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Making Sustainability Happen

EFERENCES

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TECHNICAL APPENDICES

Technical Appendix 9.1: Ornithology Surveys 2021 - 2023
Technical Appendix 9.2: Additional Bird Surveys 2023
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Technical Appendix 9.4: Avian Collision Risk Modelling Report

Introduction

9.1 This Chapter provides the Ornithological Impact Assessment for the proposed development. The specific objectives of the chapter are to:

- describe the current baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address the likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation measures.
- 9.2 This Chapter is supported by the following Technical Appendices (these appendices contain relevant glossaries terms and abbreviations):
 - Technical Appendix 9.1: Ornithology Surveys 2021 2023;
 - Technical Appendix 9.2: Additional Bird Surveys 2023;
 - Technical Appendix 9.3: Ornithology Confidential Information; and
 - Technical Appendix 9.4: Avian Collision Risk Modelling Report.
- 9.3 Bird names of species mentioned in this Chapter follow the standard British Ornithologists' Union (BOU) nomenclature (BOU, 2022). Scientific names are provided in **Technical Appendix 9.1 (Table 4-1),** and **Technical Appendix 9.2 (Table 4-1).**

Scope and Consultation

Consultation

- 9.4 A pre-scoping consultation was undertaken with NatureScot in March 2022, comprising of a review of the Year 1 bird survey data for the proposed development as well as relevant contextual data collected from adjacent wind farm sites (SLR 2022). The purpose of the review was to establish the requirement for a second year of ornithology surveys to inform the impact assessment. NatureScot confirmed that a second year of vantage point, wader and raptor surveys was expected, but that a second year of black grouse surveys was not necessary.
- 9.5 **Table 9-1** includes a summary of ornithology-specific points raised by consultees during scoping and subsequent consultation process, and where these are addressed in this Chapter and/or elsewhere in the EIA Report.
- 9.6 The design of the proposed development evolved during the period between receiving Pre Application Advice from Clackmannanshire Council, and an EIA Scoping Request being submitted (see **Chapter 2: Site Description and Design Evolution** for more detail). Initially in 2021 and 2022, the scheme was located solely within Clackmannanshire, with the five turbines located in Perth and Kinross being added just prior to scoping. In line with this, the baseline survey areas changed over time. Further details are provided in the Assumptions, Limitations and Confidence section of this Chapter, and also in **Technical Appendices 9.1** and **9.2** (including maps showing the ornithology survey areas).



9.7 A Scoping Report (SLR, 2023) was submitted to the to the Energy Consents Unit (ECU) in March 2023.

Table	9-1:	Consultation	– Key	lssues
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Consultee, form of consultation and	Issue Raised	Response/Action Taken
date		
NatureScot, Scoping Response, by letter, 10 May 2023.	"The proposed survey methodology generally appears to be appropriate, however until we receive the EIA report and associated technical appendices, we cannot confirm that we are content with the ornithology surveys and assessments undertaken. We have previously provided advice in relation to the scope and extent of the surveys which has been taken into account within the scoping report. We stand by our advice that vantage point, breeding wader and breeding raptor surveys were continued for a second year (April 2022 – March 2023). We agreed that black grouse surveys were not required in 2022 due to lack of suitable habitat and observations in 2021 and the adjacent sites not recording black grouse present since 2008. We advised that the applicant liaise with the RSPB and the local Raptor Monitoring Group for any data held on any protected or Annex I species and are pleased the applicant will consult these two groups. Any data provided by these groups should be presented with the full assessment for the proposal in the EIA report. The applicant proposes not to undertake additional vantage point surveys of the area of the five additional turbines (T11-T15). If the existing surveys are sufficient to assess the likely impacts from the additional five turbines, then this would be acceptable. We recommend that the applicant clarifies this with their ecologist"	Details of surveys undertaken are provided within this chapter ('Field Survey' and 'Current Baseline' sections) and Technical Appendices 9.1 and 9.2 . The survey scope took into account the response from NatureScot. Additional breeding wader, breeding raptor and black grouse surveys were undertaken for the additional turbines and proposed access route, in 2023. Data consultations have been undertaken with RSPB Scotland and the Central Scotland Raptor Study Group, and the results presented within this Chapter ('Data Consultations') and/ or Technical Appendix 9.3 as appropriate. The five additional turbines are covered by the existing VPs as described in the Baseline Survey Methodologies and Technical Appendix 9.1 .
PKC, Scoping Response, by letter, 19 May 2023.	"The additional five turbines (T11 – T15), which are located within Perth and Kinross, have been assessed and there is no requirement to undertake additional VP surveys of this area. The desk study and proposed field work will be sufficient to inform a robust impact assessment. PKC agrees with the overall scope and intentions of the assessment."	As described above, the five additional turbines are covered by the existing VPs as described in the Baseline Survey Methodologies and Technical Appendix 9.1 .
RSPB Scotland, Scoping Response, by letter, 10 April 2023.	"In general, the ornithological chapter of the EIA should consider all the components of the proposal including access roads (including the route on public roads to get the turbines on site), on-site tracks, borrow pits, drainage, grid connection, substation, and temporary construction buildings/storage compounds. Disturbance, displacement (including	The Ornithology EIA considers all aspects of the site infrastructure including the proposed access route, on-site tracks and drainage, borrow pits, substation and temporary



Consultee, form of consultation and date	Issue Raised	Response/Action Taken
	 barrier effects), loss of suitable habitat (breeding, wintering and foraging) and collision risk should be assessed for all species. Information within the EIA report must demonstrate that the survey data are adequate, robust, and accurate. The following should be included: Full information on the Vantage Point (VP) Survey work undertaken, including dates, times, and weather conditions Maps showing VP locations that also denote viewsheds Maps showing raptor foraging areas and flights Worked example(s) of collision risk calculations Provision of raw data in order for independent verification of collision mortality and breeding birds. We are content that the VP surveys already undertaken cover the 5 additional turbines in Perth and Kinross." 	construction compounds. The grid connection will be subject to a separate application and assessment, as standard. Habitat loss, disturbance/ displacement (including barrier effects) and collision risk have been assessed. Full details of survey data are presented in Technical Appendices 9.1 and 9.2 , with confidential information presented in Technical Appendix 9.3 . Collision Risk Modelling and data are presented in Technical Appendix 9.4 . Post-construction monitoring proposals are included in Technical Appendix 8.4 , and summarised in the 'Mitigation' section of this chapter.
Clackmannanshire Council, Scoping Response, by letter, 28/04/23	"We have no additional comments to add at this time to those sent to the consultant by email on 19 July 2022" i.e., the Pre-App Advice (see below).	None required.
Clackmannanshire Council, Pre App Advice, 19/07/22	"Moorland Bird Surveys (MBS) surveys. 3 MBS visits should be able to determine rough territories and also nest sites. Collision Risk analysis should be carried out to determine the risks (to) birds in flight. Assume that the VP surveys will be mapping flight lines. The north side of the Ochils holds a large percentage of the wintering pink footed goose population. I'm not sure what route they take. They have several migrations during the season."	MBS were undertaken targeting breeding waders. The full list of surveys undertaken is provided in the 'Field Survey' section and in Technical Appendices 9.1 and 9.2 . Maps are provided showing flightlines. Collision Risk Modelling and data are presented in Technical Appendix 9.4 .

Effects Scoped Out

- 9.8 As set out in the EIA Scoping Report (SLR, 2023), the following have been scoped out of the ornithology assessment:
 - Effects on Designated Sites;



- Due to the levels of recorded activity at the site by the qualifying species of the designated sites identified in the desk study, impacts on designated sites will be scoped out.
- Effects on species which have below a certain geographic level of importance (e.g. Local);
 - In accordance with CIEEM (2022) guidelines, detailed assessment is only required for species with a certain level of importance or above. For Windburn Wind Farm, this is for species with local level and above (as defined in 'Assessment of Effects').
- Impacts on species / groups not susceptible to significant effects from wind farms.
 - As specified in current NatureScot (SNH 2017) guidance, impacts on species groups such as passerines (songbirds) which are not considered vulnerable to significant effects from wind farm developments have been scoped out. No Schedule 1 passerine species were identified within the site.

Approach and Methodology

9.9 This Chapter takes an appropriate and topic-specific approach to assessment of the proposed development within the parameters identified in **Table 3-1** of **Chapter 3: Description of Development.** This Chapter provides a worst-case assessment for ornithology and aims to describe the likely significant effects of the proposed development and present enough information for consultees and the decision makers to comment on and determine the application.

Study Area

- 9.10 The study area used for the surveys undertaken to inform the Ornithological Impact Assessment differs between receptors as recommended NatureScot guidelines (SNH, 2017). These are summarised in the Field Survey Methodology Section and are described in more detail within Technical Appendix 9.1 and Technical Appendix 9.2.
- 9.11 For the assessment of impacts on bird species a variety of buffer distances have been applied to each turbine location and around all other infrastructure where appropriate. These buffers are in accordance with current guidance and evidence-based research. Further details are provided in the Assessment of Potential Effects Section.

Information and Data Sources

9.12 A desk study was undertaken to collate existing information on bird populations in and around the Site, and to identify target species for baseline surveys. The information, combined with baseline survey results, was also utilised to put each target bird species recorded within the study area into context in terms of its geographical scale of importance.

Designated Sites

9.13 A desk search was carried out via the NatureScot SiteLink website (NatureScot, 2021) to identify statutory designated sites within 20km of the site which are designated for their avian interest (including Special Protection Areas (SPAs) and Sites of Scientific Interest SSSIs). Beyond 20km connectivity between SPAs and development proposals is unlikely.



The distance of 20km is pertinent to grey geese species only such as greylag goose and pink footed goose. Further information on the interest features of sites was obtained through the Joint Nature Conservation Committee (JNCC) and NatureScot websites.

9.14 Non-statutory designated sites within 2km of the site were identified through the desk study for the ecology assessment (see **Chapter 8: Ecology**). None have been designated for their avian interest.

Desk Study

- 9.15 Primary sources of contextual data were as follows:
 - Windburn Wind Farm, Ornithology Data Review (SLR 2022);
 - The Birds of Scotland (Forrester et al., 2007);
 - Scottish Raptor Monitoring Scheme Reports (e.g. Challis et al., 2020);
 - Review of published estimates of bird populations in Scotland (Wilson et al. 2015) and the UK (e.g., from the Avian Population Estimates Panel (APEP, Woodward *et al.* 2020));
 - Data for breeding Schedule 1 birds in the vicinity of the site from RSPB Scotland;
 - Data for breeding raptor species in the vicinity of the site from the Central Scotland Raptor Study Group (CSRSG);
 - A search for and review of any EIA Report or Environmental Statement chapters, survey reports and post consent monitoring reports from other developments within the relevant Natural Heritage Zone (NHZ 16, Eastern Lowlands); and
 - Review of relevant online resources (e.g., BTO website).

Field Survey

9.16 Baseline ornithology surveys were conducted during the period April 2021 to March 2023, and April to July 2023. Full details are presented in **Technical Appendix 9.1** and **Technical Appendix 9.2** with a summary provided below.

Target Species

- 9.17 Target species for the flight activity surveys were chosen considering the location of the site and were defined by legal and/ or conservation status and vulnerability to impacts potentially caused by wind turbines, as defined in NatureScot Survey guidance (SNH 2017).
- 9.18 The following species were considered as primary target species:
 - Species listed on Annex I of the Birds Directive or Schedule 1 of the Wildlife and Countryside Act 1981, in particular raptors and owls;
 - Kestrel¹;



¹ Due to conservation status as a Birds of Conservation Concern (BoCC) Amber species and the species vulnerability to wind turbines

- Breeding and migratory / wintering wildfowl; and
- Breeding and migratory / wintering wader species.

9.19 The following species were considered as secondary target species:

- Non-Annex I and/ or Schedule 1 raptor species (other than kestrel);
- Raven; and
- Other species of lesser conservation importance which are considered to be potentially vulnerable to impacts from wind farm developments.

Baseline Survey Methodologies

9.20 Surveys were undertaken in accordance with current NatureScot guidance on bird survey methods for onshore wind farms (SNH 2017). Following the first year of surveys, a review of the available ornithology data for the site and surrounding area was undertaken to inform consultation with NatureScot on the survey effort required for the site (SLR 2022). On the basis of this consultation a slightly modified scope of works was undertaken in Year 2, as described below and in **Technical Appendix 9.1**. Following the expansion of the proposed development into Perth and Kinross (as explained in paragraph 9.6), additional surveys were carried out in the 2023 breeding season (**Technical Appendix 9.2**). Figures showing vantage point (VP) locations and viewsheds, plus the species-specific survey buffers, are provided in **Technical Appendix 9.1** and **Technical Appendix 9.2**.

Flight Activity Surveys

9.21 Standard flight activity surveys were conducted from a combination of three VP locations between April 2021 to March 2023 (**Technical Appendix 9.1**). A summary of the survey hours is presented in **Table 9-2**.

VP Number	Grid Coordinates (x,y)	Hours of Survey Completed (hrs:mins)					
		Apr – Sep 2021	Oct 2021 – Mar 2022	Apr – Aug 2022	Sep 2022 – Mar 2023		
VP1	289226, 701449	36:00	36:00	30:00	42:00		
VP2	287465, 702953	36:00	00:00*	00:00*	00:00*		
VP3	287008, 701812	00:00*	39:20	24:00**	33:00**		

Table 9-2: VP Surveys Hours (Apr 2021 – Mar 2023)

* VP2 was moved to VP3 in October 2021, due to land access issues. More details are in paragraph 9.30. ** Survey hours during this period are less than 36 hours due to prolonged periods of low cloud. More details are in paragraph 9.32

Breeding Wader Surveys

9.22 Surveys for breeding waders were carried out within the Clackmannanshire part of the proposed development in 2021 and 2022 (**Technical Appendix 9.1**) and within the Perth & Kinross part of the proposed development in 2023 (**Technical Appendix 9.2**). In accordance with SNH (2017) guidance, a 500m buffer of the proposed development was covered over this time period.



Breeding Raptor Surveys

9.23 Species-specific surveys were undertaken for all raptors likely to occur, following methods outlined within Hardey *et al.* (2013). As above, surveys were carried out within the Clackmannanshire part of the site in 2021 and 2022 (**Technical Appendix 9.1**) and within the Perth & Kinross part of the site in 2023 (**Technical Appendix 9.2**)., As per SNH (2017) guidance, a 2km buffer of the proposed development was covered over this time period.

Black Grouse Lek Surveys

9.24 Black grouse surveys were undertaken based on the standard methodology (Etheridge and Baines (1995), Gilbert *et al.* (1998)). Surveys were carried out within the Clackmannanshire part of the site in 2021 (**Technical Appendix 9.1**) and within the Perth & Kinross part of the site in 2023 (**Technical Appendix 9.2**)., As per SNH (2017) guidance, a 1.5km buffer of the proposed development was covered over this time period.

Access Track Surveys

9.25 The proposed access route from the north, in Perth & Kinross, was surveyed for breeding waders and breeding raptors in 2023 (**Technical Appendix 9.2**). The corresponding survey area encompassed the proposed access route and an associated 250m buffer.

Collision Risk Modelling

9.26 The standard Band Collision Risk Modelling (CRM) (Band *et. al.*, 2007) was used to estimate collision risk based on recorded target species activity levels and flight behaviour, proposed turbine numbers and specifications, and the relevant species biometrics and flight characteristics. Modelling collision risk under the Band CRM is a two-stage process. Stage 1 estimates the number of birds that fly through the rotor swept disc. Stage 2 predicts the proportion of these birds that have the potential to be hit by a rotor blade. Combining both stages produces an estimate of collision mortality in the absence of any avoidance action / behaviour by birds. Avoidance rates are then applied to generate predicted rates of collision mortality. Full details are provided in **Technical Appendix 9.4**.

Assessment Methods

- 9.27 **Chapter 5: Environmental Impact Assessment** provides further detail on the general approach to assessment. It also sets out the list of projects to be considered in the cumulative assessment and their status. The specific methodology used for the Ornithological Impact Assessment is set out below.
- 9.28 The CIEEM Guidelines for Ecological Impact Assessment in the UK (CIEEM, 2022) form the basis of the impact assessment with other relevant guidance, as listed in the **Technical Appendix 4.1**, referred to as appropriate. In accordance with the CIEEM guidelines, only ornithological receptors which are considered to be important, (including those required to be considered by the EIA Regulations and other relevant policies) and potentially affected by the project (i.e., the Important Ornithological Features or IOFs) should be subject to detailed assessment. It is not necessary to carry out detailed assessment of receptors that are not subject to legal or policy protection and are sufficiently widespread, unthreatened and resilient to project impacts and would remain viable and sustainable.



Assumptions, Limitations and Confidence

- 9.29 The validity of ornithological survey data requires that they were obtained using accepted methodologies and that surveys were carried out in suitable conditions. The field survey methodologies outlined above and described in greater detail in **Technical Appendix 9.1** and **Technical Appendix 9.2** were all carried out using survey standards recommended by NatureScot and were carried out during suitable times of the year.
- 9.30 After six months of survey (in October 2021), VP 2 had to be moved approximately 1.2km south to a new location (VP3) due to land access issues. The overall coverage from VP 1 in combination with VP 2 and then VP 1 in combination with VP 3 was similar, i.e., the majority of the site was visible. However, with VPs 1 and 2 there were two turbine locations in Perth & Kinross (Turbines No.12 & No.13) that were not covered in the viewshed of VP 2. The change to VPs 1 and 3 meant that all turbine positions in Perth & Kinross were covered by the survey viewsheds. The only gaps in the visibility apparent (at 20m above ground level) are around Fin Glen and Birken Glen, where the topography is very steep. Therefore, it is considered that the vantage point data will be representative of the site as a whole and sufficient to inform a robust assessment of the proposed development.
- 9.31 The application boundary and proposed development area changed over time. Initially the application boundary did not include land within the Blackford Estate in Perth & Kinross. Therefore, there were no breeding wader, breeding raptor or black grouse surveys within this area in 2021 and 2022, due to lack of access. This additional area where five turbines are proposed to be located, was covered by surveys in 2023 (see Technical Appendix 9.2: Additional Bird Surveys 2023).
- 9.32 Due to unsuitable weather conditions, low cloud and / or health and safety concerns (e.g. impassable access track due to ice and/or difficult conditions under foot) some VP survey hours were missed. In particular, the Ochil Hills are prone to persistent low cloud resulting in prolonged periods of poor visibility within the proposed development. This resulted in missing hours (n=12) at VP3, and delayed or missing wader and raptor surveys in June 2022 (**Technical Appendix 9.1**).
- 9.33 Despite this, the data used to inform this assessment are considered sufficiently representative of the baseline situation for the proposed development and these are considered sufficient to inform a robust assessment.

Sensitivity Criteria

- 9.34 Ornithological receptors should be considered within a defined geographical context so for this project the following geographic frame of reference is used:
 - International
 - Species that form part of the cited interest within an internationally protected site or candidate site (for example SPA, or Ramsar site).
 - A species which is either unique or sufficiently unusual (in terms of distribution and / or abundance) to be considered as being a population of the highest quality example in an international / national context that the site is likely to be designated as an SPA.
 - National (i.e. Scotland)
 - Species that form part of the cited interest within a nationally designated site (for example, a SSSI or a National Nature Reserve [NNR]).



- A population of a species which is either unique or sufficiently unusual (in terms of distribution and / or abundance) to be considered as being of nature conservation value at up to a national context. This includes Wildlife and Countryside Act Schedule 1 species, a red- or amber- listed species (as detailed in Birds of Conservation Concern [BoCC]) and a priority Scottish species.
- Regional (i.e., Eastern Lowlands Natural Heritage Zone [NHZ] 16)
 - Sites supporting a regularly occurring, regionally significant number of internationally or nationally important species in the context of NHZ 16 Eastern Lowlands.
- Local (i.e., the site plus circa 10km)
 - Populations of any species of conservation importance in the context of the local area within an approximate radius of 10km from the site.
- Negligible
 - Common species with little or no significance, the loss of which would not be seen as detrimental to the ecology of the area.
- 9.35 In assigning a level of value to the population of a species, it is necessary to consider its distribution and status, including a consideration of trends based on available historical records. Reference has therefore been made to published lists and criteria where available.
- 9.36 Examples of relevant lists include:
 - species of European conservation importance (as listed on Annex I of the Birds Directive);
 - species with enhanced legal protection (as listed on Schedule 1 of the Wildlife and Countryside Act (as amended in Scotland); and
 - species considered to be of principal importance for biodiversity in Scotland, as listed on the Scottish Biodiversity List (SBL).
- 9.37 Criteria for evaluation include the SPA and SSSI selection guidelines published by JNCC. Reference has also been made in particular to published bird population estimates such as Wilson *et al.* (2015) for NHZs within Scotland and Woodward *et al.* (2020) for Great Britain.
- 9.38 Where appropriate, the value of species populations has been determined using the standard '1% criterion' method (e.g. Holt *et al.*, 2012). Using this, the presence of >1% of the international population of a species is considered internationally important; >1% of the national population is considered nationally important; etc.

Assessing Impacts and the Significance of an Effect

9.39 Both direct and indirect impacts are considered. Direct impacts are changes that are directly attributable to a defined action, e.g., the physical loss of habitat occupied by a bird species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or feature, e.g., the creation of roads which cause hydrological changes, which, in the absence of mitigation, could lead to the drying out of wetland habitats used by important bird species.



- 9.40 For the purposes of this ornithology assessment, in accordance with CIEEM guidelines, under the EIA Regulations, a 'significant effect' is *"one that is sufficiently important to require assessment and reporting so that the decision-maker is adequately informed as to the environmental consequences of permitting the project".*
- 9.41 Effects can be considered significant at a wide range of scales from international to local. For example, a significant effect on a regionally important population of a species is likely to be of regional significance. They are also significant if they do not comply with legal and policy protection.
- 9.42 Consideration of conservation status is important for evaluating the effects of impacts on bird species and assessing their significance. Conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

Avoidance, Mitigation, Compensation and Enhancement

- 9.43 A sequential process has been adopted to avoid, mitigate and compensate for ornithological impacts. This is referred to as the 'mitigation hierarchy'.
- 9.44 The differences between avoidance, mitigation, compensation and enhancement are defined here as follows:
 - avoidance is used where an impact such as disturbance or displacement of breeding IOFs is avoided, for example through changes in scheme design;
 - mitigation is used to refer to measures to reduce or remedy a specific negative impact in situ;
 - compensation describes measures taken to offset residual effects, where mitigation in situ is not possible; and
 - enhancement is the provision of new benefits for biodiversity that are additional to those provided as part of mitigation or compensation measures, although they can be complementary.

Environmental Baseline and Potential Sources of Impact

Current Baseline

Designated Sites

9.45 Statutory ornithology designated sites are shown in Figure 9.1.1. of Technical Appendix 9.1. A brief description of each site designated in full or in part for its ornithological interest is provided in Error! Reference source not found. (other non-avian sites are covered in Chapter 8: Ecology). As noted in 'Scoping and Consultation', designated sites have been scoped out of full assessment, due to the insignificant amount of recorded activity at the site by the qualifying species of the designated sites in question.



Site Name	Designation	Distance/ Direction from Proposed Turbines	Qualifying Features / Reasons for Designation (Ornithological)	Evaluation			
International Desig	nternational Designations						
South Tayside Goose Roosts	SPA/ Ramsar	5.7km N	SPA qualifying features include: non- breeding wigeon <i>Mareca penelope</i> , pink-footed goose <i>Anser</i> <i>brachyrhynchus</i> and greylag goose <i>Anser anser</i> .	International			
			Ramsar qualifying features are: non- breeding pink-footed goose and greylag goose.				
Firth of Forth	SPA/	7.8km S	SPA qualifying features include:	International			
	Ramsar/ SSSI		passage sandwich tern <i>Sterna</i> <i>sandvicensis.</i> Non-breeding red- throated diver <i>Gavia stellata</i> , Slavonian grebe <i>Podiceps auritus</i> , golden plover <i>Pluvialis apricaria</i> , bar-tailed godwit <i>Limosa lapponica</i> , pink-footed goose; shelduck <i>Tadorna tadorna</i> ; knot <i>Calidris canutus</i> ; redshank <i>Tringa</i> <i>totanus</i> and turnstone <i>Arenaria</i> <i>interpres.</i> Waterfowl assemblage. Ramsar qualifying features are as				
			above.				
National Designat	ions	Γ		Γ			
Carsebreck and Rhynd Lochs, Drummond Lochs, and Dupplin Lakes	SSSIs Overlapping with South Tayside Goose Roosts SPA/ Ramsar	5.7km N	Non-breeding pink-footed goose and greylag goose.	National			
Firth of Forth	SSSI	7.8km S	As above for SPA/ Ramsar.	National			

Table 9-3: Statutory Sites Designated for Ornithological Features within 20 km

Data Consultations

- 9.46 Records were provided by RSPB Scotland and the CSRSG, which are summarised below, with full details in **Technical Appendix 9.4**.
 - Golden eagle: no home range within 10km;
 - Hen harrier: no breeding records within 2km;
 - Red kite: the whole area is used by foraging kites, with three nesting locations located in Perthshire, one of which is within 2km of the proposed development site boundary (3.8km from the nearest turbine); and
 - Peregrine: a historic nesting site within 2km last occupied in 1991.



Flight Activity Surveys

9.47 Full details of the flight activity (standard VP) surveys during April 2021 to March 2023 (including Figures showing flight lines) are provided in **Technical Appendix 9.1**. A seasonal summary of 'at risk' flight activity within the Collision Risk Zone (CRZ) surrounding the proposed turbine layout is provided in **Table 9-4**. A CRZ is defined as the rotor-swept area within the Wind Farm Polygon (WP) (i.e., the area within 500 m of the outermost turbine blades). Therefore, flights at risk are those at Potential Collision Height (PCH) within the WP.



Species name	Period of analysis ²	Total number of birds recorded in flight	Flights th	Flights through WP		Flights through WP at Potential Collision Height (PCH)	
			No. of Flight Events	Cumulative no. of Birds	No. of Flight Events	Cumulative no. of Birds	
Pink-footed	Apr-21 to Aug 21	0	0	0	0	0	
goose	Sep-21 to Feb-22	60	0	0	0	0	
	Mar-22 to Aug-22	0	0	0	0	0	
	Sep-22 to Mar-23	97	4	97	0	0	
Red kite	Apr-21 to Aug 21	16	13	15	13	15	
	Sep-21 to Feb-22	12	12	12	12	12	
	Mar-22 to Aug-22	13	12	12	12	12	
	Sep-22 to Mar-23	16	13	16	11	14	
Hen harrier	Apr-21 to Aug 21	2	2	2	2	2	
	Sep-21 to Feb-22	1	1	1	1	1	
	Mar-22 to Aug-22	0	0	0	0	0	
	Sep-22 to Mar-23	1	1	1	1	1	
Golden eagle	Apr-21 to Aug 21	0	0	0	0	0	

Table 9-4: Summary of 'At Risk' Flights of Target Species by Season (2021 to 2023)



² Periods of analysis relate to the breeding season (March to August) and the non-breeding season (September to February). Surveys commenced in April 2021.

Species name	Period of analysis ²	Total number of birds recorded in flight	Flights th	Flights through WP		Flights through WP at Potential Collision Height (PCH)	
			No. of Flight Events	Cumulative no. of Birds	No. of Flight Events	Cumulative no. of Birds	
	Sep-21 to Feb-22	0	0	0	0	0	
	Mar-22 to Aug-22	0	0	0	0	0	
	Sep-22 to Mar-23	1	1	1	1	1	
Kestrel	Apr-21 to Aug 21	14	13	13	13	13	
	Sep-21 to Feb-22	4	4	4	4	4	
	Mar-22 to Aug-22	4	4	4	4	4	
	Sep-22 to Mar-23	11	9	9	7	7	
Merlin	Apr-21 to Aug 21	1	1	1	1	1	
	Sep-21 to Feb-22	1	1	1	1	1	
	Mar-22 to Aug-22	0	0	0	0	0	
	Sep-22 to Mar-23	1	1	1	1	1	
Golden plover	Apr-21 to Aug 21	0	0	0	0	0	
	Sep-21 to Feb-22	0	0	0	0	0	
	Mar-22 to Aug-22	0	0	0	0	0	
	Sep-22 to Mar-23	51	5	51	4	48	
Snipe	Apr-21 to Aug 21	1	1	1	1	1	
	Sep-21 to Feb-22	0	0	0	0	0	
	Mar-22 to Aug-22	4	4	4	4	4	



Species name	Period of analysis ²	Total number of birds recorded in flight	Flights through WP		Flights through WP at Potential Collision Height (PCH)	
			No. of Flight Events	Cumulative no. of Birds	No. of Flight Events	Cumulative no. of Birds
	Sep-22 to Mar-23	0	0	0	0	0
Curlew	Apr-21 to Aug 21	0	0	0	0	0
	Sep-21 to Feb-22	0	0	0	0	0
	Mar-22 to Aug-22	0	0	0	0	0
	Sep-22 to Mar-23	1	1	1	1	1

Moorland Breeding Wader Surveys/ Access Track Breeding Waders

- 9.48 Within the Clackmannanshire part of the survey area, two snipe breeding territories were recorded in both 2021 and 2022. Additional snipe territories were recorded within 500m of the proposed turbine layout in Perth & Kinross and within 250m of the proposed access track in 2023.
- 9.49 Non-breeding curlews were recorded in 2021 and 2022. The only confirmed breeding curlew territory was within 250m of the proposed access track in 2023; there were none within 500m of the proposed turbine layout.
- 9.50 One oystercatcher breeding territory was recorded close to the A9 during the proposed access track surveys in 2023.
- 9.51 Golden plover were recorded on passage only.

Breeding Raptor Surveys/ Access Track Breeding Raptors

- 9.52 Including VP surveys, the following nine primary and secondary target raptor and owl species were recorded in 2021 and 2022: osprey, red kite, hen harrier, buzzard, golden eagle, kestrel, merlin, peregrine and short-eared owl. Of these species, only red kite, buzzard and kestrel were recorded regularly. These species used the proposed development site for foraging but were not recorded as breeding.
- 9.53 Due to the infrequency of occurrence in 2021 and 2022, the records of osprey, hen harrier, golden eagle, merlin, peregrine and short-eared owl are considered to have been of birds passing through the site only.
- 9.54 In 2023, four species of raptor and owl were recorded: red kite, buzzard, kestrel and shorteared owl. Territorial behaviours were recorded by all four species, but only kestrel and short-eared owl are likely to have been breeding.
- 9.55 A likely kestrel territory was located on crags north of the River Devon between Scadlaw and Core Hill, approximately 600m from the nearest proposed turbine in Perth & Kinross.
- 9.56 A likely short-eared owl territory was located approximately 500m from the proposed access route, but more than 3km from the nearest proposed turbine in Perth & Kinross.

Black Grouse Lek Surveys

9.57 No black grouse were recorded during the black grouse surveys in April / May 2021 and April / May 2023. There was one incidental record of a single female black grouse flying over in October 2023.

Collision Risk Modelling

9.58 Sufficient flight activity³ was recorded for three target species to undertake CRM for this assessment: red kite, kestrel and golden plover. The final site layout for the proposed development comprises thirteen turbines. Error! Reference source not found. shows the



³ Sufficient flight activity was defined as a minimum total of three flights or minimum ten individuals of each primary target species recorded in each array during each season of analysis. Numbers below these thresholds are likely to result in negligible predicted mortality.

predicted collision mortality for the three species and seasons under consideration. The final annual outputs used for the assessment are shown in bold and the full CRM Report is in **Technical Appendix 9.4: Avian Collision Risk Assessment**.

Species name	Period of analysis	Modelled collisions per Season	Years per collision
Red kite	Apr-21 to Aug-21	0.1899	5.27
	Sep-21 to Feb-22	0.0778	12.86
	Mar-22 to Aug-22	0.0770	12.99
	Sep-22 to Mar-23	0.1037	9.64
	Annual Yr1	0.2588	3.86
	Annual Yr2	0.1836	5.45
	Annual Yr1 + Yr2	0.2666	3.75
Kestrel	Apr-21 to Aug-21	0.7382	1.35
	Sep-21 to Feb-22	0.0789	12.68
	Mar-22 to Aug-22	0.1088	9.19
	Sep-22 to Mar-23	0.3075	3.25
	Annual Yr1	0.6753	1.48
	Annual Yr2	0.4822	2.07
	Annual Yr1 + Yr2	0.6699	1.49
Golden plover	Sep-22 to Mar-23	0.2205	4.54
	Annual Yr2	0.2543	3.93

 Table 9-5: Summary of CRM Output for Windburn dataset 2021-2023

Evaluation of Ornithological Features

9.59 Applying the criteria outlined in the 'Sensitivity of Features' section, an evaluation of the importance of the relevant study areas for each primary target species recorded during the baseline surveys is provided in **Table 9-6**. There is one target species with a value of 'Regional' and four with a value of 'Local', which are the ones taken forward as IOFs for detailed assessment. Details on the status of other primary and the secondary target species at the site are provided in **Technical Appendix 9.1**.



Table 9-6: Evaluation of IOF Populations within the Study Area

Value	IOF	Species Information, Status & Baseline	Justification
Regional	Red kite	Listed on: Annex I of the Birds Directive; Schedule 1 (including 1A); SBL priority species; and UK BoCC Green List. The estimated population in the UK was 4,400 pairs in 2016 (Woodward <i>et al.</i> , 2020) with an estimated population in Scotland of 60 pairs (Forrester <i>et al.</i> 2007), 253 pairs in 2013 (Wilson <i>et al.</i> 2015) and 273 pairs in 2020 (Challis <i>et al.</i> 2023). The estimated population in NHZ 16, Eastern Lowlands, was 60 pairs in 2013 (Wilson <i>et al.</i> , 2015.). Baseline surveys – up to three birds were frequently recorded during April 2021 to March 2023. No confirmed breeding within 2km of the turbine layout. Minimum of one breeding territory within 2km of the access route (CSRG data). Fifty flights were recorded within the proposed development site. An annual collision rate of 0.2666 is predicted (one collision every 3.8 years).	This species is not of conservation concern but is afforded special protection (Annex I and Schedule 1). It is a priority for biodiversity action. One pair represents 1.7% of the 2013 NHZ 16 estimated population (60 pairs). Although there are no breeding red kites within 2km of the proposed turbine layout, one territory lies within 2km of the proposed access route, and the whole site is used by foraging red kites. The population is therefore considered to be of regional importance for red kite.
Local	Kestrel	SBL priority species; and UK BoCC Amber List. The estimated population in the UK was 31,000 pairs in 2016 (Woodward <i>et al.</i> , 2020) with an estimated population in Scotland of 7,500-7,800 pairs (Forrester <i>et al.</i> 2007), 3,850 pairs in 2013 (Wilson <i>et al.</i> 2015) and 2,750-5,500 pairs in 2020 (Challis <i>et al.</i> 2023). The estimated population in NHZ 16, Eastern Lowlands, was 511 pairs in 2013 (Wilson <i>et al.</i> 2015). Thirty-three pairs were recorded in Central Scotland in 2020 (Challis <i>et al.</i> 2023).	This species is of medium conservation concern and is a priority for biodiversity action. One pair represents 0.2% of the 2013 NHZ 16 estimated population (511 pairs), and 3.0% of the 2020 Central Scotland population (33 pairs). The whole site is used by foraging kestrels. The population is therefore considered to be of Local importance for kestrel.



Value	IOF	Species Information, Status & Baseline	Justification
		Baseline surveys – frequently recorded during VP surveys, maximum of one bird recorded. One territory in the north of the proposed development site recorded in 2023. Twenty-eight flights were recorded within the proposed development site. An annual collision rate of 0.670 is predicted (one collision every 1.5 years).	
Local	Golden plover	Listed on Annex I of the Birds Directive; SBL priority species; and UK BoCC Green List. The Scottish breeding population is estimated as 15,000 breeding pairs (Forrester <i>et al.</i> , 2007) or 37,480 breeding pairs (Wilson <i>et al.</i> , 2015.). The Scottish autumn passage population was estimated by Forrester <i>et al.</i> , 2007 as 20,000-60,000. The most recent estimate of the number of golden plover breeding pairs in NHZ 16, Eastern Lowlands, is approximately 902 pairs (Wilson <i>et al.</i> , 2015.). Baseline surveys – there were five flights recorded on two dates (in September and November) in Year 2, totaling 51 individuals. The mean flock size was 10.2 birds (peak 20 birds). Golden plovers were also recorded during breeding wader surveys in spring, but these were birds on passage only. All activity involved birds in flight. There were no breeding golden plovers recorded within 500m of the proposed turbine layout. The recorded flight activity produced an annual collision estimate of zero birds in Year 1, and 0.2543 birds per year (one collision every	Priority biodiversity species and listed on Annex I. Present only in the spring and autumn passage periods. Twenty birds represent approximately 0.1% of the lower range of the Scottish autumn passage population. Given the sporadic pattern of site use (i.e., low numbers only recorded in flight, with no breeding recorded within 500m), the population is assessed as of no more than Local importance for golden plover.



Value	IOF	Species Information, Status & Baseline	Justification
Local	Common snipe	UK BoCC Amber List. The estimated population in the UK was 67,000 pairs in 2016 (Woodward <i>et al.</i> , 2020) with an estimated population in Scotland of 30,000 - 40,000 pairs (Forrester <i>et al.</i> 2007) and 34,594 pairs in 1997-2000 (Wilson <i>et al.</i> 2015.). The estimated population in NHZ 16, Eastern Lowlands, was 582 pairs in 1997-2000 (Wilson <i>et al.</i> 2015). Baseline surveys – two territories were recorded in each of 2021 and 2022, both of which were located within 500m of the proposed turbine layout. Two additional territories were located in 2023 in the extended survey area, one of which was within 500m of the proposed turbine layout, with an additional territory close to the proposed access route. Five flights were observed within the proposed development site during Year 1 and Year 2 combined which, although likely to be an under-estimate of flight activity, is considered to represent a negligible collision risk.	This species is of medium conservation concern. A maximum of five pairs represent up to 0.9% of the 2013 NHZ 16 estimated population (582 pairs). The population is therefore considered to be of no more than Local importance for common snipe.
Local	Curlew	SBL priority species; and UK BoCC Red List. The estimated population in the UK was 59,000 pairs in 2016 (Woodward <i>et al.</i> , 2020) with an estimated population in Scotland of 58,800 pairs (Forrester <i>et al.</i> 2007) and 30,194 pairs in 2005 (Wilson <i>et al.</i> 2015.). The estimated population in NHZ 16, Eastern Lowlands was 3,253 pairs in 2005 (Wilson <i>et al.</i> 2015.). Baseline surveys – one territory recorded, located more than 500m from the proposed turbine layout but close to the proposed access route. Only one flight was recorded within the proposed development site, therefore collision risk is assessed as negligible.	This species is of high conservation concern and is a priority for biodiversity action. One pair represent approximately 0.03% of the 2005 NHZ 16 estimated population (3,253 pairs). Given the limited nature of site use (i.e., the only breeding territory being near the proposed access route, with none within 500m of the proposed turbine layout), the population is assessed as of no more than Local importance for curlew.

Value	IOF	Species Information, Status & Baseline	Justification
Negligible	All other species	Species information, Status & Baseline See Technical Appendix 9.1 and Technical Appendix 9.2 for baseline survey results. The following species which are listed as Annex I, Schedule 1 or SBL were recorded so infrequently and in such small numbers that they are scoped out of further assessment: Pink-footed goose Qualifying feature of two SPA/ Ramsars which are within potential foraging range of the site. South Tayside Goose Roosts SPA/	All other species are either relatively common or widespread and / or were recorded only infrequently / in small numbers and are therefore not considered important. As specified in ' Effects Scoped Out ', in accordance with CIEEM (2022) guidelines, detailed assessment is only required for species with a certain level
	Ramsar and Firth of Forth SPA/ Ramsar.A cumulative total of 157 birds was recorded flying throug farm (peak count of 60), but none was recorded at risk he therefore collision risk is assessed as negligible.In the context of the regional population (162,039 in NHZ given the pattern of site use (i.e., only commuting throug space, with no feeding or roosting recorded within 2km), population is assessed as of negligible importance for pin goose.Red Grouse	Ramsar and Firth of Forth SPA/ Ramsar. A cumulative total of 157 birds was recorded flying through the wind farm (peak count of 60), but none was recorded at risk height, therefore collision risk is assessed as negligible. In the context of the regional population (162,039 in NHZ 16) and given the pattern of site use (i.e., only commuting through the air space, with no feeding or roosting recorded within 2km), the site population is assessed as of negligible importance for pink-footed goose. Red Grouse	of importance or above. For Windburn Wind Farm, this is likely to be for specie with local level and above. As specified in current SNH (2017) guidance, impacts on species groups such as passerines (songbirds) which are not considered vulnerable to significant effects from wind farm developments will be scoped out. No Schedule 1 passerine species were
		 Listed on SBL. Baseline surveys: Recorded during VP surveys, with a maximum of 4 birds noted. Breeding confirmed. No regional population estimates are available. In the context of the Scottish population (100,000 to 150,000 pairs), the site population is assessed as of less than local importance for red grouse. Black Grouse Listed on SBL. Baseline surveys: A single incidental record outside of the breeding season, of a single bird over-flying. 	

Value	IOF	Species Information, Status & Baseline	Justification
		In the context of the activity recorded at site, and the regional breeding population (167 males in 2005), the site population is assessed as of negligible importance for black grouse.	
		Hen harrier	
		Annex I and Schedule 1 species; and listed on SBL.	
		Baseline surveys – a single bird recorded on four occasions during August - September 2021 and September 2022. No breeding within 2 km of turbine layout. Four flights were recorded within the proposed development site. An annual collision rate of 0.0251 is predicted (one collision every 39.84 years). This collision risk is assessed as negligible. Overall, the site population is assessed as of negligible importance for hen harrier.	
		Golden eagle	
		Annex I and Schedule 1 species; and listed on SBL.	
		Baseline surveys – recorded twice, single birds in April 2022 and in March 2023. The area is not known to be part of a territorial home range.	
		Only one flight was recorded within the proposed development site, therefore collision risk is assessed as negligible. Overall, the site population is assessed as of negligible importance for golden eagle.	
		Osprey	
		Annex I and Schedule 1 species; and listed on SBL.	
		Baseline surveys – one adult was recorded on a single occasion in April 2023, during a raptor survey in the north of the site. The bird was assumed to be a migrant.	
		Due to the infrequency of occurrence, the site population is assessed as of negligible importance for osprey.	
		Merlin	
		Annex I and Schedule 1 species; and listed on SBL.	

Value	IOF	Species Information, Status & Baseline	Justification
		Baseline surveys - recorded on three occasions during VP surveys, maximum of one bird recorded. Three flights were recorded within the proposed development site. No breeding within 2km.	
		Due to the low level of flight activity recorded, collision risk is assessed as negligible. Overall, the site population is assessed as of negligible importance for merlin.	
		Peregrine	
		Annex I and Schedule 1 species; and listed on SBL.	
		Baseline surveys – recorded once in 2021, commuting over site. Due to the infrequency of occurrence, the site population is assessed as of negligible importance for peregrine.	
		Short-eared owl	
		Annex I species; and listed on SBL.	
		Baseline surveys – two incidental records within the proposed development site. One probable breeding territory in 2023, >500m from the proposed access route. This is beyond the upper limit of the disturbance distance (Goodship and Furness 2022).	
		Not recorded during flight activity surveys, therefore collision risk is assessed as negligible. Due to the infrequency of occurrence, the site population is assessed as of negligible importance for short-eared owl.	

Future Baseline

- 9.60 In the absence of the proposed development, and assuming the continuation of the current land use in the area (degraded moorland used for low level grazing), no major changes are expected to the character of the landscape. No change in these habitats is anticipated in the short to medium term and consequently the bird community is likely to continue to be present in similar abundances and distributions.
- 9.61 It is more difficult to predict changes that may occur in the long-term, especially in the wake of climate change, which is thought to cause range shifts in some bird species (Huntley *et al.*, 2008). Climate change may alter habitat types by impacting the composition and health of the plant communities present, thereby affecting the habitat suitability for some of the bird species which currently occupy the site. Baseline surveys carried out for the proposed development represent a snapshot of the bird community at the time and cannot be extrapolated to predict future population trends in the event of climate change.

Potential Sources of Impact

- 9.62 This assessment concentrates on the effects of construction, operation and decommissioning of the proposed development upon IOFs. The following potential effects have been assessed:
 - habitat loss or damage (permanent and temporary) due to construction of wind farm infrastructure;
 - inadvertent destruction of nests during construction;
 - disturbance to birds during construction due to vehicular traffic, operating plant and the presence of construction workers;
 - disturbance to birds due to the operation of the wind turbines, vehicular traffic and the presence of people during operation;
 - barrier effect due to the operation of the wind turbines; and
 - mortality of birds caused by collisions with turbine blades and other infrastructure.
- 9.63 Effects have been assessed in detail for the following IOFs (see **Table 9-6** for justification):
 - Red kite;
 - Kestrel;
 - Golden plover;
 - Common snipe; and
 - Curlew.
- 9.64 This list includes all species which are potentially vulnerable to significant effects from the proposed development, which are also:
 - species for which the study area is considered to be important at a Local level or above; and are also
 - species listed on Annex I of the Birds Directive;



- breeding species listed on Schedule 1 of The Wildlife and Countryside Act 1981 (as amended in Scotland); and/or
- priority species listed on the Scottish Biodiversity List.

Embedded Mitigation and Good Practice Measures

- 9.65 The assessment of effects is based on the information outlined in **Chapter 3: Description of Development**. The proposed development has undergone a number of design iterations in response to the constraints identified as part of the baseline studies. With respect to ornithology, no constraints have been identified during the design phase that would necessitate any changes to the design of the proposed development.
- 9.66 Full details of construction mitigation measures would be provided in a Construction Environmental Management Plan (CEMP). An outline CEMP is included as **Technical Appendix 3.1**.
- 9.67 Good practice measures, as outlined below, would be employed to reduce the possibility of damage and destruction (and disturbance in the case of sensitive species such as breeding raptors), to occupied bird nests during the construction phase.

Timing of Works, Pre-Commencement Surveys and Implementation of Disturbance-Free Buffer Zones

- 9.68 Under the Wildlife and Countryside Act 1981, it is an offence, with only limited exceptions, to:
 - intentionally or recklessly take, interfere with, damage or destroy the nest of any wild bird whilst it is in use or being built (applies year round for nests of birds included in Schedule A1);
 - obstruct or prevent any wild bird from using its nest;
 - intentionally or recklessly take, interfere with or destroy the egg of any wild bird;
 - intentionally or recklessly disturb any wild bird listed in Schedule 1 while it is nest building, or at (or near) a nest containing eggs or young, or disturb the dependent young of such a bird;
 - intentionally or recklessly harass any wild bird included in Schedule 1A; or
 - knowingly cause or permit any of the above acts.
- 9.69 Avoidance of damage to, or destruction of nests, or disturbance to sensitive species whilst nesting can be achieved through careful timing of construction activities; for example, restricting activities in sensitive areas as far as practicable in the early part of the breeding season until the location and breeding status of nesting birds has been established. If site clearance and construction activities are required to take place during the main breeding bird season, from mid-March to August inclusive, pre-commencement survey work would be undertaken to ensure that nest destruction and disturbance to sensitive species (i.e., breeding raptors and waders) are avoided. Where applicable, construction would not take place within specified disturbance-free buffer zones for certain sensitive species during the breeding season.
- 9.70 Disturbance-free buffer zones around nest sites of sensitive species would be applied and monitored closely. For breeding waders, disturbance-free buffer zones are only required



until chicks have hatched and are capable of walking away from any sources of disturbance.

- 9.71 Based on survey data and the relevant literature (e.g., Goodship and Furness 2022), the following disturbance-free buffer zones are considered likely to be required to help prevent nest failure due to disturbance during construction. It should be noted that this represents a guide only and may vary according to topography and other factors at each nest site:
 - Kestrel: 100-200m;
 - Snipe: 200-300m;
 - Curlew: 200-300m; and
 - Short-eared owl: 300-500m.
- 9.72 A Bird Protection Plan (BPP) would be developed by a suitably experienced ornithologist, and agreed in consultation with NatureScot, in advance of works commencing on the site. The BPP would set out in sufficient detail the measures and procedures that would be followed to ensure the protection of sensitive species as well as legally protected species during construction.

Environmental Clerk of Works

- 9.73 A suitably qualified Environmental Clerk of Works (EnvCoW) would be employed to oversee activity at key points for the duration of the construction and reinstatement periods (at a frequency to be agreed with the relevant Local Planning Authorities and NatureScot), to ensure natural heritage interests are safeguarded. The role of the EnvCoW would include the following specific roles with regard to the ornithology interest of the site:
 - prior to the start of construction and / or the breeding bird season, the EnvCoW would make contractors aware of the ornithological sensitivities within the site (particularly with regard to the potential presence of sensitive breeding species, i.e. breeding waders and raptors); and
 - the EnvCoW would undertake surveys for nesting birds throughout the construction period that falls within the nesting season and set up and monitor appropriate exclusion areas whilst nests of relevant species are in use.

Assessment of Potential Effects

Construction Effects

9.74 Potential effects, following the implementation of the good practice mitigation measures outlined above are implemented, are addressed for each important feature in turn.

Nest Damage or Destruction

9.75 Damage or destruction to active nests could contravene the Wildlife and Countryside Act 1981 (as amended in Scotland). However, the good practice measures would avoid the likelihood of damage, destruction or disturbance to occupied bird nests during the construction phase. As such, no significant effects are predicted for any species due to nest damage or destruction.



Habitat Loss

- 9.76 Construction of turbine bases, access tracks and other structures would lead to habitat loss (see **Chapter 8: Ecology**). There will be a direct habitat loss of approximately 18.86ha arising from construction of proposed infrastructure and borrow pits, as well as an indirect habitat loss of 54.95 ha. Indirect habitat loss includes areas within the working corridor (including construction laydown areas) that will be disturbed/ damaged during construction, and reinstated following construction where feasible.
- 9.77 Habitat loss includes the following habitat types (UKHab codes, UKHab Ltd. 2023):
 - f1a5 Blanket Bog (7.25 ha of direct loss and 37.8 ha of indirect loss);
 - f1a6 Degraded Blanket Bog (2.78 ha direct loss and 5.62 ha of indirect loss);
 - g1b6 Other Upland Acid Grassland (9.62 ha of direct and indirect loss);
 - g1c Bracken, g3c Other Neutral Grassland, g3c5 Arrhenatherum neutral grassland, g3c6 Lolium-Cynosurus neutral grassland, g3c8 Holcus-Juncus neutral grassland, g3c7 Deschampsia neutral grassland, g3c8 Holcus-Juncus neutral grassland, g4 Modified Grassland (amounting to <8 ha in total for these grassland types);
 - h1b5 Dry heaths, Upland (1.14 ha of direct and indirect loss), h1b6 Wet heathland with cross-leaved heath, Upland (0.02 ha of direct and indirect loss);
 - f2c Upland Flushes, Fens and Swamps (0.3 ha of direct and indirect loss);
 - w1g Other Woodland; Broadleaved, w1h Other Woodland; Mixed, w2c Other Coniferous Woodland (amounting to 0.57 ha of all woodland types);
 - h3e Gorse scrub (0.56 ha of direct and indirect loss); and
 - c1c7 Other Cereal Crops (0.47 ha).
- 9.78 Habitat loss is only likely to affect important species breeding within the study area, which are likely to use these habitats for nesting and foraging (i.e., red kite, kestrel, snipe and curlew). Golden plover were only recorded in flight outside of the breeding season and therefore are considered unlikely to be affected by habitat loss.

Red kite

- 9.79 Red kites utilise mature woodland for breeding and roosting and forage over extensive areas of open ground (preferably areas with livestock and rough grazing, although some arable land may be used) (Hardey *et al.* 2013). The size of woodland used for nesting varies from extensive areas to small clumps of mature trees or narrow shelterbelts (Hardey *et al.*, 2013). One red kite territory was identified through desk study (Central Scotland Raptor Study Group 2024, location confidential). This is located in a small woodland clump approximately 3.8km from the nearest proposed turbine location and approximately 800m from the nearest access track. Therefore, this nest site will not be directly affected.
- 9.80 The maximum foraging range for red kite is up to 6km (SNH 2016a) but more typically within 3km (Hardey *et al.* 2013). It is considered that the habitat loss during construction would be only a very small proportion of the available foraging habitat for any red kite breeding location.
- 9.81 Hence, it is considered that there would be **no significant effect** on the conservation status of red kite in terms of habitat loss caused by the proposed development.



Kestrel

- 9.82 Kestrels breed in almost any habitat that holds sufficient prey (small mammals or birds) and nest sites, including open moorland with trees and crags, as at Windburn (Hardey *et al.*, 2013). Home range size varies from less than 1km² to over 10km² (Village, 1990 in Hardey *et al.*, 2013) and is related to prey abundance; when prey populations are high, kestrels have smaller home ranges (Village, 1982, 1990 in Hardey *et al.*, 2013).
- 9.83 One kestrel territory was identified in 2023, located in the north of the site in an area of crags located approximately 600m from the nearest proposed turbine location and other site infrastructure. Therefore, this nest site will not be directly affected.
- 9.84 The land take is a very small proportion of the potential home range (i.e., from less than 1km² to over 10km²) but would be long term in duration. Overall, it is considered that there would be **no significant effect** on the conservation status of kestrel in terms of habitat loss caused by the proposed development.

Snipe

- 9.85 Habitat suitable for nesting and foraging snipe (wet bog and grassland) is common within the site. A combined maximum total of five snipe territories was recorded within 500m of proposed development infrastructure during 2021 to 2023.
- 9.86 The land take is a very small proportion of the potential area used by a single breeding pair of snipe but would be long term in duration. Due to the wide availability of suitable habitat it is considered that there would be **no significant effect** on the conservation status of snipe in terms of direct habitat loss.

Curlew

- 9.87 The effect of direct habitat loss on curlew due to wind farms is generally considered not to be significant compared to the species' overall territory size (core foraging range from the nest site during the breeding season is 1km, maximum 2km, SNH 2016a).
- 9.88 One curlew territory was identified just outside of the site, close to the proposed access route, more than 3.1km from the nearest proposed turbine location. The land take is a very small proportion of the potential area used by a single breeding pair of curlew, but would be long term in duration.
- 9.89 Due to the location of this territory, it is considered that there would be **no significant effect** on the conservation status of curlew in terms of direct habitat loss.

Disturbance / Displacement

- 9.90 During the construction stage of the proposed development, the potential effects of associated noise and visual disturbance could lead to the temporary displacement or disruption of breeding and foraging birds. The level of impact would depend on the timing of potentially disturbing activities, the extent of displacement (both spatially and temporally) and the availability of suitable habitats in the surrounding area for displaced birds to occupy.
- 9.91 Potential effects are likely to be greatest during the breeding season (predominantly between March and August, depending on the species under consideration) and behavioural sensitivity to the effects would vary between species.



- 9.92 Disturbance of birds due to construction activities of this type have not been sufficiently quantified in the literature and the available information is often contradictory. However, it is likely that construction impacts would be greater on species that are intolerant of noise and other sources of disturbance. Larger bird species, those higher up the food chain or those that feed in flocks in the open tend to be more vulnerable to disturbance than small birds living in structurally complex or closed habitats such as woodland (Hill *et al.*, 1997).
- 9.93 The potential effects associated with construction activities are only likely to occur for as long as the construction phase continues (likely to be 24 months) and are thus generally short-term in nature. The exception to this would be if a negative effect on the breeding success of a feature were such that the local population becomes extinct and replacement through recruitment or re-colonisation does not occur. For example, a study by Pearce-Higgins *et al.* (2012) found that snipe and curlew densities declined significantly on wind farms during construction and had not recovered by the first year post-construction.
- 9.94 Disturbance / displacement effects during construction are only likely to affect species potentially breeding within the relevant parts of the study area (i.e., red kite, kestrel, snipe and curlew). Golden plover were only recorded in flight outside of the breeding season, and therefore are considered unlikely to be affected by disturbance/ displacement.
- 9.95 Construction disturbance can be readily mitigated by avoiding sensitive areas through the implementation of appropriately defined buffer zones and by timing construction activities to avoid periods where sensitive species are present (if and where possible), such as the breeding season. A range of good practice measures have therefore been proposed to mitigate for potential construction disturbance effects (**Timing of Works, Pre-Commencement Surveys and Implementation of Disturbance-Free Buffer Zones** above).

Red Kite

- 9.96 As stated above, one territory location was identified approximately 3.8km from the nearest proposed turbine and approximately 800m from the proposed access route. These distances are well beyond the upper limit of the active disturbance distance of 500m, cited by expert opinion in Ruddock and Whitfield (2007). Goodship and Furness (2022) recommend a breeding season buffer zone of 150-300m. Goodship and Furness (2022) also state that *"for activities with a high potential for disturbance (e.g. onshore wind farms), a buffer zone up to 5km may be necessary."*. They identify that there is a knowledge gap in this respect, i.e., there is a lack of disturbance studies during both the breeding and non-breeding seasons.
- 9.97 Foraging red kites could be displaced from habitat in the vicinity of construction activities and, in theory this could lower foraging efficiency, leading to short-term adverse effects on breeding productivity or survival. However, red kite hunting ranges are likely to be large in comparison with the area occupied by the proposed development, as foraging can occur over extensive areas e.g., within 3km to 6km (Cramp & Simmons, 1980; Hardey *et al.* 2013). Red kites are primarily scavengers in Scotland, although they will also take some live prey including voles, other small mammals and birds. It is considered that the availability of food within the home range would compensate for the short-term loss (i.e. a maximum of 24 months) of foraging habitat within the proposed development during construction, which is a small area in the context of the home range.
- 9.98 Hence, it is considered that there would be **no significant effect** on the conservation status of red kite in terms of disturbance / displacement caused by construction of the proposed development.



Kestrel

- 9.99 As stated above, one territory location was identified approximately 600m from the nearest proposed turbine/ infrastructure. This distance is well beyond the breeding season buffer zone of 100-200m recommended by Goodship and Furness (2022), who state that kestrel is assessed to have a low to medium sensitivity to human disturbance.
- 9.100 Flight activity survey results show that kestrels range widely across the proposed development area (Figure 9.1.4c, Figure 9.1.5d, Figure 9.1.6c, Figure 9.1.7d of Technical Appendix 9.1), more than 2km from the territory centre shown in Figure 9.2.3 of Technical Appendix 9.2. Their primary prey are small mammals, e.g., voles, which will be widespread across the site, but subject to cyclical fluctuations in abundance. It is therefore considered that the availability of food within the home range, would not be significantly affected by any short-term loss of foraging habitat within the proposed development during construction.
- 9.101 With kestrel nesting attempts being safeguarded through the BPP and the impact caused by construction activities on foraging efficiency by breeding birds being of low magnitude and short duration, it is considered that there would be **no significant effect** on the conservation status of kestrel in terms of disturbance/ displacement caused by construction of the proposed development.

Snipe

- 9.102 Neither Ruddock and Whitfield (2007) nor Goodship and Furness (2022) cover disturbance distances for snipe. There is a lack of evidence regarding construction disturbance in the scientific literature (although Hötker *et al.* (2006) previously reported minimum disturbance distances for snipe (403m+/-221m) in the non-breeding season); however the disturbance distance to which human activity would affect snipe is likely to be low, based on the species' propensity to remain still until flushed at close proximity. Their predominantly crepuscular⁴ activity also means that construction work on site is unlikely to take place at the same time as peaks in snipe courtship or feeding activities.
- 9.103 An estimated five snipe territories lie within approximately 300m of the proposed turbine layout (based on data from 2021 to 2023) and there is therefore the potential for construction disturbance (**Technical Appendices 9.1** and **9.2**).
- 9.104 The employment of good practice measures through the BPP would serve to minimise disturbance, by avoiding construction activity around snipe nest sites by up to 300m depending on topography. On this basis it is considered that there would be **no significant effect** on the conservation status of snipe in terms of disturbance / displacement caused by construction of the proposed development.

Curlew

9.105 Goodship and Furness (2022) stated that depending on the level of habituation to disturbance, a buffer zone of 200-300 m is suggested to protect nesting curlew. Results from the study by Pearce-Higgins *et al.* (2012) suggest that curlew populations may decline by about 40% as a result of disturbance from construction work within a 620m circular buffer around the turbines. This supports earlier work (Pearce-Higgins *et al.* 2009)



⁴ Appearing or active in twilight.

which demonstrated a 30% lower density of birds within a 1,000m buffer around turbines than expected from the habitat. Other studies (e.g. Whitfield *et al.*, 2010) involving long-term monitoring found no evidence of displacement due to wind farm infrastructure however.

- 9.106 No curlew territories were identified within 1,000m of the proposed turbine layout, based on the 2021 to 2023 survey data. A single territory was identified within 200 250m of the proposed access route (based on data from 2023). There is therefore the potential for construction disturbance to one territory (**Technical Appendices 9.1** and **9.2**).
- 9.107 The employment of good practice measures through the BPP would serve to minimise disturbance, by avoiding or minimising construction activity around curlew nest sites by up to 300m depending on topography. On this basis, while some disturbance to birds away from the nest is possible, it is considered that there would be **no significant effect** on the conservation status of curlew in terms of disturbance/ displacement caused by construction of the proposed development.

Operational Effects

Habitat Loss and Modification

- 9.108 Permanent habitat modification includes the permanent land take from the wind farm infrastructure and tracks plus the areas undergoing habitat enhancement relating to the HMP. Habitat modification is only likely to affect important species breeding within the study area, which are likely to use these habitats for nesting and foraging (i.e., red kite, kestrel, snipe and curlew). Permanent land take is covered by 'Habitat Loss' in the Construction Effects section.
- 9.109 Within the OHMP (**Technical Appendix 8.4**), there are targets for the restoration and enhancement of:
 - Blanket bog: restoration of 251.31ha;
 - Blanket bog: grazing management of 360.59ha;
 - Grassland and heathland: grazing management of 162.39ha; and
 - Riparian woodland: creation of 14.43ha.
- 9.110 In terms of ornithology, these measures have the potential to enhance the nesting and foraging habitat for breeding raptors and waders. In addition, the creation of new riparian woodland could benefit black grouse in the longer term. Overall, **no significant negative or positive effects** for ornithology are considered likely as a result of habitat loss and modification.

Disturbance/ Displacement

9.111 The operation of wind turbines and associated human activities for maintenance purposes also has the potential to cause disturbance and displace birds from the site. Disturbance effects during the operational phase may be less than during the construction phase, as species may become habituated to wind turbines and disturbance due to human activities would be considerably reduced. There may be additional disturbance effects as a result of increased recreational activity utilising the new access tracks (associated with the proposed development), however this is unquantifiable at this stage and is outside the scope of this assessment.



- 9.112 Studies have shown that, in general, species are not disturbed beyond 500m to 800m (for the most sensitive species) from wind turbines (e.g. Drewitt and Langston, 2006 and references therein; Hötker *et al.*, 2006; Pearce-Higgins *et al.*, 2009) and, in some cases, birds do not appear to have been disturbed at all (e.g. Devereux *et al.*, 2008; Whitfield *et al.*, 2010; Douglas *et al.*, 2011; Fielding and Haworth, 2013).
- 9.113 The evidence suggests that impacts vary between species and sites (see discussion for raptors; Madders & Whitfield, 2006). There is potential for some disruption of feeding and nesting due to increased human activity for maintenance purposes. However, this would be relatively infrequent, involve low levels of disturbance and would be restricted to areas of the site accessible by tracks. Therefore, the overriding source of disturbance and displacement of birds during the operational period is considered to be the operating turbines (Pearce-Higgins *et al.*, 2009).
- 9.114 Disturbance / displacement effects during operation are considered for species in the breeding season, within the relevant parts of the study area, i.e. close to the proposed wind turbines. As such, the assessment concentrates on IOFs that are potentially vulnerable to disturbance / displacement based on current survey data (snipe and curlew). Whilst red kite and kestrel may suffer some disturbance from wind turbines whilst foraging, effects are not likely to be significant given the wide availability of alternative foraging habitat. The use of the study area outside of the breeding season by the IOFs in question is likely to be limited in extent therefore is not likely to be significant. Other species are therefore not considered here.

Snipe

- 9.115 Pearce-Higgins *et al.*, (2012) reported evidence of reduced habitat usage by snipe within operational wind farms. Snipe were also shown by Pearce-Higgins *et al.* (2009) to use areas of habitat within 400m of wind turbines less than expected, leading to an expected 48% decline in abundance within 500m of the wind turbines.
- 9.116 On the basis of five snipe territories within 400m of proposed turbine locations, based on survey data (Technical Appendices 9.1 and 9.2), the equivalent of two-three pairs may be displaced by the proposed development. This would result in the possible loss of <0.4% of the NHZ population. On this basis it is considered that there would be no significant effect on the conservation status of snipe in terms of disturbance / displacement caused by the operation of the proposed development.</p>

Curlew

- 9.117 Whilst there is some uncertainty over the extent of potential disturbance impacts on curlew during wind farm operation (see Paragraph 9.112), a precautionary approach has been adopted here. Even using the largest disturbance buffer of 1,000m suggested by Pearce-Higgins *et al.*, 2009) and based on survey data for 2021 to 2023, there are no territories which could be affected. The only territory identified is well beyond this distance. (Technical Appendices 9.1 and 9.2).
- 9.118 On this basis it is considered that there would be **no significant effect** on the conservation status of curlew in terms of disturbance / displacement caused by the operation of the proposed development.



Barrier Effect

9.119 Individual turbines, or a wind farm as a whole, may present a barrier to the movement of birds, restricting or displacing birds from much larger areas. The effect this would have on a population is subtle and difficult to predict with any degree of certainty. If birds regularly have to fly over or around obstacles or are forced into suboptimal habitats, this may result in reduced feeding efficiency and greater energy expenditure. By implication, this will reduce the efficiency with which they accumulate reserves, potentially affecting breeding success or survival.

All Species

- 9.120 Baseline surveys showed that the air space around the proposed development is not frequently used by migrating or commuting species, such as geese. For example, only five flights by pink-footed goose were recorded during two years of flight activity surveys, which involved a cumulative total of 157 birds. All birds recorded were above collision risk height.
- 9.121 In addition, given the relatively small scale of the development in comparison with the areas through which migrating bird species move through, it is unlikely that this development will have more than negligible effect on distances flown by migrating birds and therefore on their populations. There are no sites used for roosting or feeding that would have access restricted by any potential barrier effects.
- 9.122 Hence, it is considered that there would be **no significant effect** on the conservation status of any species in terms of barrier effects caused by the proposed development.

Collision with Wind Turbines

- 9.123 Collision of a bird with turbine rotors is almost certain to result in the death of the bird. In low density populations (e.g., raptors) this could have a greater negative effect on the local population than in higher density populations (e.g., passerines) because a higher proportion of the local population would be affected. Larger birds such as raptors also live longer and have much slower reproductive rates than passerines, which can also increase the significance of the impact of collisions on the relevant population. The frequency and likelihood of a collision occurring depends on a number of factors which include aspects of the size and behaviour of the bird (including their use of a site), the nature of the surrounding environment, and the structure and layout of the wind turbines.
- 9.124 Collision risk is perceived to be higher for birds that spend much of the time in the air, such as foraging raptors and those that have regular flight paths between feeding and breeding / roosting grounds (e.g. geese). The risk of bird collisions at wind farms is greatest in areas where large concentrations of birds are present (such as on major migration routes), and in poor flying conditions, such as rain, fog, strong winds that affect birds' ability to control flight manoeuvres, or on dark nights when visibility is reduced (Langston and Pullan, 2003; Drewitt and Langston, 2006 and references therein). Birds may also be more susceptible if the wind farm is located in an area of high prey density. For diurnal foraging raptors, the proximity of structures on which to perch can increase the likelihood of collision with wind turbines (e.g. Percival, 2005 and references therein).
- 9.125 It should be noted that operational disturbance and collision risk effects are mutually exclusive in a spatial sense; i.e. a bird that avoids the wind farm area due to disturbance cannot be at risk of collision with the turbine rotors at the same time. However, they are



not mutually exclusive in a temporal sense; i.e. a bird may initially avoid the wind farm but habituate to it, and would then be at risk of collision.

- 9.126 Passerines nesting within a wind farm site would be expected to be regularly flying between wind turbines and could therefore be expected to be most at risk of collision. However, passerines tend to fly below PCH and evidence suggests that passerines collide with wind turbines infrequently. Moreover, most of the species concerned are of low or negligible conservation value. Collision is therefore mainly considered in relation to species of high sensitivity, e.g., target raptor species and species not particularly manoeuvrable in flight, such as geese and swans.
- 9.127 Species with sufficient data (minimum of five flights per season and / or minimum of ten birds) to undertake CRM are considered at risk of collision with the proposed wind turbines at the site. The species that met this criterion and were subject to CRM are as follows:
 - Red kite;
 - Kestrel; and
 - Golden plover.
- 9.128 For all other species, the number of flights within the CRZ, i.e., flights through the WP at PCH, was so low that collision risk is considered unlikely or negligible.

Red Kite

- 9.129 Over 850 red kite collisions have been reported at European wind farms, with three of these in Scotland at the Braes of Doune wind farm (Dürr 2023). However, it is likely that there are a significant number of unreported collisions, including in the UK.
- 9.130 The red kite flight activity survey data for the proposed development is shown in **Figure 9.1.4a**, **Figure 9.1.5b**, **Figure 9.1.6b** and **Figure 9.1.7b** of **Technical Appendix 9.1**. This flight activity was recorded throughout the survey period (April 2021 to March 2023). Red kites use the area primarily for foraging (n=28 flights) and commuting (n=12 flights). Other flight behaviours observed included random/ circling flights (n=12). No breeding activity was observed. Flights were recorded across the site, with a maximum of three birds recorded simultaneously.
- 9.131 Collision risk analysis was carried out on these flight activity data. Based on these data, 46 red kite flights with a cumulative total of 49 birds were recorded at PCH within the WP during surveys (01 April 2021 to 31 March 2023). Assuming a 99% avoidance rate, 0.2666 collisions per year were predicted (approximately one collision every 3.75 years).
- 9.132 Assuming a worst-case scenario that the mortality would involve breeding adults, the annual predicted collision mortality rate of 0.2666 represents approximately 0.05% of the Scottish breeding population (546 adults) and 0.22% of the NHZ 16 breeding population (assumed to be 120 adults). Against background annual mortality of 39% for adults (BTO BirdFacts) (which amounts to 46.8 birds in NHZ 16), this represents an increase of 0.6% in adult mortality. This is not considered to be significant.
- 9.133 At Braes of Doune wind farm (Stirlingshire) where intensive monitoring was undertaken during 2004 to 2012 (Duffy and Urquhart 2014), a newly derived rate of 1.28 kites killed by the wind farm per annum was in line with pre-construction Collision Risk Modelling work which gave a broadly similar rate of annual fatalities. The Central Scotland kite population continued to increase through the entire study period, and survival of the tagged sample



of kites was comparable to populations in areas where there were no wind farm developments.

9.134 On this basis it is considered that there would be **no significant effect** on the conservation status of red kite in terms of collision mortality caused by the operation of the proposed development.

Kestrel

- 9.135 Over 800 kestrel collisions have been reported at European wind farms, with two of these in Scotland (Dürr 2023). As with red kite, it is likely that there are a significant number of unpublished collisions including in the UK.
- 9.136 The hovering behaviour of kestrel is thought to increase the species' vulnerability to wind turbine collisions (e.g., Barrios and Rodriguez, 2004 in Marques *et al.*, 2014). This is reiterated by the fact that NatureScot have retained the default avoidance rate of 95% for this species at the last review of such rates, where most species were elevated to 98% (SNH 2018). This avoidance rate is an integral element of the collision risk modelling method in Band (2007).
- 9.137 The kestrel flight activity survey data for the proposed development are shown in Figure 9.1.4c, Figure 9.1.5d, Figure 9.1.6d and Figure 9.1.7d of Technical Appendix 9.1. This flight activity was recorded throughout the survey period (April 2021 to March 2023). Flights were recorded across the site, and all but four of 31 flights involved foraging activity.
- 9.138 Collision risk analysis was carried out on these flight activity data. Based on these data, 29 kestrel flights with a cumulative total of 29 birds were recorded at PCH within the WP during surveys (01 April 2021 to 31 March 2023). Assuming a 95% avoidance rate, 0.6699 collisions per year were predicted (approximately one collision every 1.5 years).
- 9.139 Assuming a worst-case scenario that the mortality would involve breeding adults, the annual predicted collision mortality rate of 0.67 represents less than 0.01% of the Scottish breeding population (7,700 adults) and 0.07% of the NHZ 16 (assumed to be 1,022 adults). Against background annual mortality of 31% for adults (BTO BirdFacts) (which amounts to 316.8 birds in NHZ 16), this represents an increase of 0.2% in adult mortality. This is not considered to be significant for the NHZ.
- 9.140 On this basis it is considered that there would be **no significant effect** on the conservation status of kestrel in terms of collision mortality caused by the operation of the proposed development.

Golden Plover

- 9.141 Golden plover collisions with turbines are relatively rare; 47 collisions have been reported at European wind farms, none of which were in the UK (Dürr 2023).
- 9.142 Collision risk for waders is generally deemed to be low, due to a relatively low cursory flight path, coupled with high flight manoeuvrability (McGuinness et al., 2015). A review of pan-European collision assessments revealed much lower golden plover collision records than other species, though this was not controlled for survey effort or corpse recovery rates (Hötker *et al.*, 2006).
- 9.143 The golden plover flight activity survey data for the proposed development are shown in **Figure 9.1.7e** of **Technical Appendix 9.1**. This flight activity was recorded on only two



dates in September and November 2022, with all flights involving migrating or commuting birds. A maximum flock size of 20 birds was recorded.

- 9.144 Collision risk analysis was carried out on these flight activity data. Based on these data, four golden plover flights with a cumulative total of 48 birds were recorded at PCH within the WP during surveys (01 April 2021 to 31 March 2023). Assuming a 98% avoidance rate, 0.2543 collisions per year were predicted (approximately one collision every 3.9 years).
- 9.145 According to NatureScot guidance (SNH, 2018a) biogeographical zone assessments are best applied where species have relatively stable distributions (such as during the breeding season) or where species occupy a habitat in the non-breeding season that is consistent and predictable. However, no winter population estimates are given for golden plover at the NHZ level, and there is no suitable alternative regional scale available for the assessment. The flight activity recorded over the site in autumn 2022 was most likely associated with passage birds moving south (likely to be either Scottish or Icelandic in origin (Forrester *et al.*, 2007)). Autumn passage of golden plover in Scotland is in the region of 20,000-60,000 birds (Forrester *et al.*, 2007); a regional estimate is not available.
- 9.146 On this basis it is considered that there would be **no significant effect** on the conservation status of golden plover in terms of collision mortality caused by the operation of the proposed development.

Decommissioning Effects

- 9.147 Potential effects associated with decommissioning of the proposed development are assumed to be similar to those identified for the construction phase (i.e. habitat loss and disturbance/displacement). Decommissioning effects are therefore not considered separately for each species.
- 9.148 Due to the length of the operational period (40 years) the future composition of the bird community at the site is not known and the confidence in any prediction would be uncertain. In the absence of mitigation, decommissioning could cause short term effects through disturbance. Positive effects however, might also occur through the removal of turbines and the reinstatement of topsoil. Good practice measures, similar to those employed during the construction phase, including surveys prior to decommissioning, to inform an up-to-date assessment of potential effects on important bird species, would be implemented during decommissioning. Following the implementation of these measures, no significant effects would be anticipated.

Mitigation and Enhancement

- 9.149 Embedded mitigation and good practice measures during construction are outlined in the 'Timing of Works, Pre-Commencement Surveys and Implementation of Disturbance-Free Buffer Zones' section.
- 9.150 No specific mitigation measures are required for the operational phase. However, compensation and enhancement measures are proposed in the form of the Habitat Management Plan (HMP), which would remain in place during the operational phase.
- 9.151 An Outline HMP has been prepared and is available in **Technical Appendix 8.4**. A detailed HMP would be prepared at a later stage, which will focus on increasing the area of native woodland, bog restoration and heath restoration, in order to provide nature conservation enhancements that would apply for the lifetime of the proposed development



with positive effects felt thereafter. The increase in these habitats therefore has the potential to increase the amount of breeding and foraging habitat for local priority bird species including black grouse, hen harrier, merlin, golden plover, curlew, snipe and short-eared owl.

9.152 Further details of measures to be included in the HMP to benefit habitats and non-avian species are included in **Chapter 8: Ecology** and **Technical Appendix 8.4**.

Further Survey Requirements and Monitoring

- 9.153 Due to the relatively low level of collision risk and disturbance/ displacement impacts assessed within this chapter, a reduced programme of post consent monitoring is recommended. The exact scope of works would be confirmed in the detailed HMP, following consultation. Any monitoring should be designed to assess the actual versus predicted impacts on birds and to allow for a flexible monitoring plan to be undertaken during the post consent period. In order to determine the success of habitat management actions undertaken as part of the HMP a limited programme of breeding bird surveys is proposed.
- 9.154 It is proposed that ornithological monitoring should take place during and postconstruction, as outlined below:
 - year-round ad-hoc collision monitoring should be completed by site operational staff as part of standard maintenance activities. Carcasses of all species found on site should be reported to NatureScot⁵;
 - breeding bird surveys focusing on breeding wader, grouse and raptor species should be undertaken to monitor the numbers and status of these species within the vicinity of the proposed development, in order to monitor the success of habitat management actions undertaken as part of the HMP. The consequences of any management actions may not become apparent for a number of years. Monitoring is suggested annually during construction, and after the proposed development becomes operational, during years 1, 5, and 10, with the requirement for further surveys to be determined based on previous survey results.

Assessment of Cumulative Effects

- 9.155 The following section assesses the potential cumulative effects on IOFs from the proposed development along with all other operational, consented and submitted plans or projects within an appropriate zone of influence and against the relevant NHZ population estimates, following NatureScot guidance (SNH, 2018c).
- 9.156 In line with this guidance, any wind farm developments of fewer than three turbines (small scale wind energy proposals [SNH, 2016b] were excluded from the cumulative impact assessment, due to the problems associated with finding appropriate data for developments of this size. Only IOFs for which a greater than negligible residual impact is predicted are considered in the cumulative impact assessment, as unquantified negligible impacts will not result in a detectable increase in cumulative impacts.
- 9.157 All existing, consented and submitted wind farm developments (of three or more turbines) and other projects identified within NHZ16, via the Scottish Government Wind Farm



⁵ <u>https://www.nature.scot/doc/bird-collision-incident-recording-form-updated-july-2018</u>

Proposals spatial dataset (April 2024)⁶, were considered as part of the assessment of cumulative impacts. This produced a list of approximately 100 wind farms. This list was scrutinised for projects with relevant information (via the relevant Local Planning Authority and Scottish Government portals) on species which are IOFs at the proposed development site (red kite, kestrel, snipe, curlew and golden plover). The assessment also includes Braes of Doune, which is in the neighbouring NHZ15 (Loch Lomond, Trossachs & Breadalbane) as it lies within 20km of the proposed development with red kite as an IOF. Projects under consideration are shown in **Table 9-7**.



⁶ NHZ16 is very large (i.e., from the Proposed Development it extends c. 133km to the northeast (into Aberdeenshire) and c. 127km to the southeast (into the Borders and Lothian).

Table 9-7: Projects Considered for Cumulative Effects Assessment

Project	Status	Approx. Distance (km)/ Direction from Proposed turbines	No. of Turbines	Information Available	Species Assessed
Burnfoot Hill/ Extension/ Rhodders/ Burnfoot East	Operational	0.9/ East	26	ES and SEI for Rhodders; ES for Burnfoot East	Red kite, curlew
Strathallan	Operational	12.1/ North west	97	ES	Red kite
Braes of Doune	Operational	17.3/ North west	36	No planning documents, post construction research paper (Duffy & Urquhart 2014)	Red kite
Binn Eco Park, Glenfarg	Operational	30.8/ North east	4	ES	Kestrel
Torfichen	In planning	63/ South east	18	EIAR	Red kite, curlew, golden plover
Wull Muir (Hunt Law)(Carcant Extension)	Consented	64/ South east	8	EIAR	Curlew, golden plover
Crystal Rig 1 & 1a	Operational	86/ South east	25	Information in Crystal Rig IV EIAR	Curlew
Crystal Rig II & Ila	Operational	86/ South east	60	Information in Crystal Rig IV EIAR	Curlew

⁷ Only four turbines are currently operational, however all 9 turbines have been considered as part of this assessment.

Project	Status	Approx. Distance (km)/ Direction from Proposed turbines	No. of Turbines	Information Available	Species Assessed
Crystal Rig III	Operational	86/ South east	6	Information in Crystal Rig IV EIAR	Curlew
Crystal Rig IV	In construction	86/ South east	11	Information in Crystal Rig IV EIAR	Curlew
Aikengall (I, II,IIa)	Operational	89/ South east	16, 19, 18	Information in Aikengall IIa ES	Red kite, kestrel, curlew
Langhope Rig	Operational	97/ South south east	10	ES	Curlew, snipe & golden plover
Lees Hill Energy Park	In planning	97/ East south east	6	EIAR	Curlew, snipe & golden plover
Howpark	Operational	101/ South east	8	ES	Kestrel, curlew



9.158 Potential cumulative effects from the proposed development include for: red kite (potential collision mortality effects); kestrel (potential collision mortality effects); golden plover (potential collision mortality effects); common snipe (potential habitat loss and disturbance/ displacement effects); and curlew (potential habitat loss and disturbance/ displacement effects).

Red Kite

9.159 Potential cumulative effects are summarised in **Table 9-8**.

Table 9-8: Summary of Potential Cumulative Effects for Red Kite, NHZ 16 + Braes of Doune

Project	Collision Mortality				
Operational/ In Construction					
Braes of Doune	1.28				
Burnfoot Hill/ Extension/ Rhodders/ Burnfoot East	Negligible				
Strathallan	0.009				
Aikengall (I, II, IIa)	Negligible				
Total of Operational/ In Construction Developments	1.29				
In planning					
Torfichen	0.11				
Proposed Development	0.27				
Total of Developments In Planning	0.38				

- 9.160 In terms of collision mortality, the other projects within NHZ 16 that recorded flight activity by red kite predicted negligible collision risk. Along with Braes of Doune, based on the available information, the total for the operational/ in construction wind farms under consideration is not considered significant.
- 9.161 The potential loss of 0.27 birds per year due to collision mortality caused by the proposed development alone along with the potential loss of 1.29 birds per year from operational projects results in the possible loss of 1.56 birds per year. Along with one other proposed development which where there is collision risk (Torfichen 0.11 birds per year) this results in the cumulative total of 1.67 birds per year.
- 9.162 As stated in the assessment of collision risk for the proposed development alone, the Braes of Doune study found that despite the mortality there, the Central Scotland kite population continued to increase through the entire study period, and survival of the tagged sample of kites was comparable to populations in areas where there were no wind farm developments. Against the background annual mortality of 39.0% the cumulative total of 1.67 birds per year is therefore not likely to be significant. On this basis it is considered that there would be **no significant cumulative effect** on the conservation status of red kite in terms of collision mortality.



Kestrel

9.163 Potential cumulative effects are summarised in **Table 9-9**.

Table 9-9: Summary of Potential Cumulative Effects for Kestrel, NHZ 16

Project	Collision Mortality
Operational	
Binn Eco Park, Glenfarg	Negligible
Aikengall (I, II, IIa)	Negligible
Howpark	3.23
Total of Operational Developments	3.23
Proposed Development	0.67

- 9.164 In terms of collision mortality, only three other projects in NHZ 16 considered kestrel to be an IOF. This is likely to have resulted in an under-estimate of cumulative collision mortality.
- 9.165 The potential loss of 0.67 birds per year due to collision mortality caused by the proposed development alone along with the potential loss of 3.23 birds per year from operational projects results in the possible loss of 3.90 birds per year. Against the background annual mortality of 31.0% for adult kestrels, the cumulative total of 3.90 birds per year is not likely to be significant. On this basis it is considered that there would be **no significant cumulative effect** on the conservation status of kestrel in terms of collision mortality.

Snipe

- 9.166 On the basis of the available information, only two other projects in NHZ 16 considered snipe to be an IOF: 1) Langhope Rig (operational), where four territories were predicted to potentially displaced by the development (which was constructed in 2015) and 2) Lees Hill Energy Park (in-planning) where 13 territories were predicted to potentially displaced by a combination of wind turbines and solar array development. Enhancement measures are proposed⁸.
- 9.167 In addition, the potential loss of two-three territories due to disturbance/ displacement caused by the proposed development results in the potential cumulative loss of seven territories with one operational wind farm, and 15-16 territories with one in-planning development (approximately 2.7% of the NHZ 16 population). Although this would be **a potential significant cumulative effect** on the conservation status of snipe at the NHZ level in terms of disturbance/ displacement, this does not account for the potential beneficial outcomes of compensation through habitat management that has already occurred at operational wind farms. In addition, these impacts are considered likely to be temporary and reversible, in particular at sites where there is an abundance of existing suitable habitat. Habitat enhancement measures for the proposed development are



⁸ An Operational Environmental Management Plan is proposed which includes measures to restore areas of marshy grassland along with habitat creation of wetland areas for waders.

described in the in the OHMP (**Technical Appendix 8.4**). In particular, areas of bog and heath restoration will potentially benefit snipe.

Curlew

- 9.168 On the basis of the available information, the potential contribution of the proposed development to cumulative effects on curlew in NHZ 16 is negligible. There are potential positive benefits from habitat enhancement measures, such as bog restoration, grazing management and bracken control. Overall, it is considered that there would be **no significant cumulative effect** on the conservation status of curlew in terms of disturbance/ displacement.
- 9.169 Potential cumulative effects for NHZ 16 are summarised in **Table 9-10**.

Table 9-10: Summary of Potential Cumulative Effects for Curlew, NHZ 16

Project	Disturbance/ Displacement (no. of territories)	Collision Mortality		
Operational				
Burnfoot Hill/ Extension/ Rhodders/ Burnfoot East	Negligible	Negligible		
Crystal Rig 1 & 1a	3	No flight information available. Effects considered to be of low magnitude and not significant.		
Crystal Rig II & IIa	5	No flight information available. Effects considered to be of low/negligible magnitude and not significant.		
Crystal Rig III	5	0.15		
Aikengall (I, II, IIa)	11	0.03		
Langhope Rig	5	0		
Howpark	1	0		
Total of Operational	30	0.18		
Consented				
Crystal Rig IV	2	0.07		
Proposed Development	0 – no territories within 1km of turbines, only territory was close to proposed access route	0 – only 1 flight recorded		

Golden Plover

9.170 Potential cumulative effects are summarised in **Table 9-11**.



Project	Collision Mortality (98% avoidance unless stated)				
Operational/ In Construction					
Langhope Rig	0.12 (95% avoidance) (0.05 at 98%)				
Total of Operational/ In Construction Developments	0.05				
Consented					
Wull Muir (Hunt Law)(Carcant Extension)	16.02				
Total of Consented Developments	16.02				
In planning					
Torfichen	5.59				
Lees Hill Energy Park	3.2				
Proposed Development	0.25				
Total of Developments In Planning	9.04				

Table 9-11: Summary of Potential Cumulative Effects for Golden Plover, NHZ 16

- 9.171 In terms of collision mortality, four other projects in NHZ 16 considered golden plover as at risk from collision mortality.
- 9.172 The potential loss of 0.25 birds per year due to collision mortality caused by the proposed development alone along with the potential loss of 0.05 birds per year from one operational project results in the possible loss of 0.3 birds per year.
- 9.173 When considering consented and other developments in planning results in a cumulative annual total of 25.11. Three of the other developments under consideration (Wull Muir, Torfichen and Lees Hill Energy Park) predict much higher levels of collision mortality than the proposed development.
- 9.174 Population modelling for golden plover was undertaken for Stranoch 2 Wind Farm in Dumfries and Galloway (MacArthur Green 2018) where a collision rate of 65.73 was predicted. In the absence of readily available population data for south-west Scotland (i.e. NHZ 19), MacArthur Green considered the Scottish population as a whole. The numbers presented by MacArthur Green demonstrated that the population growth rate of the Scottish wintering population would decline by 1.57% at an annual cumulative mortality across Scotland of 500 birds/year. Using the same approach in this case, the proposed development alone would potentially contribute a maximum of 0.05% (0.25/500). Thus, given a hypothetical Scotland-wide cumulative mortality of 500 individuals per year, the reduction in the population growth rate due to the proposed development alone would be around 0.000785% (0.05% of 1.57%). These values can also be considered from the perspective of what minimum baseline growth rate would be required before mortality due to wind farm collisions would trigger a population decline. For example, if the baseline population growth rate is greater than 1.57% (which the available evidence indicates is the case), then even at a precautionary cumulative mortality of 500 individuals, the population would not decline. The population increase for the UK resident breeding population (which is a component of the Scottish wintering population) between 2000 and 2005 was 19% (Eaton et al. 2015). To reach mortality levels which approach this rate of growth cumulative mortality of 6,000 would be required (this reduces the growth rate by 18%).



9.175 As stated by MacArthur Green "although the level of cumulative mortality due to wind farm collisions is unknown, it is very unlikely to be in excess of 500 individuals per year. Since even at this high level of mortality the population growth rate is only predicted to decline by 1.57%, against a recent growth trend estimated to be over 12 times higher (19%), the additional mortality will have a minor impact on the growth rate". This magnitude of effect, along with the favourable conservation status of the population, leads to a conclusion that the effect of collisions arising from the proposed development in combination with other wind farms in NHZ 16 is **not likely to be significant**.

Summary

9.176 No significant residual effects are anticipated for any IOF / receptor for the project alone. Potential significant cumulative effect is possible for snipe. A summary of the assessment of the effects of the proposed development, proposed mitigation and the residual effects are provided for each IOF in **Table 9-122**.

Effect	Receptor	Enhancement & Mitigation / Monitoring Measures	Means of Implementation	Residual Effect (Project Alone)	Residual Effect (Cumulative)
Nest damage or destruction during construction	All species	Implementation of good practice, through CEMP and BPP	CEMP and BPP. Timing of Works, Pre- Commencement Surveys and Implementation of Disturbance-Free Buffer Zones	No significant negative effects	No significant negative effects
Direct habitat loss and change	All species	None required	-	No significant negative effects	No significant negative effects
Disturbance/ displacement during construction	All species, including kestrel, snipe and curlew	Implementation of good practice. Disturbance free zones apply around nests, e.g., Kestrel: 100- 200m; Snipe: 200-300m; Curlew: 200-300m Short-eared owl: 300-500m	CEMP and BPP. Timing of Works, Pre- Commencement Surveys and Implementation of Disturbance-Free Buffer Zones	No significant negative effects	No significant negative effects
Disturbance/ displacement during operation	All species	Habitat Enhancement Operational monitoring	HMP. Breeding bird surveys	No significant negative effects	Potential significant negative effect for snipe No significant negative effects

Table 9-12: Summary of Residual Effects



Effect	Receptor	Enhancement & Mitigation / Monitoring Measures	Means of Implementation	Residual Effect (Project Alone)	Residual Effect (Cumulative)
					for all other species
Collision with turbines and barrier effects during operation	All species including red kite, kestrel and golden plover	Year-round collision monitoring during the first year, thereafter the requirement for monitoring will be reviewed. Any dead birds to be reported to NatureScot.	-	No significant negative effects	No significant negative effects

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