible increases in mortality to the local population, and therefore consequently the national/flyway populations, particularly when taken within the context of the British Association for Shooting & Conservation (BASC) recommend bag limits (per hunter per day) of two greylag and five pink-footed goose (Crabtree *et al.* 2010).

8.10.11 The overall cumulative collision risk effect on geese is assessed as **negligible** on the national populations, and therefore not significant in the context of the EIA Regulations.

Table 8.15 – Predicted Cumulative Impacts Relating to Pink-footed Goose

Project	Disturbance-displacement	Collision Rate
Revised Development	Potential disturbance to an occasionally used roost area.	0.254 collisions per year
Dalquhandy[1]	Pink-footed geese were observed utilising the water bodies within the site as well as flying over. Geese were additionally observed roosting on the large water bodies in the southern portion of the site (in significant numbers during September and October 2012). The operational wind farm could potentially result in habitat fragmentation as a result of barrier effects. (Minor adverse significance predicted).	0.90 collisions per year
Hagshaw Hill & Ext.[2]	Not assessed	Not assessed
Poniel[3]	11 flights recorded during the core autumn, winter and spring migration period (September 2011 to May 2012). Loss of potential feeding habitats is minimal.	0.47 to 0.65 collisions per year
Cumberhead[4]	Area to the north is considered to be a stopover roost for a winter passage population of pink-footed goose. Species not assessed.	0.025 collisions per year

Project	Disturbance-displacement	Collision Rate
Nutberry[5]	A small amount of pink-footed goose activity, recorded on nine occasions in the 2005 autumn period (revised layout). As the use of the site is more or less confined to very infrequent overflying, the impact of disturbance was considered to be negligible.	No CRM undertaken - all flights recorded were above potential collision height (revised layout).
Galawhistle[6]	Pink-footed goose does not use the application site or general vicinity for foraging, roosting or breeding.	0.85 collisions per year (99% avoidance rate)
Broken Cross[7]	Recorded throughout the core autumn/ winter and spring migration periods with total number of birds estimated at 4,599 individuals. During the latter half of the winter pink footed geese (maximum estimated flock size of 758) utilised the northern portion of the site as a roosting site.	1.95 collisions per year (99% avoidance rate)

[1] from Dalquhandy Environmental Impact Assessment: Supplementary Environmental Information (SRG Renewables Ltd. February 2013).

[2] from Hagshaw Hill Windfarm Extension Environmental Statement.

[3] from Poniel Environmental Impact Assessment: Supplementary Environmental Information (SRG Renewables Ltd. February 2013).

[4] from Cumberhead Wind Farm Environmental Statement (May 2015)

[5] from Nutberry Wind Farm Environmental Statement (September 2006)

[6] from Galawhistle Wind Farm Environmental Statement (Infinis, March 2010)

[7] from Broken Cross Wind Farm Environmental Statement (WSP Environment & Energy / WYG Planning & Environment, October 2012)

Table 8.16 – Predicted Cumulative Impacts Relating to Greylag Goose

Project	Disturbance-displacement	Collision rate
Revised Development	Potential disturbance to an occasionally used roost area.	0.198 collisions per year
Dalquhandy	Greylag goose were considered to be of low ornithological value as it was considered that the birds are feral greylag geese. This species was observed both utilising the airspace above the site and also roosting and breeding on the water bodies within the site boundary. The operational wind farm could potentially result in habitat fragmentation as a result of barrier effect. (Minor adverse significance predicted).	0.05 collisions per year
Hagshaw Hill & Ext.	Not assessed	Not assessed
Poniel	9 flights recorded during baseline surveys, mainly in wider area. Loss of potential feeding habitats is minimal.	One 'at-risk' flight and no CRM conducted.

Project	Disturbance-displacement	Collision rate
Cumberhead	A small number of feral greylag geese recorded using the open ground to the north. Not assessed	0.013 collisions per year
Nutberry	Not recorded during autumn migration surveys (revised layout). As the use of the site is more or less confined to very infrequent overflying, the impact of disturbance was considered to be negligible.	No CRM undertaken (revised layout).
Galawhistle	Greylag goose does not use the application site or general vicinity for foraging, roosting or breeding.	0.41 collisions per year (99% avoidance rate)
Broken Cross	Not assessed	Not assessed

Black Grouse

Disturbance-displacement

8.10.12 The Revised Development site appears to be un-favoured by black grouse, although the wider local area has hosted up to four lek sites (with 4 to 6 males) in the past. Further afield, lek sites have been recorded over 1 km west of Nutberry and Galawhistle. The construction of Hagshaw Hill Extension required mitigation of potential impacts on black grouse via habitat management, which is currently being monitored. Black grouse remain present in the local area, albeit at lower numbers than recorded in 2003 to 2004, although it is not clear whether the reduction is due to the presence of the wind farm, or based on wider species' population trends. Nevertheless, if all wind farm projects are consented, it is considered less likely that the Hagshaw Hill Extension black grouse management plan will attain its aim of a return to former numbers. With the Southern Uplands population being an estimated 133 males attending 41 leks, this represents a low to medium impact on the regional/NHZ population. If the Revised Development carries out mitigation measures that are sympathetic with the Hagshaw Hill Extension management plan (habitat management is also planned at Cumberhead) however, it is predicted that a small number of birds are likely to remain in the local area, and habitat fragmentation will be avoided. As such a low magnitude of change is predicted, resulting in a **minor adverse** cumulative effect, which is not significant within the context of the EIA Regulations.

Collision Risk

8.10.13 None of the local projects, including the Revised Development, undertook collision risk modelling for black grouse due to the lack of "at-risk" flights recorded during baseline surveys (see Table 8.16). The magnitude of change predicted is therefore negligible and thus the level of significance is considered to be **negligible** and not significant within the context of the EIA Regulations.

Table 8.17 – Predicted Cumulative Impacts Relating to Black Grouse

Project	Disturbance-displacement	Collision rate
Revised Development	No lekking activity located within 500 m of infrastructure but birds may occasionally be present within or adjacent to site boundary. Disturbance-displacement considered to be Minor adverse within the context of the local population.	No CRM undertaken as no "at-risk" flights were recorded.
Dalquhandy	No records during baseline surveys	No records during baseline surveys.
Hagshaw Hill & Ext.	4 to 6 males recorded at up to 4 lekking sites within 300 m of proposed turbines. Potential for disturbance during construction minimised by spatial and temporal restrictions of construction activity around lek sites. Operational turbines at >300 m unlikely to displace leks, but foraging or nesting habitat may be lost for local population. Losses mitigated by Black Grouse Management Plan.	No CRM undertaken, and risk of collision considered to be low. 1 flight within 500 m of turbines during baseline surveys for Extension.
Poniel	Not assessed	Not assessed.
Cumberhead	Occasional records of single individuals but no lekking activity. A Habitat Management Plan will improve the fringe habitat of the woodland around the outer edges of the Cumberhead Forest for black grouse.	Not assessed.
Nutberry	Two black grouse lek sites were recorded in moorland adjacent to the site, but over 1km from the nearest turbine (original layout). Not assessed in revised layout.	Not assessed (revised layout).
Galawhistle	Active at three locations within the site but none within 1.5km of turbines, and very little evidence of site usage.	No CRM undertaken. 2 flights recorded, neither "at-risk".
Broken Cross	Not assessed	Not assessed.

Hen Harrier

Disturbance-displacement

8.10.14 It was predicted that the Revised Development would result in low levels of disturbance and displacement of non-breeding hen harriers, but this would not significantly affect the ability of individuals to successfully forage in the local area. Hen harriers were recorded foraging within the EIA Study Areas of most other local wind farm projects (Table 8.17), and so the amount of foraging habitat potentially lost to individuals is likely to increase cumulatively. The western part of the local area (see Figures 8.1 and 8.4) is reasonably close to the Muirkirk and North Lowther Uplands SPA, and although no direct connectivity between the Revised Development site and the SPA is likely,

evidence from the baseline surveys at Galawhistle for example (Table 8.17) suggests that suitable habitat between the local area and the SPA is continuous, therefore indicating that alternative foraging habitat would be available to those individuals that may be displaced by projects. As such, a low magnitude of change is predicted, resulting in a **minor adverse** cumulative effect, which is therefore not significant within the context of the EIA Regulations.

Collision Risk

8.10.15 Hen harriers were recorded foraging within most of the local wind farm sites, in varying frequencies. Collision modelling was undertaken for the Nutberry, Galawhistle and Cumberhead projects, giving a total estimated mortality of up to 0.044 hen harrier collisions per year (0.169 when including the Revised Development). This equates to a cumulative collision rate of one bird every 6 years. Although this represents a potential increase in baseline mortality within a population in unfavourable conservation status, such mortality is unlikely to significantly affect the trajectory of the long-term population trend, and so a low magnitude of change is predicted, resulting in a **minor adverse** cumulative effect, which is therefore not significant within the context of the EIA Regulations.

Table 8.18 – Predicted Cumulative Impacts Relating to Hen Harrier

Project	Disturbance-displacement	Collision rate
Revised Development	Some loss of available foraging habitat, but low magnitude within the context of the wider area.	0.125 collisions per year
Dalquhandy	Six flights of hen harrier were recorded over the course of the vantage point surveys. All flights related to birds hunting over the site and wider area with no evidence of birds roosting within the site or 500 m buffer observed.	No CRM undertaken but considered unlikely that a collision would occur within lifespan of wind farm.
Hagshaw Hill & Ext.	Recorded foraging infrequently throughout the year. Site considered unlikely to form part of an important habitat for foraging.	No CRM undertaken, and risk of collision considered to be low. 4 flights within 500m of turbines during baseline surveys for extension.
Poniel	Not assessed	Not assessed
Cumberhead	No breeding evidence. Occasional presence of foraging birds during flight activity surveys in non-breeding season. Displacement unlikely.	0.013 collisions per year
Nutberry	Revised layout: during the breeding season, hen harriers were recorded hunting at treetop height (below collision height) over the closed canopy forestry on three occasions. However, there were no flights observed in the vicinity of the proposed turbines at potential collision risk height. No recorded use of clearfell.	0.019-0.023 per year (95% avoidance rate)
Galawhistle	Potential for disturbance-displacement from foraging areas for SPA or SPA-associate birds throughout the year. However, since the site is not within the core foraging range of	0.008 collisions per year.

Project	Disturbance-displacement	Collision rate
	a breeding pair any such effects would have no more than a Minor impact at any level.	
Broken Cross	Not assessed	Not assessed

Wader Assemblage

Disturbance-displacement

8.10.16 The results of the baseline surveys for local wind farm projects (Table 8.9 and Table 8.18) show that the wader assemblage is similar across the whole local area. Because of the overlapping EIA Study Areas between projects, and the likely local shifts in breeding distributions for each species between years, it is not clear what the total wader population is, since there is a chance that some breeding territories may have been counted within more than one EIA Study Area. However, cumulatively there are some reasonably high numbers of territories of some wader species in the local area, which may reach district importance. However, only a small proportion of these are likely to be affected by the various developments, with many located well away from turbines.

8.10.17 The local area has over its recent history been subject to a good deal of human pressure, whether it be opencast works, wind farm construction or farming. There appears to therefore be a level of tolerance to the presence of human activity, although it is likely that further development pressure will result in the loss of at least some breeding territories, with curlew highlighted as being at risk at Hagshaw Hill Extension and Galawhistle. A small number of territories are likely to be lost from the local area, and although the regional populations of wader species are unknown, this is likely to reach at worst a low magnitude of change, resulting in a **minor adverse** cumulative effect, which is therefore not significant within the context of the EIA Regulations.

Table 8.19 – Predicted cumulative impacts relating to wader assemblages

Project	Disturbance-displacement	Collision rate
Revised Development	Up to 14 wader territories may be affected (two pairs each of lapwing, common sandpiper and curlew, single redshank and seven snipe pairs).	0.110 curlew p.a. 0.028 lapwing p.a. 0.098 snipe p.a. 0.004 oystercatcher p.a.
Dalquhandy	Although a number of breeding territories for lapwing, curlew, oystercatcher, snipe, common sandpiper and redshank were identified it is unlikely that the Revised Development will result in the long term direct loss of territories as all infrastructures is located out with these areas. Golden plover was recorded during the non-breeding season roosting on the island in the water body to the east of the Site which is located within the 500 m EIA Study Area. In total, 29 flights were observed, the majority adjacent to the large water bodies within the 500 m wider EIA Study Area. Golden plover were also recorded in the breeding season but, no evidence of breeding was observed.	0.02 golden plover p.a. <0.001 lapwing p.a. 0.003 curlew p.a. 0.015 snipe p.a.
Hagshaw Hill & Ext.	5 pairs of curlew within 300m of turbines predicted to be displaced by Extension.	0.022 golden plover p.a. <0.01 lapwing p.a. 0.003 curlew p.a. 0.016 snipe p.a.

Project	Disturbance-displacement	Collision rate
Poniel	Only golden plover (winter), oystercatcher and curlew (non-breeding) recorded within site boundary. Some loss of foraging habitat likely but minimal.	0.03 curlew p.a. 0.003 golden plover p.a. 0.01 oystercatcher p.a.
Cumberhead	Curlew confirmed as breeding in relatively high numbers in suitable upland habitat particularly towards the west of the survey area (away from turbines) with nine confirmed territories and a further four probable territories. Up to four snipe territories. Lapwing also probable breeder. Presence of winter flocks of golden plover up to 200 individuals in flight.	0.013 curlew p.a. 0.628 golden plover p.a.
Nutberry	Some wader species recorded in wider area within open ground but well away from turbines. A single golden plover flight was recorded during the breeding season.	0.162 golden plover p.a. 0.178 curlew p.a. (95% avoidance rate)
Galawhistle	Operation of the wind farm would lead to long-term disturbance of five pairs of curlew within 250m. No foraging golden plovers were observed within the EIA Study Area.	0.291 curlew p.a. 0.048 golden plover p.a. 0.017 lapwing p.a. 0.032 snipe p.a.
Broken Cross	Potential loss of two ringed plover territories, and displacement from a further two. Some minimal loss of foraging habitat for other wader species.	0.002 curlew p.a. 0.02 golden plover p.a.

Collision Risk

8.10.18 Similar ranges of estimates of collision rates for each breeding wader species were presented across the local projects, including the Revised Development. Cumulatively 0.630 curlews are predicted to collide with turbines each year, which equates to one collision every 1 to 2 years. For other species, cumulative collision rates were one lapwing every 18 years, one snipe every 6 years, and one oystercatcher every 71 years. For golden plover, predominantly present in winter months, the annual mortality rate was 0.903 birds, largely due to the sizeable flocks recorded on occasion at Cumberhead. Based on flight activity survey results however, the Revised Development would not contribute anything to this collision rate (no "at-risk" flights recorded).

8.10.19 Although these values represent an increase in baseline mortality within an assemblage in unfavourable conservation status, such mortality rates are unlikely to significantly affect the trajectory of the long-term population trends at a regional level, and so a low magnitude of change is predicted, resulting in a **minor adverse** cumulative effect, which is therefore not significant within the context of the EIA Regulations.

8.11 Summary

8.11.1 Various data have been used to ascertain the baseline ornithological interests within the Revised Development site and surrounding area. This includes surveys carried out in 2014 to 2015 and 2009 to 2010 within the site, as well as results of studies on behalf of other local wind farm developments in recent years. All surveys show that there has been a relatively similar bird assemblage present over time in the local area.

8.11.2 It was agreed with SNH that there is no connectivity between the Revised Development site and any SPA. The VORs identified from baseline surveys were pink-footed goose, greylag goose, black grouse, hen harrier and the breeding wader assemblage. The site is of relatively low sensitivity, with no records of target raptor species breeding within 2 km, and black grouse lekking activity confined to areas outside of the site.

8.11.3 The potential impacts on VORs identified and assessed were construction disturbance, habitat loss, operational disturbance and displacement and collision risk. No significant effects were predicted as a result of the construction and operation of the Revised Development, either alone or cumulatively with other projects, particularly when mitigation measures outlined in Section 8.7 are implemented. An overall summary of effects is presented in Table 8.20 below.

Table 8.20 – Summary Table

Description of Effect	VOR	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect		Comparison with the Consented Development
		Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse	
During Construction / Decommissioning							
Construction disturbance	Geese	Minor	Adverse	-	Minor	Adverse	No Change
	Black grouse	Minor	Adverse	Pre-construction surveys; spatial and temporal restrictions around lek sites	Negligible	Neutral	No Change
	Hen harrier	Minor	Adverse	-	Minor	Adverse	No Change
	Waders	Minor	Adverse	-	Minor	Adverse	No Change
Habitat loss	Geese	Negligible	Neutral	-	Negligible	Neutral	No Change
	Black grouse	Negligible	Neutral	-	Negligible	Neutral	No Change
	Hen harrier	Minor	Adverse	-	Minor	Adverse	No Change
	Waders	Minor	Adverse	-	Minor	Adverse	No Change
During Operation							
Operational disturbance and displacement	Geese	Negligible	Neutral	-	Negligible	Neutral	No Change
	Black grouse	Minor	Adverse	Additional Habitat Enhancement to the west of the site.	Negligible	Neutral	No Change
	Hen harrier	Minor	Adverse	-	Minor	Adverse	No Change
	Waders	Minor	Adverse	Habitat management across the site	Minor	Adverse	No Change
Collision risk	Geese	Negligible	Neutral	-	Negligible	Neutral	No Change

Description of Effect	VOR	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect		Comparison with the Consented Development
		Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse	
	Black grouse	Negligible	Neutral	-	Negligible	Neutral	No Change
	Hen harrier	Minor	Adverse	-	Minor	Adverse	No Change
	Waders	Negligible	Neutral	-	Negligible	Neutral	No Change
Cumulative Effects							
Disturbance and displacement	Geese	Minor	Adverse	-	Minor	Adverse	No Change
	Black grouse	Minor	Adverse	-	Minor	Adverse	No Change
	Hen harrier	Minor	Adverse	-	Minor	Adverse	No Change
	Waders	Minor	Adverse	-	Minor	Adverse	No Change
Collision risk	Geese	Negligible	Neutral	-	Negligible	Neutral	No Change
	Black grouse	Negligible	Neutral	-	Negligible	Neutral	No Change
	Hen harrier	Minor	Adverse	-	Minor	Adverse	No Change
	Waders	Minor	Adverse	-	Minor	Adverse	No Change

8.12 References

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