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 Proposed Development on ornithological features present.

8.1.2 Field surveys were conducted in accordance with NatureScot consultation advice and relevant guidance during the 2019 breeding season and 2019-20 non-breeding season in order to determine the current breeding and non-breeding assemblage within the study area. Ornithological surveys have regularly taken place for wind farm projects close to the Proposed Development site over the last 15 years and as a result, a number of adjacent projects' survey areas have at least in part overlapped spatially with the Proposed Development site. The assessment therefore utilises relevant long-term data recorded for local wind farm sites as well as the 2019-20 survey results.

8.1.3 In general, the bird assemblage recorded in 2019-20 corresponded with results of surveys undertaken for other wind farm projects in the local area, with few target species sensitive to wind farm development present within the site. Ornithological features taken forward to the assessment included those recorded breeding during historic surveys within the 2 km study area but showed no breeding evidence in 2019-20. These comprised: hen harrier, merlin, goshawk, black grouse, curlew and golden plover. Due to potential connectivity with the Proposed Development, the Muirkirk and North Lowther Uplands Special Protection Area (SPA) (and associated Muirkirk Uplands Site of Special Scientific Interest (SSSI)) was scoped into the assessment.

8.1.4 The ornithological assessment identified habitat loss and disturbance during the construction and decommissioning phases, and displacement, collision risk and lighting effects during the operational phase, as potential impacts. Unmitigated effects from construction, operation and decommissioning activities on all ornithological features were assessed as being at worst minor adverse and not significant in the context of the EIA Regulations. The likelihood of a significant effect is reduced by the consideration of mitigation and enhancement measures in the form of a Breeding Bird Protection Plan during the construction period, and a Habitat Management Plan (HMP) during the operational period.

8.1.5 It was considered that, particularly when mitigation and enhancement measures are implemented, the magnitude of impacts of the Proposed Development on all ornithological features would contribute very little to the overall cumulative effect for each potential impact at a regional level, and so no significant cumulative effects due to the impact of the Proposed Development alongside other projects were concluded.

8.1.6 Information to inform an Appropriate Assessment as part of the Habitats Regulations Appraisal (HRA) process was presented separately in Appendix 8.3, and it was concluded that there was no potential of the Proposed Development to adversely affect the integrity of the Muirkirk and North Lowther Uplands SPA, either alone or in-combination with other projects.

8.2 Introduction

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

- describe the ornithological baseline;
- describe the assessment methodology and significance criteria used in completing the assessment;
- describe the potential unmitigated effects of predicted impacts (direct or indirect) on Important Ornithological Features (IOFs);
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation, including cumulatively with other wind farm projects.

8.2.2 This chapter is supported by three appendices:

- Appendix 8.1: Ornithology, which contains the following Annexes:
  - Annex A – Ornithological legal protection;
  - Annex B – Ornithological survey methodology;
  - Annex C – Ornithological survey effort and general information;
  - Annex D – Ornithological survey results;
  - Annex E – Collision Risk Assessments; and
  - Annex F – Review of the effects of artificial light on birds in relation to deployment of obstruction lighting on turbines.
- Appendix 8.2: Ornithology Scoping Report which was provided to NatureScot (formerly Scottish Natural Heritage (SNH)) in October 2019 to reach agreement that a robust ornithological impact assessment for the Proposed Development could be undertaken based on available field survey and desk study information (see Table 8.1); and
- Appendix 8.3: Habitats Regulations Appraisal, which provides information to inform and Appropriate Assessment on the potential effects on Natura sites, specifically in relation to qualifying features of the Muirkirk & North Lowther Uplands Special Protection Area (SPA).

8.2.3 This chapter is also supported by the following figures:

- Figure 8.1: Ornithological Designated Sites within 20 km;
- Figure 8.2: Wind Farm Projects within the Hagshaw cluster plus any others within 2 km;
- Figure 8.3: Site Boundary and Study Areas;
- Figure 8.4: Vantage Points and Viewshed;
- Figure 8.5: Raptor Flight Activity Results: 2019 Breeding Season and 2019-20 non-breeding season;
- Figure 8.6: Golden plover, herring gull and pink-footed goose Flight Activity Results: 2019 Breeding Season and 2019-20 non-breeding season;
- Figure 8.7: Wader Activity: 2019 Breeding Season and 2019-20 non-breeding season;

- Figure 8.8: Black Grouse Historic Records;
- Confidential Figure 8.2.1: Hen Harrier, Merlin and Peregrine Breeding Activity; and
- Confidential Figure 8.2.2: Goshawk Breeding Activity.

8.3 Legislation, Policy and Guidelines

Legislation

8.3.1 Relevant European legislation has been reviewed and taken into account as part of this ornithological assessment. Of particular relevance is the following European legislation:

- Directive 2009/147/EC on the Conservation of Wild Birds ('Birds Directive'; European Commission, 2016a);
- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) ('Habitats Directive'; European Commission, 2016b); and
- Environmental Impact Assessment Directive 2014/52/EU (European Commission, 2016c).

8.3.2 The following national legislation is also considered as part of the ornithology assessment:

- The Wildlife and Countryside Act 1981 (as amended);
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (The Habitats Regulations);
- The Nature Conservation (Scotland) Act 2004 (as amended); and
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

Planning Policy

8.3.3 Chapter 5: Planning Policy 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 (LDP) (2015) and the proposed LDP 2 (2020), due for adoption in early 2021. This assessment also considers the relevant aspects of Scottish Planning Policy (SPP), Planning Advice Notes and other relevant guidance. Of relevance to ornithology, regard has been had to the following policies:

- UK Post-2010 Biodiversity Framework (2012);
- *Scottish Biodiversity Strategy*: It's in Your Hands (2004)/2020 Challenge for Scotland's Biodiversity (2013); and
- Scottish Government (2017). Planning Advice Note 1/2013-Environmental Impact Assessment, Revision 1.0.

Guidance

8.3.4 Recognisance has been taken of the following guidance:

- CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.
- Eaton M.A., Aebischer N.J., Brown A.F., Hearn R.D., Lock L., Musgrove A.J., Noble D.G., Stroud D.A. and Gregory R.D. (2015). *Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man*. British Birds 108, 708–746;
- European Commission (2010). Natura 2000 Guidance Document *'Wind Energy Developments and Natura 2000*'. European Commission, Brussels;

- NatureScot (2020a). *General pre-application and scoping advice for onshore wind farms*. Guidance.
- NatureScot (2020b). *The Effect of Aviation Obstruction Lighting on Birds at Wind Turbines, Communication Towers and Other Structures.* NatureScot Information Note.
- Scottish Natural Heritage (SNH) (2000). *Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action*. SNH Guidance Note;
- SNH (2016a). *Assessing connectivity with Special Protection Areas (SPAs)*. Version 3;
- SNH (2016b). *Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees* Version 2;
- SNH (2017) *Recommended Bird Survey Methods to inform impact assessment of Onshore Windfarms*.
- SNH (2018a). *Assessing significance of impacts from onshore windfarms on birds out with designated areas*. Version 2
- SNH (2018b). *Assessing the cumulative impacts of onshore wind farms on birds*. SNH Guidance Note;
- SNH (2018c). *Environmental Impact Assessment Handbook – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland*; and
- 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.

8.4 Consultation

8.4.1 During the pre-application EIA process, NatureScot, Royal Society for the Protection of Birds (RSPB) and South Lanarkshire Council (SLC) provided comment relating to the Ornithology Scoping Report for the Proposed Development (Appendix 8.2), and specifically the collection of baseline ornithology data which would be used to inform this assessment. A summary of the consultation responses and how they have been addressed in this Chapter is presented in Table 8.1.

Table 8.1 – Scoping Key issues

Consultee	Comment	How Addressed in Chapter
NatureScot (formerly Scottish Natural Heritage) 08 November 2019	*"we're fairly relaxed about only one year of survey for the site; the availability of the historical information and similarity in results so far seems to support a reduced need for two years' survey. However, we obviously don't know how the non-breeding activity compares with previous years yet. While we don't think this is likely to change our assessment, we'd highlight it as a possibility."*	The surveys and data sources used to obtain sufficient information to allow a robust assessment of the Proposed Development are presented in Section 8.5, Section 8.6 of this chapter and in detail in Appendix 8.1 Ornithology. Non-breeding season activity within the site in 2019-20 was low for all target species, and consistent with results of surveys undertaken for other

		nearby wind farm projects (see Section 8.6 of this chapter).
	"Although we're generally happy with the rest of the scope of proposed survey work, the one area where we don't agree with what's proposed is in respect of the upland/ moorland breeding bird surveys. Although noting that what's proposed was the approach we accepted at Douglas West Extension, as this site is adjacent to it there's potential for boundary effects on the [Muirkirk and North Lowther Uplands] *SPA. As such, some survey work beyond the defined site boundary would be helpful and would give confidence about possible edge effects during construction and operation"*	Although no formal upland breeding bird surveys were undertaken in 2019, as noted in the EIA scoping report, surveyors were asked to record signs of any breeding waders etc. during raptor/scarce breeding bird surveys out to 2 km, as well as during flight activity surveys (as outlined in Section 8.5 of this chapter). Curlew and lapwing were present in low numbers within the surrounding moorland and farmland areas during the summer of 2019 (Section 8.6). Any presence of waders were also recorded in winter walkover surveys out to 500 m from the site boundary during the 2019-20 non-breeding season (Section 8.5).
RSPB 29 July 2020	*"we would agree that one year's data is likely to be robust enough to consider the impacts of this proposal"*	The surveys and data sources used to obtain sufficient information to allow a robust assessment of the Proposed Development are presented in Section 8.5, Section 8.6 of this chapter and in detail in Appendix 8.1 Ornithology.
	"we would advise that breeding waders are included as a target species in the Environmental Impact Assessment for this project along with other designated features of [the Muirkirk & North Lowther Uplands SPA] *on adjacent ground"*	Impacts on sensitive breeding waders (curlew and golden plover) and qualifying features of the SPA were considered in the assessment and are presented in Section 8.7 of this chapter, and Appendix 8.3 respectively.
	"we would also advise that survey for black grouse should be included in survey effort"…" this assessment should be informed by survey to identify lek sites within and out with the project area"	Although no specific black grouse surveys were undertaken, evidence for black grouse was searched for during all other surveys. As a precaution, the species was

		taken forward to assessment based on historical information available from other nearby wind farm sites and is considered in the assessment Section 8.7 of this chapter.
	"We agree with the need for assessment of cumulative impact to target species and designated sites from this project and other projects within a NHZ level"	The requirement for a cumulative assessment is discussed in Section 8.10 of this chapter.
East Ayrshire Council 11 August 2020	*"The Council welcomes the confirmation that a Habitats Regulations Assessment will be undertaken in respect of the Muirkirk and North Lowther SPA. The Council expects this to be carried out to the satisfaction of the Council and SNH"*	Information to inform an HRA for the Muirkirk and North Lowther SPA is presented in Appendix 8.3.
	"I note that Hare Craig to the North East of Muirkirk, currently under consideration by East Ayrshire Council, is not included in the list"	Data from Hare Craig Wind Farm are considered in Sections 8.5 and 8.6 of this chapter.

8.5 Assessment Methodology and Significance Criteria

8.5.1 This chapter takes an appropriate and topic-specific approach to assessment of the Proposed Development within the parameters identified in Chapter 3: Proposed Development. This chapter provides a worst-case assessment of the Proposed Development for ornithology and presents sufficient information for consultees and the decision makers to comment on and determine the application within the parameters of the Proposed Development.

Site status and context

8.5.2 The site is located largely within an area of active commercial forestry within the larger Cumberhead Forest complex (refer to Chapter 7: Ecology for further details) and is adjacent to the north-eastern extent of the Muirkirk and North Lowther Uplands SPA (Figure 8.1). It is surrounded by open rough grazing moorland and historical opencast mine workings (the former Dalquhandy opencast mine being located to the east), as well as operational wind farms, the closest being Nutberry, Galawhistle and Hagshaw Hill (Figure 8.2).

Scope of Surveys

8.5.3 Consultation was undertaken with NatureScot to reach agreement on the scope of ornithological surveys required to inform the assessment (Table 8.1).

8.5.4 Survey coverage was based on the main site boundary (see Figure 8.3), where all turbines would be located. As access will be taken via existing access tracks and tracks which have been created/upgraded as part of the Douglas West Wind Farm and Douglas West Wind Farm Extension works (see Chapter 3: Proposed Development for further details), no ornithology surveys were considered necessary along the access track, In general, the commercial forestry is considered to be of low importance to bird species of conservation concern.

8.5.5 Ornithological surveys have however, regularly taken place for wind farm projects within and surrounding Cumberhead Forest, including near the access track route, over the last 15 years. As a result, a number of these projects' survey areas have overlapped spatially with the site and wider ornithology study area (Figure 8.2). It is thus considered to be the case that the ornithological baseline conditions within the site and surrounding area are well known.

8.5.6 It was therefore agreed with NatureScot (Table 8.1) that one breeding season of site-specific survey effort was sufficient to allow a robust characterisation of the baseline ornithological assemblage and usage of the site and surrounding area, when used in combination with the substantial information collated for other nearby projects (e.g. previous EIAs).

Study Area

8.5.7 The assessment focused on the site and appropriate buffer areas, as recommended by SNH (2017) guidance (see Appendix 8.1 for further details).

8.5.8 The specific study areas associated with this assessment are as follows:

- ornithological designated sites: within 20 km of the site (Figure 8.1);
- scarce breeding birds (raptors, owls and black grouse): up to 2 km buffer around the site (Figure 8.3);
- breeding birds (waders): within suitable upland habitat (non-forested), up to 500 m from the site (Figure 8.3); flight activity (Vantage Point, VP) surveys: within the turbine area a 500 m buffer of the outermost turbine locations, referred to for collision risk modelling (CRM) purposes as the Collision Risk Analysis Area (CRAA) (see Appendix 8.1: Ornithology, Annex E and Figure 8.4); and
- winter walkover surveys: up to 500 m from the site (Figure 8.3).

8.5.9 It should be noted that access to the main part of the site where all turbines would be located would be taken via existing access tracks, and tracks which would be created/upgraded as part of the Douglas West Wind Farm and Extension works (see Chapter 3: Proposed Development for further details). If the Douglas West Wind Farm Extension is not constructed in advance of the Proposed Development, then a 1.38 km section of new track would be required within the Douglas West Wind Farm Extension site boundary (see Appendix 3.3 for details on ornithology information). No additional ornithology surveys were conducted along the proposed access track, with baseline activity levels associated with ongoing commercial forestry activities likely to be similar to wind farm construction vehicular movements. Desk study results from Douglas West, Douglas West Extension and Cumberhead wind farms which have covered this route, have been considered in this chapter. The whole access route would be subject to best practice measures during construction, as outlined in section 8.8 Mitigation.

Information and Data Sources

Desk Study

8.5.10 The desk study used the following source for information on designated sites:

- NatureScot Sitelink (https://sitelink.nature.scot/home).

8.5.11 The desk study also gathered ornithological information that was available within Environmental Statements, EIA reports and associated Technical Appendices in the public domain relating to applications of the following local wind farm projects within the Hagshaw cluster and surrounding local area (see Figure 8.2). Table 8.2 outlines the timeline of baseline ornithology surveys carried out for these projects:

- Hagshaw Hill Extension Wind Farm (HHX): April 2003 to July 2004;
- Dungavel Wind Farm (DG): February 2004 to November 2005;
- Nutberry Wind Farm (NU): April 2004 to March 2006;
- Galawhistle Wind Farm (GA): September 2007 to August 2009;
- Kype Muir Wind Farm (KM); October 2008 to November 2010;

- Auchrobert Wind Farm (AR): March 2010 to August 2011;
- Kype Muir Extension Wind Farm (KMX): October 2010 to August 2013;
- Broken Cross Revised Wind Farm (BC): April 2011 to August 2012; and September 2017 to August 2018 (for revised application);
- Dalquhandy Revised Wind Farm (DQ): November 2011 to November 2012; and April to July 2017 (for revised application);
- Cumberhead Revised Wind Farm (CU): April 2013 to August 2014;
- Douglas West Wind Farm (DW): September 2014 to September 2015. Includes a report '*Final Breeding Raptor Survey Report 2015 of the Proposed Douglas West & Dalquhandy DP Renewable Energy Project*' (DES, 2015) which contains historic breeding raptor information provided by the South Strathclyde Raptor Study Group (SSRSG);
- Hare Craig Hill Wind Farm (HCH): September 2015 to August 2017;
- Hagshaw Hill Repowering Wind Farm (HHR): March to August 2018; and
- Douglas West Extension Wind Farm (DWX); March to August 2018.

8.5.12 In addition, the desk study used information relating to the following proposed local wind farm project which was not taken forward for development:

- Douglas West Community Wind Farm: November 2009 to November 2010 and a scoping visit was also carried out at the Douglas West site in September 2009. The site boundary for this project largely overlapped with the Douglas West Wind Farm.

Table 8.2 – Timeline of Baseline Ornithological Surveys Carried out at Local Wind Farm Sites

Wind farm	Year (2003 to 2018)															
	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
HHX							Operational Monitoring									
DG																
NU																
GA																
KM																
DWDQ																
AR																
KMX																
BC																
DQ																
CU																
DW																
HCH																
HHR																
DWX																

8.5.13 A range of ornithology data was collected at these wind farms during breeding and non-breeding seasons. Each wind farm covered some or all of the following survey types:

- flight activity surveys (summer, winter, spring and autumn migration watches);
- scarce breeding bird surveys (walkover surveys for raptors and any other species listed in Schedule 1 of the Wildlife and Countryside Act 1981);

- upland breeding bird surveys (waders and any other species of conservation concern) and
- winter walkover surveys (concentrating on locating species of conservation concern, e.g. hen harrier roost activity).

Field Surveys

8.5.14 Ornithological fieldwork for the Proposed Development commenced in May 2019 and was completed in March 2020, and comprised the surveys detailed below (see Appendix 8.1, Annexes B and C for further details).

Scarce breeding bird surveys:

8.5.15 Monthly surveys from June to August 2019 for breeding raptors, black grouse, waders and any other species listed in Schedule 1 of the Wildlife and Countryside Act 1981 took place within the site and a survey area buffer of up to 2 km, following survey methodologies from Hardey et al. (2013) and Gilbert et al. (1998).

Flight activity surveys:

8.5.16 Flight activity surveys were carried out each month from May 2019 to March 2020. A total of five VPs were selected to cover the site; to accommodate a design change during the 2019 breeding season, the location of VP1 (May to August 2019) was changed to VP6 (August 2019 to March 2020) in August 2019, the viewshed from VP6 was similar to VP1 (Figure 8.4).

8.5.17 It was agreed with NatureScot (Table 8.1), that one year of flight activity surveys were sufficient for the following reasons:

- Considerable information exists on flight activity surveys recorded for nearby wind farm projects, which have survey areas that either overlap with the site, or are close by; and
- The mature conifer plantation is likely to be of low habitat quality for target species such as breeding raptors or waders. Activity levels over the site are therefore likely to be very low.

8.5.18 The following wind farm projects have carried out flight activity surveys where viewsheds have at least in part overlapped with the Proposed Development site and surrounding area (see Appendix 8.2: Ornithology Scoping Report), or the respective project's Environmental Statement/ EIA Report for details of vantage point locations and associated viewsheds):

- Cumberhead Wind Farm (2013-14): Five VPs have combined coverage of approximately 80% of the site;
- Auchrobert Wind Farm (2010-11): One VP covers northernmost extent off site and surrounding moorland; and
- Nutberry Wind Farm (2005-06): no figure showing VPs was available, but grid references provided show likely considerable overlap with the site, with some similar VPs, e.g. at Nutberry Hill and Birkenhead:
  - Black Hill NS 76599 33798;
  - Nutberry Hill NS 74550 33769;
  - Little Auchinstilloch NS 75053 31596;
  - Birkenhead NS 76584 36412;
  - Disused railway NS 77627 32384;
  - Meikle Auchinstilloch NS 77091 31227; and
  - Dunside Rig NS 72600 36700.

Upland breeding bird surveys:

8.5.19 The conifer plantation habitat within the site is unsuitable for upland breeding birds such as waders, and so no upland breeding bird surveys were undertaken in 2019, although waders were recorded as target species during all other survey types.

8.5.20 Baseline surveys for the Cumberhead Wind Farm were undertaken in 2013 within the moorland adjacent to the site. Further to the north-west of the site, surveys for Kype Muir Wind Farm in 2009 and 2010 recorded breeding waders and any other species of conservation concern within a 500 m buffer overlapping with the south of the Proposed Development site. Results of these projects have been considered here

Winter walkover surveys:

Three winter walkover surveys, one each month in November and December 2019 and February 2020 took place within the site and a survey area buffer of up to 500 m. Surveys concentrated on recording species listed in Schedule 1 of the Wildlife and Countryside Act 1981.

Assessment of Potential Effect Significance

Outline Assessment Process

8.5.21 This section defines the methods used to assess the significance of effects through the process of an evaluation of the sensitivity of a feature (a combination of nature conservation importance and conservation status) and magnitude for each likely impact. The assessment focuses on a 'worst-case' Proposed Development as described in the Potential Effects Section, 8.7.

8.5.22 The evaluation for wider-countryside interests (not relating to Natura sites covered by the Habitats Regulations Appraisal (HRA) process) involves the following process:

- identifying the potential impacts associated with the Proposed Development;
- considering the likelihood of occurrence of potential impacts where appropriate;
- defining the nature conservation importance and conservation status of the bird populations present to establish level of sensitivity;
- establishing the magnitude of the likely impact (both spatial and temporal);
- based on the above information, making a judgement as to whether or not the resultant unmitigated effect is significant with respect to the EIA Regulations;
- if a potential effect is determined to be significant, suggesting measures to mitigate or compensate the effect where required;
- considering opportunities for enhancement where appropriate; and
- confirming residual effects after mitigation or enhancement are considered.

HRA Process

8.5.23 The method for assessing the likely significant effects on a Natura site (in this context, an SPA) is different from that outlined above for wider-countryside ornithological interests. This is based on the Habitats Directive, which is transposed into domestic legislation by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) Regulation 48 and includes a number of steps to be taken by the competent authority before granting consent (these are referred to here as an HRA). All information relating to the assessment of potential effects on SPAs is presented separately in Appendix 8.3: Habitats Regulations Appraisal and not addressed in this chapter.

Sensitivity of Feature

8.5.24 Determination of the level of sensitivity of a feature is based on a combination of the feature's nature conservation importance and conservation status.

8.5.25 There are three levels of nature conservation importance as detailed in Table 8.3.

Table 8.3 – Determining factors of a feature's Nature Conservation Importance

Importance	Description
High	Populations receiving protection by an SPA, proposed SPA, Ramsar Site, SSSI or which would otherwise qualify under selection guidelines. Species present in nationally important numbers (>1% national breeding or wintering population).
Medium	The presence of species listed in Annex 1 of the Birds Directive (but population does not meet the designation criteria under selection guidelines). The presence of breeding species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The presence of rare breeding species noted on the latest Birds of Conservation Concern (BoCC) Red list (Eaton et al. 2015). 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 Proposed Development. Species present in regionally important numbers (>1% regional breeding population).
Low	All other species' populations not covered by the above categories.

8.5.26 IOFs (as per CIEEM, 2018) to be assessed for the purposes of EIA, were taken to be those species of high and medium nature conservation importance.

8.5.27 As defined by SNH (2018a), 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*". Conservation status is considered by SNH (2018a) to be 'favourable' under the following circumstances:

- "*population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats;*
- *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*".

8.5.28 SNH (2018a) recommends that "*the concept of favourable conservation status of a species should be applied at the level of its Scottish population, to determine whether an impact is sufficiently significant to be of concern. An adverse impact on a species at a regional scale (within Scotland) may adversely affect its national conservation status*". Thus, "*An impact should therefore be judged as of concern where it would adversely affect the existing favourable conservation status of a species or prevent a species from recovering to favourable conservation status, in Scotland*."

8.5.29 In the case of non-designated sites in Scotland, the relevant regional scale for breeding species is considered to be the appropriate NHZ which the site falls within. The majority of the Proposed Development site is within NHZ 19 Western Southern Uplands & Inner Solway, on the edge of NHZ 17 West Central Belt, although the majority of the access track falls within NHZ 17. As the majority

of the site is within NHZ 19 and the upland habitats and topography of the site are more similar to those of NHZ 19 rather than NHZ 17, effects were assessed based on NHZ 19 species' populations.

8.5.30 For wintering or migratory species, the national UK population or flyway population is considered to be the relevant scale for determining effects on the conservation status, and this approach is applied here.

Magnitude of Impact

8.5.31 An impact is defined as a change of a particular magnitude to the abundance and/or distribution of a population as a result of the Proposed Development. Effects can be adverse, neutral or favourable.

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

8.5.33 The sensitivity of individual species to disturbance during relevant behaviours is considered when determining spatial and temporal magnitude of effect and is assessed using guidance described by Bright et al. (2006), Hill et al. (1997) and Ruddock and Whitfield (2007).

Impacts are judged in terms of magnitude in space and time. There are five levels of spatial and temporal impact magnitude as detailed in Table 8.4 and

8.5.34 Table 8.5 respectively.

Table 8.4 – Spatial magnitude of impact

Spatial magnitude	Description
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 or increase in 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 or increase in 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 or increase in 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 or increase in 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.

Spatial magnitude	Description
	Guide: < 1 % of population lost or increase in additive mortality.

Table 8.5 – Temporal magnitude of Impact

Temporal magnitude	Description
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25-30 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.

Potential Cumulative Effects

8.5.35 The *Cumulative Assessment* section (Section 8.10) presents information about the potential cumulative effects of the Proposed Development combined with other operational, consented or proposed wind farm projects.

8.5.36 SNH (2018b) has provided guidance on assessing the cumulative effects on birds. This assessment follows the principles set out in that guidance.

8.5.37 Cumulative effects may include cumulative disturbance-displacement, collision mortality, habitat loss or barrier effects. Some cumulative impacts, such as collision risk, may be summed quantitatively, but according to SNH (2018b) "I*n practice, however, some effects such as disturbance or barrier effects may need considerable additional research work to assess impacts quantitatively. A more qualitative process may have to be applied until quantitative information becomes available for developments in the area, e.g. from post-construction monitoring or research*".

8.5.38 The main projects likely to cause similar effects on ornithological features are other operational wind farms, or those under construction, consented, or in the planning process within the Hagshaw Cluster (Figure 8.2).

Statement of Significance

8.5.39 The potential significance of effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude of change as detailed

in Table 8.6. Major and moderate effects are considered significant in the context of the EIA Regulations.

Table 8.6 – Significance criteria

Significance	Description
Major	Significant effect, as the effect is likely to result in a permanent/ long term and very high/ high extent significant adverse effect on the integrity of the feature.
Moderate	Significant effect, as the effect is likely to result in a medium term and high / medium extent partially significant adverse effect on the integrity of the feature.
Minor	The effect is likely to adversely affect the feature at an insignificant level by virtue of its limited duration and/or extent, but there will probably be no effect on its integrity. This is not a significant effect.
Negligible	No material effect. This is not a significant effect.

Requirements for Mitigation

8.5.40 Mitigation will be required if the potential effect determines that there is an unmitigated moderate adverse or major adverse and therefore potentially significant effect on any IOF identified in this chapter.

Assessment of Residual Effect Significance

8.5.41 If a potential effect is determined to be significant, suggested measures to mitigate the effect to a non-significant level will be considered and the revised significance of residual effects after mitigation will be assessed.

Limitations to Assessment

8.5.42 There can often be varying degrees of uncertainty over the sensitivity of features or magnitude of impacts as a result of limited information. A precautionary approach is therefore adopted for the assessment where the response of a population to an effect is uncertain.

8.5.43 The following potential limitations to assessment were identified at an early stage, but it was agreed with NatureScot during pre-scoping consultation that they would not significantly affect the ability to conduct a robust impact assessment (Table 8.1):

- Baseline surveys did not cover the early 2019 breeding season, meaning that data gaps were filled by the data collected for other local wind farm projects over the past 15 years. As the site is primarily comprised of commercial conifer plantation, ornithological interest is likely to be low, and this was consistent with results in the local area. As agreed with NatureScot (Table 8.1), the baseline dataset is considered sufficient to assess impacts.
- Access outside of Cumberhead Forest was limited during the 2019-20 baseline surveys (a series of scarce breeding bird surveys within the 2 km study area inside the SPA was however undertaken in July 2019), and so bird activity recorded by local wind farms in this area was included in the assessment because it provides additional survey coverage of parts of the study area where access was limited.

- Although only a single year of surveys was undertaken, inter-annual variation can be determined using the data collected from other wind farm sites in the local area as agreed with NatureScot (Table 8.1).

8.6 Baseline Conditions

Designated Sites

8.6.1 There are no statutory nature conservation designations with an ornithological interest within the site. Table 8.7 details the designated sites located within 20 km of the Proposed Development site that have ornithological interests. It should be noted that the two SSSIs are coincidental in extent with the Muirkirk and North Lowther Uplands SPA.

Table 8.7 – Designated Sites within 20 km of the Proposed Development

Name	Distance	Qualifying interests	Status
Muirkirk and North Lowther Uplands SPA	Adjacent to western site boundary	Hen harrier (*Circus cyaneus*), breeding	Unfavourable Declining
		Short-eared owl (*Asio flammeus*), breeding	Favourable Maintained
		Peregrine (*Falco peregrinus*)	Unfavourable No Change
		Golden plover (*Pluvialis apricaria*), breeding	Favourable Maintained
		Merlin (*Falco columbarius*), breeding	Unfavourable No Change
		Hen harrier (*Circus cyaneus*), non-breeding	Unfavourable Declining
Muirkirk Uplands SSSI	Adjacent to the western site boundary	Hen harrier (*Circus cyaneus*), breeding	Favourable Maintained
		Short-eared owl (*Asio flammeus*), breeding	Favourable Maintained
		Hen harrier (*Circus cyaneus*), non-breeding	Unfavourable Declining
		Breeding bird assemblage	Favourable Maintained
North Lowther Uplands SSSI	3.2 km to site boundary, south	Hen harrier (*Circus cyaneus*), breeding	Unfavourable No Change
		Breeding bird assemblage	Unfavourable Declining

Birds Recorded During Desk and Field Surveys

8.6.2 The following paragraphs summarise the results of target species recorded during the 2019/2020 field surveys (May 2019 to March 2020) and of the desk study that included the local wind farm projects (Figure 8.2, surveys undertaken from 2003 to 2018). Full details of the results of 2019/2020 surveys can be found within Appendix 8.1 and Figures 8.5 to 8.8 and Confidential Figures 8.2.1 to 8.2.2.

Bird Assemblage within the Local Area

8.6.3 Table 8.9 summarises the results of baseline surveys within the local area over the long-term period, and states whether each target species recorded was found to be present (P) or whether there was no evidence (NE) recorded during surveys, or in the cases where information was unavailable (U).

8.6.4 Over the period of surveys, Table 8.9 shows that the species assemblage has remained relatively similar between years, as well as across different local wind farm sites. In general, the local area including the Proposed Development site is of limited importance for most target species, with few breeding records of raptors and low levels of site usage by foraging raptors. A similar variety of wader species do breed within most sites, although the habitat within the Proposed Development site is unsuitable.

Table 8.8 – Summary of Desk-based Findings for Target Species (Raptors, Waders and Wildfowl) at 2 Wind Farm Projects within the Hagshaw cluster plus any others within 2 km (P = 'Present'; NE = 'No Evidence'; U = Unknown)

Species	Conservation status and legal protection	HHR	HHX	NU	GA	DWDQ	DQ	CU	DW	HCH	DG	KM	KMX	BC	AR	DWX
Wildfowl																
Pink-footed goose	BoCC Amber-listed, Annex II (Part B), Schedule 2	NE	NE	P	P	P	P	P	P	P	P	P	P	P	P	NE
Greylag goose	BoCC Amber-listed, Annex II (Part B), Schedule 2	NE	NE	P	P	P	P	P	P	P	NE	P	P	P	P	NE
Whooper swan	BoCC Amber-listed, Annex II (Part B), Schedule 2	NE	NE	NE	P	P	P	P	P	NE	P	P	P	P	P	NE
Raptors and Owls																
Goshawk	BoCC Green-listed, Schedule 1	NE	NE	NE	NE	NE	NE	P	P	P	P	P	P	NE	NE	NE
Hen harrier	BoCC Red-listed, Annex I, Schedule 1	NE	P	P	P	P	P	P	P	P	P	P	P	P	P	NE
Merlin	BoCC Red-listed, Annex I, Schedule 1	NE	P	P	P	P	P	P	P	P	P	P	P	P	P	NE
Osprey	BoCC Amber-listed, Annex 1, Schedule 1	P	NE	P	P	P	P	NE	P	NE	NE	NE	NE	NE	NE	P
Peregrine	BoCC Green-listed, Annex 1, Schedule 1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Red kite	BoCC Green-listed, Annex 1, Schedule 1	NE	NE	P	P	NE	NE	NE	P	NE	NE	NE	P	NE	NE	NE
Barn owl	BoCC Green-listed, Schedule 1	NE	P	NE	P	NE	NE	NE	P	NE	NE	P	P	NE	NE	NE
Short-eared owl	BoCC Amber-listed, Annex 1	NE	NE	P	P	NE	P	P	P	P	P	NE	P	P	NE	NE
Waders																

Species	Conservation status and legal protection	HHR	HHX	NU	GA	DWDQ	DQ	CU	DW	HCH	DG	KM	KMX	BC	AR	DWX
Common sandpiper	BoCC Amber-listed	P	NE	NE	P	P	P	P	P	NE	P	NE	NE	P	NE	NE
Curlew	BoCC Red-listed; sensitive to wind farms (SNH, 2018c)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Golden plover	BoCC Green-listed, Annex 1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Green sandpiper	BoCC Amber-listed, Schedule 1	NE	NE	NE	P	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Lapwing	BoCC Red-listed	P	U	P	P	P	P	P	P	NE	P	P	P	NE	NE	P
Oystercatcher	BoCC Amber-listed	P	U	P	P	P	P	P	P	P	P	NE	NE	NE	NE	P
Redshank	BoCC Amber-listed	NE	NE	NE	NE	P	P	NE	P	P	NE	NE	NE	NE	NE	NE
Ringed plover	BoCC Red-listed	P	U	NE	P	P	P	P	P	NE	NE	NE	NE	P	NE	P
Snipe	BoCC Amber-listed	P	U	P	P	P	P	P	P	P	P	NE	NE	P	NE	P
Other Target Species																
Black grouse	BoCC Red-listed, sensitive to wind farms (SNH, 2018c).	NE	P	P	P	P	NE	P	P	P	P	P	P	NE	NE	NE
Herring gull	BoCC Red-listed	P	U	U	P	P	P	P	U	U	U	P	U	P	U	P

Flight Activity Surveys

8.6.5 A summary of the results of flight activity surveys conducted in 2019 and 2020 is presented below in Table 8.9. Further detail is presented in Appendix 8.1: Ornithology.

Table 8.9 – Flight Activity Survey Results 2019-20

Species	Total flight events	Total birds recorded	Total flight seconds recorded
Golden plover	5	46	1,097
Goshawk	18	18	2,256
Hen harrier	2	2	115
Herring gull	2	41	3,760
Merlin	1	1	35
Osprey	2	2	230
Peregrine falcon	4	4	275
Pink-footed goose	3	589	43,195

8.6.6 Collision risk modelling was undertaken using the flight activity survey data across the 2019-20 baseline period (see Appendix 8.1: Ornithology, Annex E). The annual collision rate for each species has been calculated by summing the breeding season (2019) and the non-breeding season (2019-20) collision rates. Hen harrier and merlin were recorded during flight activity surveys, but no flights were considered to be 'at-risk' (i.e. the flights were outside of the CRAA and associated viewshed and/or were only recorded flying below lower rotor tip height).

Table 8.10 – Collision Risk Modelling Results (collision rate per season)

Species	2019 Breeding Season	2019-20 Non-breeding Season	Annual	One every *X* years
Golden plover	0	0.0016	0.0016	626.02
Goshawk	0	0.1529	0.1529	6.54
Herring gull	0.0493	0.0149	0.0641	87.59
Osprey	0.0095	0	0.0095	105.09
Peregrine falcon	0.0091	0	0.0091	110.13
Pink-footed goose	0	0.3102	0.3102	3.22

Wildfowl

8.6.7 A total of three pink-footed goose flights were recorded during flight activity surveys in October 2019 (Figure 8.6); no birds were recorded on the waterbodies within 2 km of the site, including

Logan Reservoir and Dunside Reservoir. Pink-footed geese have been recorded in flight during baseline surveys at most other local wind farm sites, and at Dalquhandy a peak flock of 2,400 birds was recorded in October 2012 flying over the site before settling down onto large water bodies to roost. Birds remained on the Dalquhandy site in significant numbers until late October 2012 before numbers started to decline throughout November 2012. The Dalquhandy Supplementary Environmental Information (SEI) assessment suggested that observed activity during early autumn 2012 may indicate that the Dalquhandy site is being utilised as a staging post for the regional population of pink-footed goose as they migrate, particularly in autumn and early winter.

8.6.8 One greylag goose was recorded in flight within the 2 km study area in July 2019. The species was recorded in flight at 11 local wind farm sites. Flock sizes in the local area have often been small, suggesting birds were part of a resident breeding population. Up to 185 birds were recorded roosting within the Dalquhandy site.

8.6.9 Whooper swans were not recorded during baseline surveys in 2019-20, however this species has been recorded occasionally, in low numbers for other projects within the 2 km study area. During baseline surveys for Dalquhandy wind farm in 2011-12, whooper swans were frequently observed utilising the waterbodies within the Dalquhandy site (203 m east of the Proposed Development).

Black grouse

8.6.10 Black grouse were not recorded during the 2019-20 surveys. Black grouse have however been recorded during baseline surveys for the following wind farm sites within 1.5 km of the Proposed Development site (see Figure 8.8 for summary):

- Cumberhead: no leks were recorded. A single non-lekking male was recorded in 2013 just over 100 m outside the south-east boundary of the Proposed Development at Priesthill Height. On a separate occasion, a single female was located in a similar location to the non-lekking male bird. Droppings were noted near the male and female bird records, as well as outside the northern-most edge of Cumberhead Forest complex.
- Nutberry: two leks were located within moorland out with the Nutberry application boundary in 2004, one male black grouse was recorded lekking in an area of open moorland at Sclanor Hill approximately 850 m south of the Proposed Development (1.45 km from the closest proposed turbine), and a group of four lekking males were recorded south of Priesthill Height approximately 500 m south-west of the Proposed Development (960 m from the closest proposed turbine). The lekking behaviour of these birds indicated that black grouse are breeding in the area.
- Hare Craig: no leks recorded. The only observation of black grouse across all survey effort comprised a single flight of two black grouse east of the site which was mapped as an incidental record in April 2016.

8.6.11 Lekking birds have also been recorded in close proximity to the existing access track to Cumberhead Forest and Hagshaw Hill Wind Farm which would be utilised by the Proposed Development (Figure 8.8).

- A total of 4-6 males (plus two females) were recorded lekking at four lek sites within 300 m of proposed turbines for the Hagshaw Hill Extension in 2004 and a single lek of two males was recorded within the Hagshaw Hill Wind Farm area during black grouse surveys for the Douglas West Community Wind Farm in 2010. A lek of two males was recorded in a similar location in 2015 during black grouse surveys for the Douglas West Wind Farm, and operational monitoring for Hagshaw Hill Extension. A single female flight was recorded during operational monitoring in 2017, over the Hagshaw Hill Extension Management Plan Area.

8.6.12 Further afield, one lek with two males was recorded within the Dungavel Wind Farm area in 2004 and four lek sites were recorded as part of the baseline surveys at Kype Muir in 2010, one which was likely the same lek recorded at Dungavel in 2004 (exact locations unknown).

Goshawk

8.6.13 One goshawk pair likely bred successfully within the site during the 2019 breeding season, with two juveniles successfully fledged. Although the precise nest location of the goshawk nest was not identified, flight activity records shown in Confidential Figure 8.2.2 indicate the likely area. In 2020 it was reported by foresters that goshawk again nested within the site, reasonably close to the area in 2019 (Confidential Figure 8.2.2). Goshawks were recorded regularly in most months (July 2019 to March 2020) during the flight activity surveys, with a total of 18 flights recorded (Figure 8.5). One female goshawk was also recorded flying over the site during a winter walkover survey in February 2020.

8.6.14 Goshawk was also confirmed as breeding within the Cumberhead Forest in 2013 during the breeding raptor surveys for the Cumberhead Wind Farm project; the confirmed nest was within 2 km of the Proposed Development site and 400 m of the Access Track (Confidential Figure 8.2.2). Goshawk was also assessed as probably breeding during the 2014 breeding raptor survey at Cumberhead.

8.6.15 Goshawk was frequently recorded at the Dungavel site between 2004-05, although most flights were recorded outside the 500 m buffer zone and no breeding evidence was observed. Goshawk were also recorded during the non-breeding season at the Kype Muir Extension site; no breeding activity was observed.

Hen harrier

8.6.16 Two hen harrier flights were recorded within the site in January and March 2020 (Figure 8.5), but no breeding evidence was observed within the 2 km study area in 2019. SSRSG identified that hen harrier has historically bred within the Muirkirk and North Lowther Uplands SPA at distances upwards of around 1.2 km from the Proposed Development site boundary, and around 2 km from the closest proposed turbine location, up until 2011 (Confidential Figure 8.2.1). There are however no records of nesting hen harriers within 2 km in more recent years. Projects such as Cumberhead, Dalquhandy and Galawhistle recorded occasional flight activity during baseline surveys, and SSRSG identified that hen harrier has historically bred on high ground at distances over 1 km east from the Dungavel site between 2004 and 2005 (locations unknown); two to three pairs were reported breeding in these years. In 2010, hen harriers bred successfully at a location 2.9 km from the Auchrobert site (exact location unknown), but this species was not recorded breeding within 2 km of the Auchrobert site in 2010 or 2011.

Merlin

8.6.17 Two sightings of merlin were recorded in 2019; one bird was recorded within 2 km of the site in July 2019 and another was recorded within 500 m of the site in September 2019 (Figure 8.5), no breeding evidence was recorded. SSRSG identified that merlin bred at two locations within the Muirkirk and North Lowther Uplands SPA located 1.8 km from the site boundary in 2013 (approximately 2.3 km from the closest proposed turbine) and 2 km from the site in 2010 and 2011 (approximately 2.5 km from the closest proposed turbine; (Confidential Figure 8.2.1). There is no evidence of merlin breeding within the 2 km study area since 2013.

8.6.18 At the Kype Muir Extension site, merlin was reported to be breeding within the Muirkirk and North Lowther Uplands SPA in 2009 at two locations approximately 1.3 km (successful breeding) and 2.4 km (unsuccessful breeding) from the nearest turbine location. At the Dungavel site, two pairs of merlin are thought to have nested within the survey area in 2004, although nesting was not confirmed. Breeding activity was observed in one area in 2005, but the success of the nesting attempts is unknown.

8.6.19 Merlins have been recorded infrequently foraging over the other local wind farm sites surrounding the Proposed Development, but no breeding activity has been recorded.

Peregrine

8.6.20 Four peregrine flights (all individual birds) were recorded within 500 m of the Proposed Development site in July to August 2019 (Figure 8.5); two of these flights were made by juvenile birds. SSRSG reported one peregrine breeding location used between 2015-19 that was located

approximately 1.8 km from the site boundary and approximately 2 km from the closest proposed turbine, outside of the Muirkirk and North Lowther Uplands SPA (Confidential Figure 8.2.1).

8.6.21 Raptor surveys in 2005, undertaken for Nutberry Wind Farm, identified a peregrine breeding attempt within 2 km of the Nutberry site (location unknown), although few flights were made by this species within the Nutberry site boundary between 2005-06.

8.6.22 Peregrine was confirmed as breeding during surveys for the Hare Craig Wind Farm in 2016 and 2017, although the exact location of the nest was not determined during surveys due to access restrictions to the 2 km buffer surrounding the site.

8.6.23 Peregrine was confirmed to be breeding within the survey area for Galawhistle Wind Farm (approximately 2 km from the Proposed Development site) in 2008 and 2009, although breeding locations are unavailable.

8.6.24 Peregrine presence was recorded at most other wind farm sites within 2 km of the Proposed Development, although activity levels were low and no breeding evidence was recorded.

Osprey

8.6.25 Ospreys were recorded on three occasions within 500 m of the Proposed Development between August and September 2019; two sightings were recorded in flight and a third sighting recorded an osprey perching on a stump with a fish prey item (Figure 8.5). The paucity of observations throughout the breeding season indicates that these sightings relate to migratory birds. No breeding evidence was recorded within 2 km of the site, nor for any other wind farm sites within 2 km surrounding the Proposed Development. Ospreys were however occasionally recorded in flight during baseline surveys for other local wind farms.

Barn owl

8.6.26 The 2019-20 surveys did not record breeding barn owl within 2 km of the Proposed Development site. One incidental sighting of a barn owl roost was recorded during an ecology survey in 2020, the roost was located approximately 295 m from the Proposed Development site boundary and 445 m from the closest proposed turbine (Figure 8.5).

8.6.27 No evidence of barn owl breeding activity was recorded during surveys for wind farm sites within 2 km of the Proposed Development including Cumberhead or Nutberry.

8.6.28 Barn owl breeding was confirmed at one location within the Galawhistle site in 2008 and 2009 and a second pair bred close to the Galawhistle access track in 2009 and probably 2008; these birds would have been >2 km away from the Proposed Development.

Short-eared owl

8.6.29 The 2019-20 surveys did not record short-eared owl within 2 km of the Proposed Development.

8.6.30 Flight activity and behaviour recorded for the Nutberry wind farm site indicated that one pair of short-eared owls might have bred in suitable habitat within 2 km of the Nutberry site boundary in 2004 (location unknown). Two pairs of short-eared owl were recorded displaying breeding activity in moorland at least 3 km to the south-east of the Dungavel wind farm site in 2004 (location unknown).

8.6.31 Short-eared owls have been recorded infrequently over some other local wind farm sites surrounding the Proposed Development, but no breeding activity has been recorded.

Other Raptors

8.6.32 In addition to the above target species, there were sightings of buzzard, kestrel and sparrowhawk (secondary species) during the 2019-20 surveys.

8.6.33 One short golden eagle flight was recorded at the Galawhistle site in June 2008, but this species was not recorded at any other site within the 2km study area.

8.6.34 Red kite was recorded flying over the Nutberry site in 2004 and the Galawhistle site between 2007 and 2009, although no breeding evidence of this species was recorded. Red kite was not recorded in the Proposed Development 2019-20 surveys.

Waders

Curlew

8.6.35 In 2019, two possible curlew breeding territories were recorded to the north of the Proposed Development site (Figure 8.7). One territory was identified next to Logan Reservoir approximately 600 m from the site and the other territory was identified over 850 m north-west from the site boundary. One individual curlew was recorded approximately 150 m north of the site at Birk Knowes during the non-breeding season.

8.6.36 Curlew are known to breed in the local area around the site and this species has been recorded at all proposed wind farm sites within 1 km, including: six confirmed breeding territories recorded in 2013 and one territory recorded in 2014 at the Cumberhead wind farm site (Figure 8.7); 3-5 breeding territories in 2016 and 2-3 breeding territories in 2017 at the Hare Craig site; five pairs in 2004/2005 at the Nutberry site; one territory in 2018 at the Hagshaw Hill Repowering site and three pairs in 2011 at the Auchrobert site.

Golden plover

8.6.37 Five golden plover flocks were recorded flying within 500 m the Proposed Development site boundary during the autumn migration in September and October 2019 (Figure 8.6) and a group of three individuals was recorded in December 2019 (Figure 8.7), but they did not breed within 2 km of the site.

8.6.38 Flocks of golden plover have been recorded flying through all of the wind farm sites within 1 km surrounding the Proposed Development during the non-breeding season, although breeding was not recorded at any site. The most frequent activity for golden plover in the local area was at Cumberhead Wind Farm between September 2012 and February 2014, when 11 flocks (one to 200 individuals per flight) were recorded.

8.6.39 Surveys for Nutberry Wind Farm in 2005 recorded flocks of golden plover feeding in fields around Birkenhead Farm, just to the north of the Proposed Development site.

8.6.40 A single flight of golden plovers comprising of 52 birds, not at collision risk height, was recorded at Auchrobert in March 2010/11.

Lapwing

8.6.41 In June 2019, two lapwings were recorded approximately 600 m north of the Proposed Development next to Logan Reservoir (Figure 8.7). It is possible that these birds were breeding, outside of the 500 m study area.

8.6.42 Lapwing are not known to have bred within 1 km of the Proposed Development. At Nutberry and Cumberhead wind farm sites, small numbers of lapwing were present, but breeding activity was not recorded. Lapwing were not recorded at the Auchrobert site during surveys between 2010-11.

Other waders (oystercatcher, ringed plover & snipe)

8.6.43 Oystercatcher, ringed plover and snipe were not recorded during surveys for the Proposed Development in 2019-20, nor within 1 km at wind farms surrounding the site.

8.6.44 Ringed plover has not been recorded as breeding within 1 km at wind farms surrounding the site. Ringed plover was recorded as present, but not breeding at the Cumberhead site in 2014. Snipe have been recorded as breeding at the Nutberry site (four pairs in 2004 and two pairs in 2005), the Cumberhead site (one probable and three possible territories in 2014) and also at the Hagshaw Hill Repowering site (three breeding territories recorded within 500 m of the site in 2018).

8.7 Potential Effects

8.7.1 The assessment of potential effects is based on the project description outlined in Chapter 3: Proposed Development. In relation to describing impacts on ornithological features, the relevant specifications used to determine the 'worst-case' Proposed Development involves:

- 21 turbines with a maximum tip height of 200 m and a maximum rotor diameter of 155 m. Each turbine will have a typical generating capacity of approximately 6 MW.
- Forest within the site will be felled as part of the Revised Felling Plan (refer to Chapter 16: Forestry) and turbines will be key-holed within the forestry block and any new forestry will not be planted within these areas.
- The construction period will last for up to 18 months, comprising a construction programme as described in Chapter 3 Proposed Development. The associated infrastructure will include: site access, access tracks, crane hardstanding, underground cabling, on-site substation and maintenance building, energy storage compound, temporary construction compound, laydown area, concrete batching plant, potential excavations/borrow workings and two permanent meteorological masts.

Scoped-in/out Important Ornithological Features

Target Species

8.7.2 The scoping-in of target species to assess as IOFs is based on information gathered during 2019-20 baseline surveys as well as from surveys undertaken for other local wind farm projects which provide a longer-term dataset of the likely bird assemblage within the site and surrounding area.

8.7.3 SNH's (2018c) guidance on assessing effects of wind farms on birds identifies 22 species that are widespread across Scotland which utilise habitats or have flight behaviours that may be adversely affected by a wind farm. The initial scoping-in stage therefore considers which of these species have been recorded within or around the site, as confirmed through survey results and desk studies outlined above.

8.7.4 Of these 22 species, 16 have been observed within the site and local area (Table 8.11).

8.7.5 The second stage of the scoping-in process is to determine which of these species have been recorded in numbers that may be of importance – i.e. the study area, or the airspace above the study area, is of some value to the species, and the wider NHZ population. This has been determined by the following method:

- Wildfowl: species recorded either utilising the site or wider 2 km study area, or regularly recorded in flight above the study area;
- Raptors: Schedule 1/Annex I species potentially breeding within 2 km study area, or regularly found in flight above, or in proximity to the site; and
- Waders: species found breeding in proximity to the site (nominally within 500 m), or regularly recorded in non-breeding flocks above the study area.

Table 8.11 – Scoped-in/out Target Species

Target Species	Summary of Activity within 2 km Study Area	Scoped In / Out
Whooper swan	Not recorded in 2019-20. Low flight activity recorded at local wind farms within and no suitable foraging habitat available within the site.	Out

Target Species	Summary of Activity within 2 km Study Area	Scoped In / Out
Pink-footed goose	Very low flight activity recorded 2019-20. An area to the east of the Cumberhead site at Dalquhandy Revised Wind Farm is considered to be a stopover roost for a winter passage population of pink-footed goose, but none were recorded on the waterbodies within 2 km of the site, including Logan Reservoir and Dunside Reservoir during the winter of 2019-20.	Out
Greylag goose	One greylag goose recorded in flight in October 2019. Low flight activity recorded at local wind farms sites and no suitable foraging habitat available within the site.	Out
Red kite	Not recorded in 2019-20. Occasional flights recorded at Nutberry and Galawhistle.	Out
Hen harrier	Two flights recorded in 2020, no breeding activity was recorded within the 2 km study area in 2019-20. Qualifying feature of the SPA with theoretical connectivity to site, based on historic breeding records provided by SSRSG. Recorded at all other local wind farm sites in flight, foraging, sometimes regularly.	In
Goshawk	One confirmed breeding location recorded within the site in 2019 and 2020 and birds were regularly recorded flying across the site in 2019-20.	In
Golden eagle	Not recorded in 2019-20. Single non-breeding flight at Galawhistle in 2008.	Out
Osprey	Three records in 2019, no evidence of breeding behaviour. Occasional flights recorded at other wind farm sites within 2km study area, no nesting or foraging records.	Out
Merlin	Two flight records in 2019, no evidence of breeding behaviour. Qualifying feature of SPA with theoretical connectivity to site, based on historic breeding records provided by SSRSG. Infrequent presence recorded at all local wind farm sites.	In
Peregrine	Four flights recorded in 2019. Qualifying feature of SPA, but significant connectivity to site unlikely, based on location of historic breeding records provided by SSRSG up to 2019 (none within SPA at least 2km from Proposed Development site) and low site presence. Predicted collision rate very low (one every 110 years, Table 8.10). Breeding behaviour recorded at Nutberry. Infrequently to regularly recorded at other local wind farm sites, but no breeding evidence.	Out

Target Species	Summary of Activity within 2 km Study Area	Scoped In / Out
Black grouse	No records in 2019-20. Lekking activity however recorded historically within 850 m of the main Proposed Development site and in close proximity to access route (Figure 8.8). Subject of ongoing habitat management in local area.	In
Barn owl	No breeding or flight activity records in 2019-20. One barn owl roost located approximately 295 m from the Proposed Development site boundary and 445 m from the closest proposed turbine is unlikely to be affected. No identified potential roost or nest sites within site.	Out
Golden plover	Five non-breeding flocks recorded in 2 km study area in 2019, no breeding records. Non-breeding records for local wind farms within 2 km of the site, no breeding records. Foraging records in the fields surrounding Birkenhead Farm within 1 km of the site.	In
Lapwing	One possible breeding pair identified outside of the 500 m study area of the site in 2019. Not known to breed within 1 km of the site, low numbers recorded for Cumberhead and Nutberry.	Out
Curlew	Two breeding territories identified in 2019. Known to breed in the local area and has been recorded breeding at all local wind farm sites.	In
Herring gull	Three flights recorded in 2019. Likely to be occasionally present within most sites, but no breeding recorded.	Out
Short-eared owl	Not recorded in 2019-20. Infrequently recorded at all local wind farm sites, no breeding evidence within 2 km study area.	Out

8.7.6 From this process, a total of six species, determined to be of high and medium nature conservation importance (Table 8.3) are considered to be the IOFs (Table 8.12).

Table 8.12 – Nature Conservation Importance of IOFs

Feature	Nature conservation importance	Reason
Hen harrier	High	SPA qualifying feature; Annex 1; Schedule 1; BoCC Red-listed
Goshawk	Medium	Schedule 1

Feature	Nature conservation importance	Reason
Merlin	High	SPA qualifying feature; Annex 1; Schedule 1; BoCC Red-listed
Black grouse	Medium	BoCC Red-listed; key feature of local habitat management plans
Curlew	Medium	BoCC Red-listed
Golden plover	Medium	SPA qualifying feature (breeding only); Annex I; BoCC Green-listed

8.7.7 In addition, it is necessary to consider the species' conservation status when assessing the likely effects. Relevant conservation status information for the 'scoped in' IOFs is detailed within Table 8.13 based on the following BoCC criteria in Eaton et al. (2015):

HD: Historical decline in breeding populations. Species judged to have declined severely between 1800 and 1995;

BR = Breeding rarity. Species qualified as rare breeders if the UK breeding population was <300 pairs.

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

BDMr: Breeding range decline. Moderate decline (>25% but <50%) between 1988–91 and 2007–11 (BDMr1) or 1968–71 and 2007–11 (BDMr2); and

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

Table 8.13 – Conservation Status of Scoped In IOFs

Species	Conservation Status Information	Conservation Status
Hen harrier	BoCC Red list (HD)	Hen harrier is Red-listed due to an historical decline in the UK between 1800 and 1995, without substantial recent recovery. The UK and Isle of Man hen harrier population was estimated at 575 territorial pairs in 2016, which is a decline of 13% since 2010 and 24% since 2004. Scotland held the bulk (80%) of the population (460 territorial pairs), where a decline of 9% since the previous survey was observed (Wotton et al. 2018). Thus, the national population is considered to be in unfavourable conservation status. The regional NHZ 19 population was considered by Fielding et al. (2011) to be in unfavourable conservation status due to persecution and low productivity. The NHZ 19 population was estimated by Wilson et al. (2015) to be 18 (range 15-20) pairs in 2011, although 35 pairs were monitored in the larger South Strathclyde area (mainly comprising NHZ 19) monitored by the SSRSG in 2018 (Challis et al. 2019), indicating the population may have somewhat recovered since 2011.

Species	Conservation Status Information	Conservation Status
Goshawk	BoCC Green List	There are an estimated 620 pairs in Britain (Woodward et al. 2020) indicating an increase from 400 pairs recorded in Britain in 2013 (Musgrove et al. 2013). The NHZ 19 population was estimated by Wilson et al. (2015) to be 31 (range 17-41) pairs in 2013. The most recent Scottish Raptor Monitoring Scheme (SRMS) Annual Report for 2018 (Challis et al. 2019) provided information for nine occupied home ranges in South Strathclyde suggesting that the population in this part of NHZ 19 is relatively strong. The goshawk population appears to be expanding in range in Scotland (Forrester et al. 2007) and as the species is BoCC Green-listed, the national and regional/NHZ populations are likely to be in favourable conservation status.
Merlin	BoCC Red list (HD)	The last national merlin survey carried out in 2008 suggested a national breeding population of around 1,159 breeding pairs with approximately 733 pairs in Scotland (Ewing et al. 2011). Comparison with the previous 1993-94 survey suggests an overall stable population, albeit with regional differences in success. The NHZ 19 population was estimated by Wilson et al. (2015) to be 12 (range 7-18) pairs in 2008, although only one breeding attempt in South Strathclyde was monitored by the SSRSG in 2018 (Challis et al. 2019). There is relatively poor monitoring coverage in the South Strathclyde region, and the national survey did not focus on this region. It was apparent however that estimates of change were more negative for regional populations at southern latitudes than more northerly populations, and so the regional/NHZ population is likely to be in unfavourable conservation status.
Black grouse	BoCC Red List (HD, BDp1, BDp2, BDMr2)	Black grouse is Red-listed due to a historical decline in the UK, 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 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 high in south western Scotland (-49%). Evidence suggests that the national and regional populations are in unfavourable conservation status. The NHZ 19 population was estimated by Wilson et al. (2015) to be 121 (range 71-168) displaying males.

Species	Conservation Status Information	Conservation Status
Curlew	BoCC Red List (BDMp1, BDp2)	The most recent national curlew population estimate recorded 58,000 pairs in 2016 (Woodward et al. 2020) and there has been a significant continued decline across Scotland, including in the south west. The recent inclusion of the species on the BoCC Red-list suggests that the national and NHZ/regional populations are in unfavourable conservation status. The NHZ 19 population was estimated to be 4,284 (3,851-4,717) pairs in 2005 (Wilson et al. 2015).
Golden plover	BoCC Green List	The UK golden plover breeding population is estimated to be 32,500-50,500 pairs (Woodward et al. 2020), although Forrester et al. (2007) give a Scottish breeding population estimate of 15,000 pairs, stating that this represents 80% of the British breeding population. The spring passage population of golden plover in Scotland was estimated by Forrester et al. (2007) to be 10,000-30,000 individuals. BirdFacts estimated the UK winter population to be 400,000 individuals in 2006/07 (Robinson, 2005). The NHZ 19 breeding population was estimated by Wilson et al. (2015) to be 778 (range 716-839) pairs in 2005. The latest BTO BirdTrends information (Massimino et al. 2019) states that the national population is in probable decline, and this is likely to reflect the regional/NHZ population.

Designated Sites

8.7.8 Table 8.11 details the theoretical foraging ranges of species as given in SNH (2016), that are qualifying features of the Muirkirk and North Lowther Uplands SPA, Muirkirk Uplands SSSI and North Lowther Uplands SSSI, which can be used to determine possible connectivity between the designated sites and the Proposed Development site.

Table 8.14 – Foraging ranges of SPA qualifying features and potential connectivity

Qualifying interests	SNH (2016) Foraging Range	Connectivity
Golden plover (*Pluvialis apricaria*), breeding	3 km	Potential connectivity (SPA, Muirkirk Uplands SSSI)
Hen harrier (*Circus cyaneus*), breeding	2 km	Potential connectivity (SPA, Muirkirk Uplands SSSI)
Hen harrier (*Circus cyaneus*), non-breeding	N/A	No ranging distances for wintering hen harrier specified in SNH (2016), potential connectivity assumed on basis of breeding ranging distances (SPA, Muirkirk Uplands SSSI)

Qualifying interests	SNH (2016) Foraging Range	Connectivity
Merlin (*Falco columbarius*), breeding	5 km	Potential connectivity (SPA, Muirkirk Uplands SSSI). Connectivity unlikely with North Lowther Uplands SSSI.
Peregrine (*Falco peregrinus*)	2 km	Potential connectivity (SPA, Muirkirk Uplands SSSI)
Short-eared owl (*Asio flammeus*), breeding	2 km	Potential connectivity (SPA, Muirkirk Uplands SSSI)

8.7.9 Considering the information detailed in Section 8.6 of this chapter and the proximity of the site, there is potential for connectivity between the site and all Muirkirk and North Lowther SPA qualifying features, and as such, due to a likely significant effects conclusion, the Muirkirk and North Lowther Uplands SPA is scoped in to the HRA process dealt with separately in Appendix 8.3. The associated Muirkirk Uplands SSSI is scoped into this chapter as part of the EIA process.

8.7.10 Due to distance from the site (3.2 km away) and given foraging ranges of qualifying features in SNH (2016), there is likely to be a lack of connectivity between the North Lowther Uplands SSSI and the Proposed Development site and this SSSI is scoped out of the assessment.

Potential Effects

Construction

- The main potential impacts of construction activities across the site are the displacement and disruption of breeding, foraging or roosting 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).
- Impacts on breeding birds would be confined to areas in the locality of temporary construction compounds, turbines, tracks and other infrastructure. Few attempts have been made to quantify the impacts 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).
- Direct habitat loss would also occur due to the Proposed Development's construction, which would be both temporary (e.g. construction compounds) and longer term (access tracks and turbines). This has the potential to impact on breeding or foraging individuals.

Hen harrier

8.7.11 Impact: breeding, foraging or roosting hen harrier may be displaced from the site during construction, either by disturbance or direct habitat loss.

8.7.12 Sensitivity: as an Annex 1 and Schedule 1 listed species with a red-list conservation status (Eaton et al. 2015), hen harrier is classified as high nature conservation importance (Table 8.12). The national and NHZ 19 populations are considered to be in unfavourable conservation status (Table 8.13) and the Muirkirk and North Lowther Uplands SPA population is considered to be in unfavourable, declining condition (Table 8.7). The species sensitivity in the context of this site is therefore High.

8.7.13 Magnitude of Impact: hen harrier activity within the site is currently low, with only two flights recorded across the site, in January and March 2020. No breeding evidence was recorded within the 2 km study area in 2019. No hen harrier nesting has been recorded within 2 km of the site

boundary since 2011, and during the design layout process, effort was made to locate proposed turbines at least 2 km from historic breeding records.

8.7.14 Considering that no breeding has taken place within 2 km of the site since 2011, and based on historic records, suitable nesting habitat appears to be at least 2 km from the nearest proposed infrastructure, it is unlikely that construction activities would disturb breeding hen harriers, either in the context of the current population situation, or should numbers start to recover prior to construction.

8.7.15 With the site comprising a mixture of mature conifer plantation, recently felled plantation and young second rotation crop, loss of suitable habitat by further felling for infrastructure (keyholing) is not considered to affect the species, with no evidence of birds currently utilising the site.

8.7.16 The magnitude of impact due to construction disturbance and habitat loss is therefore considered to be negligible spatial and short-term temporal.

8.7.17 Significance of Effect: The unmitigated effect on breeding hen harrier from construction is classified as **minor** adverse and is therefore Not Significant in the context of the EIA Regulations. It also follows that there are no significant effects predicted for the Muirkirk Uplands SSSI.

Merlin

8.7.18 Impact: breeding or foraging merlin may be displaced from the site during construction, either by disturbance or direct habitat loss.

8.7.19 Sensitivity: as an Annex 1 and Schedule 1 listed species with a red-list conservation status (Eaton et al. 2015), merlin is classified as high nature conservation importance (Table 8.12). The national and NHZ 19 populations are considered to be in unfavourable conservation status (Table 8.13) and the Muirkirk and North Lowther Uplands SPA population is considered to be in unfavourable condition (Table 8.7). The species' sensitivity in the context of this site is therefore High.

8.7.20 Magnitude of Impact: merlin activity within the study area was rare, with only one flight recorded within 2 km of the site in September 2019; no evidence of breeding evidence was recorded within the 2 km study area in 2019. SSRSG identified two historic nest sites in 2010 and 2013 within the Muirkirk and North Lowther Uplands SPA, over 2 km from the nearest proposed turbine location. There are no records of breeding within 2 km since 2013.

8.7.21 Considering that bird surveys have not recorded any merlin breeding activity within 2 km of the site since 2013, and the closest historic merlin breeding activity was recorded over 2 km from the nearest proposed turbine location, it is considered unlikely any breeding birds would be affected by construction disturbance. Any additional felling of conifer plantation associated with the Proposed Development is likely to take place within the interior of Cumberhead Forest, and so would not remove any suitable nesting or foraging habitat.

8.7.22 The magnitude of impact due to construction disturbance and habitat loss on merlin is considered to be negligible spatial and short-term temporal.

8.7.23 Significance of Effect: The unmitigated effect on breeding merlin from construction is classified as **minor adverse** and is therefore Not Significant in the context of the EIA Regulations. It also follows that there are no significant effects predicted for the Muirkirk Uplands SSSI.

Goshawk

8.7.24 Impact: breeding or foraging goshawks may be displaced from the site during construction, either by disturbance or direct habitat loss.

8.7.25 Sensitivity: as a Schedule 1 listed species unconnected to a designated site, goshawk is classified as medium nature conservation importance (Table 8.12). The national and NHZ 19 populations are considered to be in favourable conservation status (Table 8.13) and the species' sensitivity in the context of this site is therefore Medium-Low.

8.7.26 Magnitude of Impact: one goshawk territory was identified within the site in 2019 and 2020; two juveniles successfully fledged in 2019 and although the location of the nest was not recorded in

2019, a nest site in 2020 was recorded approximately 260 m from the closest proposed turbine (Confidential Figure 8.2.2). Cumberhead Forest provides suitable habitat for breeding goshawk and one further territory was recorded in the forest in 2013, over 2 km from the Proposed Development. However, within the Proposed Development site, commercial forest harvesting activities are currently taking place as part of a forestry felling plan in the area of the 2019 and 2020 goshawk territory containing the nest site, not associated with the Proposed Development. The forestry activity in this area means that the location of suitable goshawk breeding habitat will have changed before construction is due to start at the Proposed Development.

8.7.27 Forestry Commission Scotland (2006) has recommended a safe working distance of up to 450 m for forestry activities around a goshawk nest, with Ruddock & Whitfield (2007) concluding that birds may be affected up to 500 m from disturbance source. As such, depending on the location of future territories and the extent of planned felling activities for the Proposed Development, one territory may be affected by construction activities over the short-term, or permanently should any loss of nesting habitat occur (although this may be in part balanced by additional edge habitat being created, which is beneficial for foraging, and possibly nesting).

8.7.28 If any territory should remain within the site at the time of construction, because this area of forest is subject to ongoing commercial forest harvesting activities, any breeding birds are likely to be accustomed to a regular amount of localised activities that would be of a reasonably similar nature to those associated with wind farm construction, including keyholing activities, which would reduce the likelihood of territory abandonment. Additionally, due to the size of Cumberhead Forest it is considered unlikely that a pair would be lost from the NHZ population, but rather would be more likely to relocate at sufficient distance from disturbance sources. Overall, a negligible spatial and short-term temporal magnitude of impact due to construction disturbance is predicted on the NHZ 19 goshawk population (31 pairs).

8.7.29 Significance of Effect: The unmitigated effect on breeding goshawk from construction is classified as **negligible** and is therefore not significant in the context of the EIA Regulations.

Black Grouse

8.7.30 Impact: lekking or foraging black grouse may be displaced from the site during construction, either by disturbance or direct habitat loss.

8.7.31 Sensitivity: due to its Red-list conservation status (Eaton et al. 2015) and sensitivity to wind farms, the species is classified as medium nature conservation importance (Table 8.12). The NHZ and national populations are likely to be of unfavourable conservation status (Table 8.13) and the species sensitivity in the context of this site is therefore medium-high.

8.7.32 Magnitude of Impact: no infrastructure is planned to overlap with any lekking location, and in general, the mature plantation and recently felled plantation habitat within the site is unsuitable for the species.

8.7.33 Black grouse were not recorded during baseline surveys in 2019-20, although Figure 8.8 shows that during baseline surveys for Nutberry and Cumberhead wind farms, black grouse were recorded in proximity to the site boundary. Lekking birds were also recorded between 2003 and 2015 in close proximity to the existing access track to Cumberhead Forest and Hagshaw Hill Wind Farm, which would be utilised by the Proposed Development.

8.7.34 The access track to the Proposed Development site is also adjacent to land used as part of the Hagshaw Hill Wind Farm Extension Black Grouse Management Plan (Figure 8.8). The aim of this Plan is to enhance the habitat for black grouse out with Hagshaw Hill Extension Wind Farm area in an effort to maintain lekking black grouse numbers from baseline levels of 4-6 males recorded in 2003.

8.7.35 Given that there is no evidence that black grouse currently utilise the main site and the nearest lek was last recorded in 2004 approximately 960 m from the closest proposed turbine, it is considered unlikely that a lek, or any breeding or foraging individuals would be significantly disturbed by construction of turbines, new access track or any other infrastructure.

8.7.36 It is however possible that with the closest lek site (two males recorded in 2015), within 500m of the existing access track, increased numbers of vehicular movements associated with the Proposed Development may result in disturbance to lekking, breeding or foraging birds, if unmitigated.

8.7.37 The magnitude of unmitigated construction impacts causing disturbance to two lekking males (equating to 1.6% of the NHZ 19 population) close to the existing access track is considered to be low spatial, and short-term temporal.

8.7.38 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.

Curlew

8.7.39 Impact: breeding curlews may be displaced from the site during construction, either by disturbance or direct habitat loss.

8.7.40 Sensitivity: as Red-listed (Eaton et al. 2015) species sensitive to wind farm development, curlews are classified as being of medium nature conservation importance (Table 8.12). The national and NHZ 19 population in considered to be in unfavourable conservation status (Table 8.13) and this species sensitivity is medium-high.

8.7.41 Magnitude of Impact: the site does not provide suitable habitat for any waders including curlew, and so no direct habitat loss from construction of infrastructure is predicted. In the 2019 breeding bird surveys, curlews were recorded over 500 m from the site in open moorland in areas to the north, in particular at lower altitudes next to Logan Reservoir and approximately 500 m north-east of Cleughead Farm. One non-breeding curlew was recorded at Birk Knowes within 500 m of the site boundary.

8.7.42 Surveys conducted for Cumberhead Wind Farm, adjacent to the Proposed Development site, confirmed six breeding territories recorded in 2013 and one territory recorded in 2014, five of the Cumberhead curlew territories recorded in 2013 were within 500 m of the Proposed Development site (see Figure 8.7). As a precaution, it is therefore considered possible that during the construction period, the curlew population within around 500 m of the Proposed Development site may be reduced by up to 5 pairs, based on results from adjacent Cumberhead surveys in 2013-14. Surveys for the Nutberry Wind Farm site recorded five pairs in 2004/2005, Hare Craig recorded 2-5 pairs in 2016/2017 and three pairs were recorded in 2011 at the Auchrobert site, although the locations of these territories are not publicly available. Within an NHZ 19 population context, this level of temporary loss is considered to be of negligible spatial and short-term temporal magnitude.

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

Golden Plover

8.7.44 Impact: golden plovers may be displaced from the site during construction, either by disturbance or direct habitat loss.

8.7.45 Sensitivity: non-breeding golden plover is an Annex I listed species, and the national and NHZ 19 populations are likely to be in unfavourable conservation status. The species sensitivity is therefore medium-high.

8.7.46 Magnitude of Impact: Five golden plover flocks were recorded flying within 500 m the site boundary during autumn migration in September and October 2019 and a group of three individuals was recorded in December 2019 within the site. No breeding evidence was recorded.

8.7.47 There would be no direct habitat loss for golden plover because plantation forest within the Proposed Development site is unsuitable for the species. The immediate surrounds are also unlikely to be regularly used by non-breeding golden plovers as waders are known to avoid forest edge habitats (e.g. Wilson et al. 2014, who recorded suppressed numbers within 700 m of forestry). Construction disturbance to non-breeding birds is therefore unlikely to be significant in terms of impacts on individual fitness or survival.

8.7.48 The impact of construction on the national passage golden plover population would result in an impact of negligible spatial and short-term temporal magnitude.

8.7.49 Significance of Effect: the unmitigated effect from construction on golden plover is classified as **minor** adverse and is not significant in the context of the EIA Regulations.

Operation

8.7.50 The following operational impacts are assessed in this section:

- displacement of birds around operational turbines;
- collisions with turbines; and
- increased lighting associated with operational turbines.

Potential Effects: Displacement

8.7.51 The displacement of nesting, foraging or roosting birds from the site has the potential to extend beyond the construction phase, as described above, and to occur during the operational phase.

8.7.52 Displacement away from operational turbines has been found to occur in a number of individual wind farm studies, although the effects vary considerably between sites and species. 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 effects 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 effects during construction were reversed during operation with numbers returning to pre-construction numbers.

8.7.53 It is recognised that disturbance may occur due to maintenance or recreational activities throughout the operational phase, although since these are likely to be of shorter duration and smaller extent than construction activities, effects would be lower than those predicted for construction effects.

8.7.54 Pearce-Higgins et al. (2009) observed certain species experience localised population increases with proximity to wind farm infrastructure, 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.

Hen Harrier

8.7.55 Impact: nesting, foraging or roosting hen harrier may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on breeding success, productivity or survival rates.

8.7.56 Sensitivity: High.

8.7.57 Magnitude of Impact: No hen harrier breeding evidence was recorded within the 2 km study area in 2019, and no hen harrier nesting has been recorded within 2 km of the site boundary since 2011, and during the design layout process, effort was made to locate proposed turbines at least 2 km from known historic breeding records.

8.7.58 Hen harrier is a ground nesting species, breeding in longer heather and feeding on predominantly small birds and small mammals. There is evidence from a number of wind farms (e.g. Cruach Mhor (Robson 2012), Edinbane (Haworth & Fielding 2012) and Paul's Hill (Robinson & Lye 2012)) that hen harrier can exist alongside turbines, with anecdotal evidence of birds flying and nesting in proximity to turbines. No displacement/disturbance impacts have been noted at those wind farms, and the likelihood of any such impacts due to the Proposed Development is therefore considered to be low.

8.7.59 The impact of displacement on the hen harrier NHZ 19 population is considered to result in an impact of negligible spatial and long-term temporal magnitude.

8.7.60 Significance of Effect: with the NHZ 19 and national populations of hen harrier likely to be in unfavourable conservation status, the unmitigated effect on breeding hen harrier from construction is classified as **minor** adverse and is therefore Not Significant in the context of the EIA Regulations. It also follows that there are no significant effects predicted for the Muirkirk Uplands SSSI.

Merlin

8.7.61 Impact: nesting and foraging merlin may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on breeding success, productivity or survival rates.

8.7.62 Sensitivity: High.

8.7.63 Magnitude of Impact: no breeding evidence was recorded during the 2019-20 baseline surveys at the site, merlin activity was very low with one flight recorded within 2 km of the site in September 2019. SSRSG identified two historic nest sites in 2010 and 2013 within the Muirkirk and North Lowther Uplands SPA, over 2 km from the nearest proposed turbine location. There are no records of breeding within 2 km since 2013.

8.7.64 Merlin feed predominantly on small birds, preferentially feeding on skylark and meadow pipit (Sale, 2015) which inhabit open ground areas, and so although potentially suitable breeding habitat theoretically exists within and surrounding the site, considering that there is little current activity, and no evidence to show that merlin have bred in the local area since 2013 and when they did breed the nest locations were located at 2.3 to 2.5 km from the nearest proposed turbine location, it is very unlikely that breeding merlin would be displaced or disturbed during operation. The impact of displacement on the merlin NHZ 19 population is considered to result in an impact of negligible spatial and long-term temporal magnitude.

8.7.65 Significance of Effect: with the NHZ 19 and national populations of merlin likely to be in unfavourable conservation status, the unmitigated effect on breeding merlin from construction is classified as **minor** adverse and is therefore Not Significant in the context of the EIA Regulations. It also follows that there are no significant effects predicted for the Muirkirk Uplands SSSI.

Goshawk

8.7.66 Impact: nesting or foraging goshawks may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on breeding success, productivity or survival rates.

8.7.67 Sensitivity: Medium-Low.

8.7.68 Magnitude of Impact: one goshawk territory was identified within the site in 2019 and 2020 and goshawk was the most frequently recorded species during flight activity surveys in 2019-20. Surveys for Cumberhead Wind Farm recorded a goshawk nest elsewhere within the Cumberhead Forest in 2013, over 2 km from the Proposed Development, and inter-annual variation in numbers and distribution is likely to occur each year as a result of ongoing commercial forestry activities within Cumberhead Forest. The areas where goshawk nests were recorded in 2019 and 2020 will be clear felled as part of ongoing commercial forestry activities by the time the Proposed Development would become operational, meaning that these locations would no longer be suitable for nesting.

8.7.69 If a territory was to remain within the site, with a nest site located elsewhere in mature plantation, as a predominantly woodland species, it is unlikely that goshawks would be subject to extensive displacement around operational turbines compared to some open moorland species for example. Some localised loss of foraging or nesting habitat in close proximity to operational turbines may occur, but this is unlikely to result in a significant effect on the viability of any territory, with sufficient woodland habitat still likely to exist in the wider area. Keyholing may result in increased forest edge habitat, which may increase foraging opportunities. The impact of displacement on the goshawk NHZ 19 population is therefore considered to result in an impact of negligible spatial and long-term temporal magnitude.

8.7.70 Significance of Effect: with the NHZ 19 and national populations of goshawk likely to be in favourable conservation status, the unmitigated effect from operational displacement is classified as **negligible** and is not significant in the context of the EIA Regulations.

Black Grouse

8.7.71 Impact: black grouse is recognised as a species which is potentially sensitive to the presence of wind farms (e.g. SNH, 2018a), and wind farm operation may cause some displacement of breeding and foraging black grouse from areas close to turbines and other infrastructure.

8.7.72 Sensitivity: Medium-High.

8.7.73 Magnitude of Impact: Although no birds were recorded in 2019-20, historically, two small leks were recorded in 2004 outside of the site boundary, with the closest approximately 960 m from the nearest proposed turbine (Figure 8.8).

8.7.74 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 a 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 which was located approximately 500-600 m from a turbine (Ross, 2012). At Berry Burn Wind Farm, the closest active leks to turbines recorded during the operational period were 240 m away in 2004, and 175 m away in 2016 (with a second 280 m away) (MacArthur Green, 2019).

8.7.75 On balance, known historic lekking areas to the south-west of the site are likely to be outside of potential displacement range, and are likely to remain available for black grouse should numbers recover in future years. With the keyholing of turbines within forestry and replanting of other commercial forestry blocks after felling, it is likely that sufficient screening would mean that the moorland and forest edge habitat would still be used.

8.7.76 Leks recorded in proximity to the existing access track for Cumberhead Forest and Hagshaw Hill Wind Farm are unlikely to be affected by the Proposed Development during the operational phase, being located well outside of potential displacement range due to turbines, with any vehicular movements due to maintenance activities being infrequent and similar to the existing situation.

8.7.77 Given that there is no evidence that black grouse currently utilise the site and the nearest recorded historic lek was 1.0 km from the nearest proposed turbine location, it is considered unlikely that any birds would be lost from the NHZ population.

8.7.78 The magnitude of operational displacement impacts on the current NHZ 19 black grouse population is therefore considered to be negligible spatial, and short-term temporal.

8.7.79 Significance of Effect: the effect on black grouse is classified as **minor** adverse and is not significant in the context of the EIA Regulations.

Curlew

8.7.80 Impact: nesting or foraging curlew may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting breeding success, productivity or survival rates.

8.7.81 Sensitivity: Medium-High.

8.7.82 Magnitude of Impact: data from 2019 and historic surveys indicate that around 5-6 pairs of curlew may breed within approximately 500-750 m of the Proposed Development site boundary, although over 1 km from a proposed turbine location. The study by Wilson et al. (2014) on the impacts of forest edge effects on wader breeding suggests that it is unlikely that birds would attempt to nest in closer proximity to the site, even in the absence of the Proposed Development. No wader breeding activity for example, was recorded close to forestry during surveys in 2019, although curlew were present further north. Thus, additional impacts are likely to be of negligible spatial and long-term temporal magnitude within the NHZ 19 populations' context.

8.7.83 Significance of Effect: the unmitigated effect from operational displacement on the NHZ 19 lapwing and curlew populations is classified as **minor** adverse and not significant in the context of the EIA Regulations.

Golden Plover

8.7.84 Impact: foraging golden plover may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

8.7.85 Sensitivity: Medium-High.

8.7.86 Magnitude of Impact: golden plover were not recorded breeding during the 2019 baseline surveys within the 2 km study area. Five autumn passage golden plover flocks were recorded flying within 500 m over the site in 2019.

8.7.87 As no birds were recorded in foraging or breeding within 500 m of Cumberhead Forest during baseline surveys it is considered unlikely that any significant displacement would occur due the Proposed Development. The magnitude of impact is therefore considered to be negligible spatial and long-term temporal.

8.7.88 Significance of Effect: the unmitigated effect on the national/flyway golden plover population from operational displacement is classified as **minor** adverse and is not significant in the context of the EIA Regulations.

Potential Effects: Collision Risk

8.7.89 Birds that utilise the airspace within the site at potential collision heights would be at risk of collision with wind 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, species' behaviour and the ability of birds to detect and manoeuvre around rotating turbine blades. Collision rates are likely to increase with a wind farm's proximity to large concentrations of birds, whether these are breeding and foraging birds, wintering birds, or those utilising specific areas for local or large-scale migration (Gill et al. 1996).

8.7.90 Band et al. (2007) described a method of quantifying potential bird collisions with onshore wind turbines, in which the following estimates are combined:

(i) the flight activity rate per unit area per season, extrapolated from a representative sample of observations; and

(ii) the likelihood that a flight through the rotor swept area would result in a collision.

8.7.91 Finally, an 'avoidance rate' is applied to account for behavioural adaptation of birds to the presence of wind turbines. This results in a figure for the likely mortality rate associated with the Proposed Development which is then assessed within the context of the species' relevant populations to determine the significance of any losses.

Hen harrier

8.7.92 Impact: hen harrier flying within the site may be subject to a collision risk with turbines, thereby increasing the mortality rate of the population above background levels.

8.7.93 Sensitivity: High.

8.7.94 Magnitude of Impact: two hen harrier flights were recorded during flight activity surveys in the 2019-20 non-breeding season, but neither was considered to be 'at-risk' and consequently no collision risk modelling was undertaken.

8.7.95 With no nesting recorded within 2km of the Proposed Development site since at least 2010, collision risk is likely to be very low. As such, a negligible spatial and long-term temporal magnitude of impact is predicted.

8.7.96 Significance of Effect: The unmitigated effect on breeding hen harrier from collision risk is classified as **minor** adverse and is therefore Not Significant in the context of the EIA Regulations. It also follows that there are no significant effects predicted for the Muirkirk Uplands SSSI.

Merlin

8.7.97 Impact: merlin flying within the site may be subject to a collision risk with turbines, thereby increasing the mortality rate of the population above background levels.

8.7.98 Sensitivity: High.

8.7.99 Magnitude of Impact: one merlin flight was recorded during flight activity surveys in September 2019 during the non-breeding season but was not 'at-risk' and consequently no collision modelling was undertaken.

8.7.100 Merlin are in general likely to fly below turbine rotor heights when hunting on moorland and fly at risk heights mainly when displaying around nest sites. With no nesting recorded within 2km of the Proposed Development site since 2013, collision risk is likely to be very low. As such, a negligible spatial and long-term temporal magnitude of impact is predicted.

8.7.101 Significance of Effect: with the NHZ 19 and national populations of merlin likely to be in unfavourable conservation status, the unmitigated effect on breeding merlin from construction is classified as **minor** adverse and is therefore Not Significant in the context of the EIA Regulations. It also follows that there are no significant effects predicted for the Muirkirk Uplands SSSI.

Goshawk

8.7.102 Impact: goshawk flying within the site may be subject to a collision risk with turbines, thereby increasing the mortality rate of the population above background levels.

8.7.103 Sensitivity: Medium-Low.

8.7.104 Magnitude of Impact: goshawks were recorded in flight within the site during flight activity surveys in the 2019 breeding and 2019-20 non-breeding seasons. A total of 18 flight events were recorded, and a resultant mean annual collision risk of 0.1529, or one collision every 6.54 years was predicted. The goshawk flights recorded during 2019 baseline surveys were associated with a breeding territory within the site (nest site unknown), and a nest site in 2020 was recorded (Confidential Figure 8.2.2). However, due to commercial forest harvesting activities currently taking place within the site, the areas used for nesting in 2019 and 2020 will be cleared and unsuitable for nesting when the Proposed Development would be operational. Goshawks are in general likely to fly below turbine rotor heights when hunting within and adjacent to forestry and fly at risk heights mainly when displaying around nest sites. As such the recorded flight activity in proximity to turbines, and estimated collision rate, may be overestimated.

8.7.105 Nevertheless, assuming an NHZ 19 breeding population of at least 31 pairs and a mean adult annual survival rate of 0.830 (BTO BirdFacts), this collision rate would result in an additional mortality of 1.4 %. A low spatial and long-term temporal magnitude of impact due to collision risk is predicted.

8.7.106 Significance of Effect: with the NHZ 19 and national populations of goshawk likely to be in favourable conservation status, the unmitigated effect from operational displacement is classified as **minor** adverse and is not significant in the context of the EIA Regulations.

Black Grouse

8.7.107 Impact: black grouse flying within the site may be subject to a collision risk with turbines or other infrastructure, thereby increasing the mortality rate of the population above background levels.

8.7.108 Sensitivity: Medium-High.

8.7.109 Magnitude of Impact: no black grouse were recorded in 2019, and no collision risk modelling was conducted for any other local wind farm project due to the low number of, or lack of at-risk flights. In general, black grouse fly at low altitudes below rotor height although they 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 reports strong declines in black grouse numbers in local populations in areas where three wind farms were constructed in the Alpine zone in Austria.

8.7.110 There is a potential risk to black grouse from any structures such as fences and railings of the steps associated with turbines. However, based on the lack of suitable habitat within the site, and the

proposed key-holing of turbines within mature forestry, the likelihood of this occurring is considered to be very low.

8.7.111 The magnitude of impact of collision with turbine infrastructure on black grouse is considered to be negligible spatial and long-term temporal on the NHZ 19 black grouse population.

8.7.112 Significance of Effect: the effect on black grouse is classified as **negligible** and is not significant in the context of the EIA Regulations.

Curlew

8.7.113 Impact: curlew flying within the site may be subject to a collision risk with turbines, thereby increasing the mortality rate of the population above background levels.

8.7.114 Sensitivity: Medium-High.

8.7.115 Magnitude of Impact: curlews were not recorded during flight activity surveys in 2019-20, with the Proposed Development site mainly comprising unsuitable habitat. Collision risk modelling was therefore not undertaken.

8.7.116 Nearby wind farm sites within 1 km, including those more suitable for curlew than the Proposed Development site, including Nutberry wind farm (2004-2006) and Galawhistle wind farm (2007-2009) recorded curlew flight activity during baseline surveys, but predicted collision rates were no more than every c. 3.4-5.6 years.

8.7.117 Overall, collision risk for curlew associated with the Proposed Development is considered to be of negligible spatial and long-term temporal magnitude.

8.7.118 Significance of Effect: despite the unfavourable status of the NHZ 19 curlew populations, the overall effect is considered to be **minor** adverse and not significant in the context of the EIA Regulations.

Golden Plover

8.7.119 Impact: golden plover flying within the site may be subject to a collision risk with turbines, thereby increasing the annual mortality rate of the population above background levels.

8.7.120 Sensitivity: Medium-High.

8.7.121 Magnitude of Impact: five flocks of golden plover were recorded in flight activity surveys during the autumn migration in the 2019-20 non-breeding season. A total of 3 out of 5 flight events were 'at-risk' (Appendix 8.1, Annex D), and a resultant mean annual collision risk of 0.0016, or one collision every 626 years was predicted (Table 8.10).

8.7.122 The additional mortality due to collisions associated with the Proposed Development is therefore considered to be of negligible spatial and long-term temporal magnitude within the context of the passage population.

8.7.123 Significance of Effect: the overall effect on golden plover is assessed as **minor** adverse and not significant in the context of the EIA Regulations.

Potential Effects: Lighting

8.7.124 Where turbines have a rotor tip height over 150 m, lighting would be required, in accordance with Article 222 of the UK Air Navigation Order (ANO) (in line with current guidance from the Civil Aviation Authority (CAA, 2016). As advised by NatureScot (2020a), there are potential lighting impacts on birds which therefore require consideration within an EIA.

All IOFs

8.7.125 Impact: impacts on IOFs might arise as a consequence of deployment of obstruction lighting on turbines over 150 m to blade tip. Once installed on-site, the Proposed Development turbines would need to be lit with medium intensity (2000 candela) steady red aviation warning lights, mounted on the nacelle of the turbines and at intervals of no more than 52 m on the tower.

8.7.126 Lighting could have various effects on birds: they may be attracted to lights and thereby placed at higher risk of collisions, have migration patterns disrupted, show avoidance of lights with a consequent displacement impact, or be subject to increased predation threat. NatureScot (2020b) has identified attraction (phototaxis) as posing the principal threat to birds, in relation to wind turbines.

8.7.127 Sensitivity: medium-low for hen harrier, goshawk and merlin; medium-high for black grouse and waders.

8.7.128 Magnitude of Impact:

8.7.129 Annex F of Appendix 8.1 provides a literature review on the potential impacts of artificial lighting on birds, going into further detail than the NatureScot (2020b) information note. The review concluded that for breeding birds, there are no studies or observations reporting clear examples of any seasonal activities of birds being affected by exposure to artificial light (a similar conclusion was reached in NatureScot 2020b). There is also very little, if any, impact of artificial light on photoperiod responses (e.g. daily period of time birds are active, or breeding or migratory cues) of wild birds.

8.7.130 It is widely recognised that nocturnal migrant birds are attracted to artificial light while migrating, and historical reports of collisions associated with structures such as lighthouses or oil rigs suggest that risks are highest during periods of poor visibility and high winds. Watson et al. (2016) conclude that artificial lighting changes behaviour of nocturnal migrant birds, either by changing their flight paths to pass over lit areas, by flying at lower altitudes over lit areas, by increasing their call rates over lit areas, or by remaining longer over lit areas.

8.7.131 The evidence provided in the literature review indicates that lights on turbines may increase numbers of nocturnal migrant birds that collide, particularly if lights are steady rather than flashing. Obstruction lighting on turbines however appears to be several orders of magnitude less effective than the light from lighthouses and lightships in attracting nocturnal migrant birds.

8.7.132 Regarding potential displacement around turbines, Day et al. (2017) reported that migrating eiders showed higher avoidance at night of an oil-production facility in Alaska when it was illuminated with a hazing light system. However, this seems to be a rare example of birds being displaced by artificial lights, and there seem to be more examples of birds using artificial lights to their benefit, such as the use by shorebirds of artificial lights to allow them to feed visually at night.

8.7.133 In NatureScot's (2020a) advice on the scope of assessment for turbine lighting, it is identified that an assessment of the possible effects of lighting on birds may be required in the following three situations, where risk is greater: (i) wind turbines on or adjacent to a seabird colony that hosts burrow nesting species; (ii) wind turbines that are on or adjacent to protected areas that host large concentrations of wintering waterbirds, where such sites are located within open country away from other sources of artificial light; and (iii) where wind farms are located on migratory corridors or bottlenecks for nocturnally migrating passerines.

8.7.134 It is clear that the Proposed Development does not fit the first two situations. In the case of migrating passerines, there is no evidence to suggest from results of surveys that the site is of any importance as a migration route, with conditions likely to be of no particular importance. The habitats within the site are generally poor for food or shelter, the topography does not suggest that it would be a significant flight corridor (e.g. such as a natural feature such as a valley or loch side), and it is distant from coastal areas which would be of greater importance to continental migrants.

8.7.135 As such, based on the literature review in Appendix 8.1, Annex F, and guidance provided by NatureScot (2020a; 2020b), it is considered that there is little evidence to indicate that any species would be significantly impacted either negatively or positively by lighting requirements, particularly at a relatively small project such as the Proposed Development. An impact of negligible, long-term magnitude is therefore predicted for all IOFs.

8.7.136 Significance of Effect: in conclusion, the magnitude of impact on IOFs associated with lighting is predicted to be negligible spatial and long-term temporal, and **negligible** and not significant in the context of the EIA Regulations. It also follows that there are no significant effects predicted for any feature associated with the Muirkirk Uplands SSSI.

Decommissioning

8.7.137 Decommissioning effects for the Proposed Development are difficult to predict with any confidence because of the long timeframe until their occurrence (30 years). Decommissioning impacts are considered for the purpose of this chapter to be similar to those of construction effects in nature but are likely to be of shorter duration. The significance of effects predicted in the Construction Effects section are therefore considered appropriately precautionary for assessing decommissioning effects on IOFs.

8.8 Mitigation

8.8.1 No significant effects were predicted for any IOF, and therefore no specific mitigation is required.

8.8.2 A Breeding Bird Protection Plan (BBPP) would be set up as standard to comply with legislation and avoid the destruction or disturbance of any nest site. Pre-construction breeding bird surveys would be undertaken by a suitably qualified ornithologist to determine whether any breeding activity is taking place within potential species-specific disturbance zones of any proposed infrastructure (assumed to be 500 m for Schedule 1 raptors and 750 m for black grouse). If breeding (or lekking in the case of black grouse) does occur within a potential disturbance zone, all construction works would be halted immediately and a disturbance risk assessment would be prepared. The risk assessment would consider the likelihood and possible implications of the associated construction activities on the breeding attempt and set out necessary measures to ensure that no disturbance occurs. The proposed mitigation measures, and if required, the exact distance of any disturbance-free zone would be agreed with NatureScot, within which any construction activity that is considered to be potentially disturbing would be prohibited in that area until chicks are fledged (or the core lekking period of March to May has passed in the case of black grouse). Details of proposed mitigation, please clarify whether the mitigation is during construction, operation or decommissioning.

8.8.3 For ecological enhancement of the site, an Outline Habitat Management Plan (OHMP) is described in Appendix 7.5 for the Proposed Development, which aims to restore and enhance blanket bog and increase native woodland coverage. This would provide improved habitat quality for Muirkirk and North Lowther Uplands SPA qualifying features, either directly within the site, or indirectly within the SPA itself by removing forest edge effects which may suppress breeding numbers close to the site boundary. These management measures would also help compensate for any habitat loss or displacement effects for black grouse and goshawk and provide wider biodiversity improvements.

8.9 Residual Effects

8.9.1 As there is no mitigation required, the level of significance and therefore residual effects are unchanged for all IOFs (**negligible** or **minor adverse**, and therefore not significant in EIA terms).

8.10 Cumulative Assessment

8.10.1 The assessment of ornithological effects associated with the Proposed Development alone predicted unmitigated non-significant effects for every IOF, due to the low suitability of habitat within the site, lack of breeding records, and/or the low activity levels of IOFs recorded during baseline surveys. Consequently, no breeding activity is likely to be significantly affected for any IOF, and collision rates are likely to be negligible within a population context, both when considering all wind farm projects within the local area, and at an NHZ 19 level.

8.10.2 It is therefore considered that the magnitude of impacts of the Proposed Development on IOFs would contribute very little to the overall cumulative effect for each potential impact at an NHZ 19 level. An NHZ-level cumulative assessment is therefore not considered necessary.

8.11 Summary

8.11.1 This chapter has assessed the potential effects associated with the construction, operation and decommissioning of the Proposed Development on birds.

8.11.2 The compilation of baseline information for the ornithological assessment consisted of a desk-based assessment and one breeding season plus one non-breeding season of field surveys in accordance with SNH (2017) guidance. The desk-based assessment included bird monitoring data recorded for wind farm developments surrounding the site (providing data from 2003 to 2018). Baseline surveys in 2019-20 collected flight activity data, breeding bird data and wintering bird data for the site.

8.11.3 IOFs taken forward to assessment, were identified from the baseline assessment as hen harrier, merlin, goshawk, black grouse, curlew and golden plover. Impacts from unmitigated construction and decommissioning activities were assessed as not significant in the context of the EIA Regulations.

8.11.4 A BBPP and pre-construction surveys would be set up as standard to avoid the destruction or disturbance of any nest site during the construction period, with species-specific temporal and spatial restrictions around construction works.

8.11.5 During the operational period, unmitigated effects were also assessed as not significant in the context of the EIA Regulations.

8.11.6 It was considered that the magnitude of impacts of the Proposed Development on IOFs would not contribute to the overall cumulative effect, therefore a cumulative assessment was not undertaken.

8.11.7 Information to inform an Appropriate Assessment on the Muirkirk and North Lowther Uplands SPA is provided separately in Appendix 8.3, and it was concluded that no adverse effects on integrity would occur to the Muirkirk & North Lowther Uplands SPA (or any other SPA) due to the Proposed Development alone, or in-combination with any other projects.

Table 6.2 – Summary Table

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
During Construction & Decommissioning					
Hen harrier	Minor (Not significant)	Adverse	BBPP and pre-construction surveys. Spatial and temporal restrictions of construction activity if required.	Not significant	Adverse
Merlin	Minor (Not significant)	Adverse		Not significant	Adverse
Goshawk	Negligible (Not significant)	Adverse		Not significant	Adverse
Black grouse	Minor (Not significant)	Adverse		Not significant	Adverse
Curlew	Minor (Not significant)	Adverse		Not significant	Adverse
Golden plover	Minor (Not significant)	Adverse		Not significant	Adverse
During Operation: Displacement					
Hen harrier	Minor (Not significant)	Adverse	None required. HMP would provide enhanced habitat.	Not significant	Adverse
Merlin	Minor (Not significant)	Adverse	None required. HMP would provide enhanced habitat.	Not significant	Adverse
Goshawk	Negligible (Not significant)	Adverse	None required. HMP would provide enhanced habitat.	Not significant	Adverse
Black grouse	Minor (Not significant)	Adverse	None required. HMP would provide enhanced habitat.	Not significant	Adverse
Curlew	Minor (Not significant)	Adverse	None required. HMP would provide enhanced habitat.	Not significant	Adverse
Golden plover	Minor (Not significant)	Adverse	None required. HMP would provide enhanced habitat.	Not significant	Adverse
During Operation: Collision Risk					
Hen harrier	Minor (Not significant)	Adverse	None required	Not significant	Adverse
Merlin	Minor (Not significant)	Adverse	None required	Not significant	Adverse
Goshawk	Minor (Not significant)	Adverse	None required	Not significant	Adverse
Black grouse	Negligible (Not significant)	Adverse	None required	Not significant	Adverse

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Curlew	Minor (Not significant)	Adverse	None required	Not significant	Adverse
Golden plover	Minor (Not significant)	Adverse	None required	Not significant	Adverse
During Operation: Lightning Effects					
All IOFs	Negligible (Not significant)	Adverse	None required	Not significant	Adverse
Cumulative Effects					
All IOFs	Minor (Not significant)	Adverse	None required	Not significant	Adverse

8.12 References

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.

Bright, J. A., Langston, R. H. W., Bullman, R., Evans, R. J., Gardner, S., Pearce-Higgins, J. & Wilson, E. (2006). *Bird Sensitivity Map to provide locational guidance for onshore Windfarms in Scotland*. Royal Society for the Protection of Birds.

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

CAA (Civil Aviation Authority) 2016. *The Air Navigation Order 2016 and Regulations*. Available at: https://publicapps.caa.co.uk/docs/33/CAP393_E5A3_MAR2018(p).pdf.

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

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.

Day, R.H., Prichard, A.K., Rose, J.R., Streever, B. and Swem, T. 2017. *Effects of a hazing-light system on migration and collision avoidance of eiders at an artificial oil-production island*, Arctic Alaska. Arctic, 70, 13-24.

DES (Dunnock Environmental Services) 2015. *Final Breeding Raptor Survey Report 2015 of the Proposed Douglas West & Dalquhandy DP Renewable Energy Project*.

Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015). *Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man*. British Birds 108, 708–746.

European Commission (2010). *Natura 2000 Guidance Document 'Wind Energy Developments and Natura 2000*. European Commission, Brussels. Available at: http://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf.

European Commission (2016a). *Directive 2009/147/EC on the Conservation of Wild Birds*. Available at: http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm.

European Commission (2016b). *Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora*. Available at: http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm.

European Commission (2016c). *Environmental Impact Assessment Directive 2014/52/EU*. Available at: http://ec.europa.eu/environment/eia/eia-legalcontext.htm.

Ewing, S. R., Rebecca, G.W., Heavisides, A., Court, I.R., Lindley, P., Ruddock, M., Cohen, S. and Eaton, M.A. (2011). *Breeding status of Merlins Falco columbarius in the UK in 2008.* Bird Study 58: 379-389.

Fielding, A., Haworth, P., Whitfield, P., McLeod, D. & Riley, H. 2011. A Conservation Framework for Hen Harriers in the United Kingdom. JNCC Report 441. Joint Nature Conservation Committee, Peterborough.

Forest Commission Scotland (2006). Guidance Note 32: Forest operations and birds in Scottish forests: November 2006. Accessed Oct 2020: https://forestry.gov.scot/images/corporate/pdf/Guidancenote32Birddisturbance.pdf

Forrester, R.W., Andrews, I.J., McInerny, C.J. et al. (eds). 2007. *The Birds of Scotland*. The Scottish Ornithologists Club, Aberlady.

Gill, J.P., Townsley, M. and Mudge, G.P. (1996). Review of the impacts of Windfarms and other aerial structures upon birds. SNH Review 21: 68pp.

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

Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. & Thompson, D. (2009; updated 2013) *Raptors: a field guide for surveys and monitoring (2nd and 3rd editions)*. The Stationery Office, Edinburgh.

Haworth, P. & Fielding, A. (2012). A review of the impacts of terrestrial wind farms on breeding and wintering hen harriers. Haworth Conservation. http://www.alanfielding.co.uk/fielding/pdfs/Hen%20harriers%20and%20Windfarms.pdf

Hill, D.A., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. (1997). *Bird disturbance: improving the quality of disturbance research*. Journal of Applied Ecology 34:275-288.

MacArthur Green (2019) Berry Burn Wind Farm: Habitat Management Plan Implementation 2018.

Massimino, D., Woodward, I.D., Hammond, M.J., Harris, S.J., Leech, D.I., Noble, D.G., Walker, R.H., Barimore, C., Dadam, D., Eglington, S.M., Marchant, J.H., Sullivan, M.J.P., Baillie, S.R. & Robinson, R.A. (2019) BirdTrends 2019: trends in numbers, breeding success and survival for UK breeding birds. BTO Research Report 722. BTO, Thetford. Available at: www.bto.org/birdtrends.

Musgrove, A., Aebischer, N., Eaton, M., Hearn, H., Newson, S., Noble, D., Parsons, M., Risely, K. and Stroud, D. (2013). *Population estimates of birds in Great Britain and the United Kingdom*. British Birds 106, pp. 64 –10.

NatureScot (2020a). *General pre-application and scoping advice for onshore wind farms*. Guidance.

NatureScot (2020b). *The Effect of Aviation Obstruction Lighting on Birds at Wind Turbines, Communication Towers and Other Structures.* NatureScot Information Note.

Pearce-Higgins, J.W., Stephen, L., Douse, A. and Langston, R.H.W. (2012). *Greater impacts of Windfarms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis*. Journal of Applied Ecology 49: 386-394.

Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. and Bullman, R. 2009. The distribution of breeding birds around upland wind farms. J. Appl. Ecol., 46: 1323–1331.

Robinson, R.A. (2005) BirdFacts: profiles of birds occurring in Britain & Ireland (BTO Research Report 407). BTO, Thetford (http://www.bto.org/birdfacts, accessed on 21/10/2020).

Robinson, C. & Lye, G. (2012). Paul's Hill Wind Farm: Flight Activity & Breeding Success of Hen Harrier. Presentation at Sharing Good Practice: Assessing the Impact of Windfarms on Birds Battleby, April 2012.

Robson, P. (2012). Hen Harrier activity at Cruach Mhor windfarm. Review of monitoring data 2001-2011. SNH Sharing Good Practice Workshop - Assessing the impact of windfarms on birds, 3 April 2012. https://www.yumpu.com/en/document/view/8045986/hen-harrier-activity-at-cruach-mhor-windfarm-peter-robson-spr.

Ross, A. (2012). Griffin Windfarm LMP: Black grouse lek survey report 2012. Northern Ecological Services report to SSE Renewables.

Ruddock, M. & Whitfield, D. P. (2007). *A Review of Disturbance Distances in Selected Bird Species*, A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

Sale, R. (2015). *The Merlin.* Snowfinch publishing.

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. Available at: http://jncc.defra.gov.uk/pdf/HDir_Rpt.pdf.

Scottish Government (2004). *The Nature Conservation (Scotland) Act 2004* (as amended). Available at: https://www.legislation.gov.uk/asp/2004/6/contents.

Scottish Government (2012). *The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (The Habitats Regulations)*. Available at: https://www.legislation.gov.uk/ssi/2012/228/contents/made.

Scottish Government (2014). *The Wildlife and Countryside Act 1981 (as amended).* Available at: https://www.gov.scot/Topics/Environment/Wildlife-Habitats/InvasiveSpecies/legislation.

Scottish Government (2017). *The Electricity Works (Environmental Impact Assessment) (Scotland*) Regulations 2017. Available at: http://www.legislation.gov.uk/ssi/2017/101/contents/made.

Scottish Natural Heritage (2000). *Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action.* SNH Guidance Note. Available at: https://www.nature.scot/windfarms-and-birds-calculating-theoretical-collision-risk-assuming-no-avoiding-action.

Scottish Natural Heritage (2016a). *Assessing connectivity with Special Protection Areas (SPAs). Version 3*. Available at: https://www.nature.scot/sites/default/files/2017-06/A2015314%20-%20Assessing%20connectivity%20with%20special%20protection%20areas%20-June%202016.pdf.

Scottish Natural Heritage (2016b). *Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees* Version 2. Available at: https://www.nature.scot/sites/default/files/2017-10/A2097001%20-%20Environmental%20Statements%20and%20Annexes%20of%20Environmentally%20Sensitive%20Bird%20Information%20-%20September%202016.pdf.

Scottish Natural Heritage (2017). *Recommended bird survey methods to inform impact assessment of onshore wind farms*. Available at: https://www.nature.scot/recommended-bird-survey-methods-inform-impact-assessment-onshore-windfarms.

Scottish Natural Heritage (2018a). *Assessing significance of impacts from onshore windfarms on birds outwith designated areas.* Version 2. Available at: https://www.nature.scot/sites/default/files/2018-02/Guidance%20-%20Assessing%20the%20significance%20of%20impacts%20on%20bird%20populations%20from%20onshore%20wind%20farms%20that%20do%20not%20affect%20protected%20areas.pdf.

Scottish Natural Heritage (2018b). *Assessing the cumulative impacts of onshore wind farms on birds*. SNH Guidance Note. Available at: https://www.nature.scot/guidance-assessing-cumulative-impacts-onshore-wind-farms-birds.

Scottish Natural Heritage (2018c). *Environmental Impact Assessment Handbook* – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland. Available at: https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf.

Sim, I.M.W., Eaton, M.A., Setchfield, R.P., Warren, P. & Lindley, P. 2008. Abundance of male Black Grouse Tetrao tetrix in Britain in 2005, and change since 1995–96. Bird Study, 55, 303–315.

Watson, M.J., Wilson, D.R. and Mennill, D.J. 2016. *Anthropogenic light is associated with increased vocal activity by nocturnally migrating birds*. Condor, 118, 338-344.

Wilson, J.D., Anderson, R., Bailey, S., Chetcuti, J., Cowie, N.R., Hancock, M.H., Quine, C.P., Russell, N., Stephen, L. and Thompson, D.B.A. (2014). *Modelling edge effects of mature forest plantations on peatland waders informs landscape-scale conservation*. Journal of Applied Ecology Vol 51. pp204-213.

Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). *Natural Heritage Zone Bird Population Estimates*. SWBSG Commissioned report number SWBSG_1504. pp72. Available from: www.swbsg.org.

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

Wotton, S.R., Bladwell, S., Mattingley, W., Morris, N.G., Raw, D., Ruddock, M., Stevenson, A. & Eaton, M.A. (2017). Status of the Hen Harrier, *Circus cyaneus*, in the UK and Isle of Man in 2016. Bird Study 65:2, 145-160.

Zieler and Grünschachner-Berger, (2009). Impact of wind power plants on black grouse, *Lyrurus tetrix* in Alpine regions. Folia Zoologica -Praha- 58(2):173-182.

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