ACHANY EXTENSION WIND FARM
TECHNICAL APPENDIX 9.1

Ornithology Baseline, Collision Risk Modelling and Cumulative Report

SEC8606
V01
June 2021

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
V1.0	Technical Appendix	Dr Simon Zisman, Director Rob Dalziel, Senior Ecologist	Stephen Lockwood	Dr Simon Zisman	20 May 2021

Approval for issue

Dr. Simon Zisman	[redacted]	16 June 2021

Prepared by:

RPS

Robert Dalziel
Senior Ecologist

Suite D10, Josephs Well, Hanover Walk
Leeds, West Yorkshire LS3 1AB

T 01132 206 190
E robert.dalziel@rpsgroup.com

Prepared for:

SSE Renewables

Karen Anderson
Consent Manager

1 Waterloo Street
Glasgow, G2 6AY

T 01738 341866
E karen.anderson@sse.com>

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1 INTRODUCTION

1.1 Purpose of this Technical Appendix

The purpose of this Technical Appendix is to provide baseline bird results, combining desk study details and the bird survey data for the Proposed Development. It explains desk study information collected, the baseline survey methods used and survey results. It also provides collision risk modelling predictions for target species and data on the cumulative effects of the Proposed Development along with other developments in the area.

The resulting combination of information has been used to inform the assessment reported in **Chapter 9: Ornithology (EIAR**) and to provide information to inform the Appropriate Assessment, reported in **Technical Appendix 9.2: Habitats Regulations Appraisal.**

The Technical Appendix is divided into 6 Sections. In Section 1 (Introduction), Section 1.2 recaps on the selection of Important Ornithological Features for the assessment. Section 1.3 details the screening for designated sites with ornithological interests that may have connectivity to the Proposed Development through potential impact pathways. Section 2 provides details of the methods used to assemble the ornithology baseline, covering the desk study approach in Section 2.1 and survey methods in Section 2.2. Section 3 provides the baseline results for key species. Section 4 details the approach and results of collision risk modelling and Section 5 details the developments considered for the cumulative ornithological impact assessment. Section 6 present confidential information on sensitive species (available to Scottish Ministers, NatureScot, and the Royal Society for the Protection of Birds (RSPB) only, as noted below).

The Technical Appendix is accompanied by Chapter 9 figures (Figure 9.1 to Figure 9.9) and its own figures (Figure A9.1 to Figure A9.40).

The terminology used to describe the site in this Technical Appendix follows the same approach as Chapter 9, in that the Site is the red line boundary (shown in Figure 9.5). The Proposed Development is the area occupied by the turbines and associated tracks and other infrastructure.

In accordance with the guidance on the publication of environmentally sensitive information (NatureScot 2016[1]), this **Technical Appendix 9.1 Ornithology Baseline** is issued in Confidential and Non-confidential versions (the former, along with associated confidential figures, and is available to Scottish Ministers, NatureScot and the Royal Society for the Protection of Birds (RSPB).

1.2 Identification of Important Ornithological Features

Potential Important Ornithological Features (IOFs) were selected on the basis set out in paragraphs 9.5.1 to 9.5.5 **Chapter 9: Ornithology (EIAR**). This process took into account the Site context, desk study results, stakeholder feedback, and NatureScot guidance relevant to wind farm development (NatureScot 2017[2]). As a result, surveys were undertaken to identify the study area's use by upland waders, raptors, waterfowl (including red-throated diver and black-throated diver) and black grouse.

1.3 Designated Sites

As well as the conservation status of individual species, identification of IOFs involved determining which sites designated to protect important bird populations had potential connectivity to the Proposed Development. NatureScot provide guidance on connectivity distances for different species (NatureScot 2016) and this was used to identify all protected areas within 20km of the Proposed Development. Internationally important designated sites are shown in Figure 9.1 **EIAR: Chapter 9: Ornithology** and Sites of Special Scientific

[1] NatureScot (2016). Environmental Statements and Annexes of Environmentally Sensitive bird Information. Guidance for Developers, Consultants and Consultees. Available from: https://www.nature.scot/environmental-statements-and-annexesenvironmentally-sensitive-bird-information

[2] NatureScot (2017) Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms, Scottish Natural Heritage, Battleby.

Interest local to the Proposed Development are shown in Figures 9.3 and 9.4 **EIAR: Chapter 9: Ornithology**. Details of each designated site with potential connectivity are provided below.

1.3.1 Caithness and Sutherland Peatlands SPA and Ramsar Site

The Caithness and Sutherland Peatlands SPA (UK9001151) covers 145,516.75 (ha) and borders the Proposed Development to the north east (Figure 9.1 **EIAR: Chapter 9: Ornithology**)[3].

The Caithness and Sutherland Peatlands SPA/Ramsar site is located across the northern-most parts of mainland Scotland and forms one of the largest and most intact areas of blanket bog in the world. Its diverse peatland and freshwater habitats support a wide variety of breeding birds including internationally important populations of raptors, wildfowl and waders.

The SPA has 12 species qualifying under Article 4.1 or 4.2 of the Birds Directive (79/409/EEC), listed in **Table 1-1**. The SPA is coincident with the Caithness and Sutherland Peatlands Ramsar site, the designated ornithological features of which are shown in **Table 1-2**.

Table 1-1. Qualifying Species of the Caithness and Sutherland Peatlands SPA

Feature	Designation	Feature population	Status at last round of condition monitoring	SPA connectivity distances[3]
Red-throated diver	SPA (Article 4.1)[1]	46 breeding pairs, 3.5% of GB population (2006)	Favourable maintained (31/07/2006)	Generally <8km, although regularly 11-13.5km
Black-throated diver	SPA (Article 4.1)[1]	26 breeding pairs, 15% of GB population (1994)	Favourable maintained (07/06/2018)	Likely <10km
Golden eagle	SPA (Article 4.1)[1]	5 breeding pairs, 1% of GB population (1992)	Favourable maintained (31/08/2016)	Core range of 6km, with maximum range up to 9km.
Hen harrier	SPA (Article 4.1)[1]	14 breeding pairs, at least 2.8% of GB population (mean population 1993 to 1997)	Favourable maintained (21/06/2016)	Core range of 2km, with maximum range of 10km.
Merlin	SPA (Article 4.1)[1]	54 breeding pairs, 4% of GB population (estimate 1993 and 1994)	Favourable maintained (31/07/2004)	Within 5km
Golden plover	SPA (Article 4.1)[1]	1,064 breeding pairs, 5% of GB population (1993 and 1994)	Favourable recovered (30/06/2015)	Core range of 3km, with maximum range of 11km.
Dunlin	SPA (Article 4.1)[1]	1,860 breeding pairs, up to 20% of GB population (1993 and 1994)	Favourable maintained (30/06/2015)	Core range of 500 m, with maximum range of 3km.
Wood sandpiper	SPA (Article 4.1)[1]	Up to 5 breeding pairs, up to 40% of GB population	Favourable maintained (30/06/2004)	None published
Greenshank	SPA (Article 4.2)[2]	At least 653 pairs (0,9% of Europe/ West Africa biogeographic population and 59.4% of of GB population (2009)	Favourable maintained (30/06/2015)	Core range of 2km, with maximum range of 3km.
Short-eared owl	(Article 4.1)[1]	20 breeding pairs, 2% of GB population	Not assessed	Core range of 2km, with maximum range of 5km
Common scoter	SPA (Article 4.2)[2]	At least 21 breeding pairs, at least <0.1% of the Western Siberia/ North-western/North-eastern European biogeographic population and at least 40.4% of the GB population	Unfavourable declining (03/06/2013)	None published
Wigeon	SPA (Article 4.2)[2]	At least 43 breeding pairs, at least <0.1% of the Western Siberia/ North-western/North-eastern European biogeographic population and at least 10.8% of the GB population (1993/4)	Favourable maintained (08/06/2004)	None published

[3] The area is also designated a Special Area of Conservation (SAC) on account of its peatland habitats and otter population. Details of these interests are provided in **EIAR: Chapter 8: Ecology**

Table Note

[1] Article 4.1: Regularly supporting populations of Annex I species of European importance.

[2] Article 4.2: Regularly supporting populations of migratory species of European importance.

[3] Core range during breeding season is used to determine whether there is connectivity between the proposal and the qualifying feature (NatureScot guidance).

Table 1-2. Features of the Caithness and Sutherland Peatlands Ramsar Site

Feature	Designation	Feature population	Status at last round of condition monitoring	Ramsar connectivity distances[3]
Greylag goose	Ramsar: feature[1]	30 pairs (count as mid-1990s); Baltic/UK/Ireland population (count as mid-1990s)	Favourable maintained	None published (winter)
Wigeon	Ramsar: Assemblage feature[2]	43 breeding pairs, representing an average of 14.3% of the GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	None published
Teal	Ramsar: Assemblage feature[2]	106 breeding pairs, representing an average of 7% of the GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	None published
Common scoter	Ramsar: Assemblage feature[2]	27 breeding pairs, representing an average of 28.4% of the GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	None published
Red-throated diver	Ramsar: Assemblage feature[2]	89 breeding pairs, representing an average of 9.5% of GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	Generally <8km, although regularly 11-13.5km
Black-throated diver	Ramsar: Assemblage feature[2]	25 breeding pairs, representing an average of 16.1% of GB population (1995-2004)	Favourable maintained (breeding bird assemblage [12/07/2009])	Likely <10km
Golden eagle	Ramsar: Assemblage feature[2]	5 breeding pairs, representing an average of 1.2% of GB population (count as at 1992)	Favourable maintained (breeding bird assemblage [12/07/2009])	Core range of 6km, with maximum range of up to 9km.
Hen harrier	Ramsar: Assemblage feature[2]	14 breeding pairs, representing an average of 2.8% of GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	Core range of 2km, with maximum range of 10km.
Merlin	Ramsar: Assemblage feature[2]	54 breeding pairs, representing an average of 4.1% of GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	Within 5km
Golden plover	Ramsar: Assemblage feature[2]	1,064 breeding pairs, representing an average of 4.7% of GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	Core range of 3km, with maximum range of 11km.
Wood sandpiper	Ramsar: Assemblage feature[2]	<5 breeding pairs, representing an average of 100% of GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	None published
Greenshank	Ramsar: Assemblage feature[2]	256 breeding pairs, representing an average of 23.7% of the GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	Core range of 2km, with maximum range of 3km.
Curlew	Ramsar: Assemblage feature[2]	517 breeding pairs, representing an average of 1.5% of the GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	Core range of 1km, with maximum range usually within 2km
Arctic skua	Ramsar: Assemblage feature[2]	39 apparently occupied territories, representing an average of 1.8% of the GB population (Seabird 2000 Census)	Favourable maintained (breeding bird assemblage [12/07/2009])	None published
Short-eared owl	Ramsar: Assemblage feature[2]	30 breeding pairs, representing an average of 3% of the GB population (count as mid-1990s)	Favourable maintained (breeding bird assemblage [12/07/2009])	Core range of 2km, with maximum range of 5km

Table Note

[1] Designated feature: Ramsar site population of international significance.

[2] Assemblage feature: Ramsar site population of national significance. Collectively, these species qualify as Ramsar feature 'breeding bird assemblage'.

[3] Information sheet on Ramsar Wetland does not present population data for breeding greylag goose. However, the Ramsar summary data spreadsheet provides the count of 30 pairs (Current version 21/10/2015. Online: accessed 25/04/2021 from http://archive.jncc.gov.uk/page-2392).

1.3.2 Strath Carnaig and Strath Fleet Moors SPA

The Strath Carnaig and Strath Fleet Moors SPA (UK9020300) is 11.6km east of the Proposed Development (Figure 9.1: **EIAR: Chapter 9: Ornithology**). Details of the SPA/Ramsar site qualifying interests are provided for the sake of completeness (Table 1-3), as NatureScot (2016) guidance is that SPAs up to 10km should be considered for potential connectivity for this species. Given the separation distance of 11.6km from the Proposed Development, there is considered to be no potential connectivity with regards to the qualifying feature detailed below, therefore this SPA has been screened out of the assessment.

Table 1-3. Qualifying Species of the Strath Carnaig and Strath Fleet Moors SPA

Feature	Feature population	Status at last round of condition monitoring	SPA connectivity distances
Hen harrier	Breeding peak mean of 12 birds during the breeding season the area regularly supports: *Circus cyaneus* 2.5% of the population in Great Britain Three year mean for 2002 to 2004	Favourable maintained (08/03/2015)	Core range of less than 10km

1.3.3 Inverpolly, Loch Urigill and Nearby Lochs SPA

The Inverpolly, Loch Urigill and nearby Lochs SPA (UK9001511) is 11.7km west of the Proposed Development (Figure 9.1 **EIAR: Chapter 9: Ornithology**). Details of the SPA/Ramsar site qualifying interests are provided for the sake of completeness (Table 1-4), as NatureScot (2016) guidance is that SPAs up to 10km should be considered for potential connectivity. Given the separation distance of 11.7km from the Proposed Development, there is considered to be no potential connectivity with regards to the qualifying feature detailed below, therefore this SPA has been screened out of the assessment.

Table 1-4. Qualifying Species of the Strath Carnaig and Strath Fleet Moors SPA

Feature	Feature population	Status at last round of condition monitoring	SPA connectivity distances
Black-throated diver	Breeding peak mean of 8 birds during the breeding season the area regularly supports: *Gavia arctica* (Western Siberia/Europe) 5% of the GB breeding population Mean from 1986 to 1998	Favourable maintained (08/03/2015)	Core range of less than 10km.

1.3.4 Lairg and Strath Brora Lochs SPA

Lairg and Strath Brora Lochs SPA (UK9001611) is 11.6km east of the Proposed Development (Figure 9.1, **EIAR: Chapter 9: Ornithology**). Details of the SPA/Ramsar site qualifying interests are provided for the sake of completeness (Table 1-5), as NatureScot (2016) guidance is that SPAs up to 10km should be considered for potential connectivity. Given the separation distance of 11.6km from the Proposed Development, there is considered to be no potential connectivity with regards to the qualifying feature detailed below, therefore this SPA has been screened out of the assessment.

Table 1-5. Qualifying Species of Lairg and Strath Brora Lochs SPA

Feature	Feature population	Status at last round of condition monitoring	SPA connectivity distances
Black-throated diver	Breeding peak mean of 6 birds during the breeding season the area regularly supports: *Gavia arctica* (Western Siberia/Europe) 3.9% of the GB breeding population Mean from 1986 to 1998	Favourable maintained (08/03/2015)	Core range of less than 10km

1.3.5 Sites of Special Scientific Interest

Underlying the SPA/Ramsar Site are Sites of Special Scientific Interest (SSSI). These are designated under national legislation (rather than European) in order to protect different biological and geological features of interest. Those SSSIs within 20km designated for ornithological features are.

- Grudie Peatlands
- Lairg and Strath Brora Lochs
- Strath Carnaig and Strath Fleet Moors
- Strath an Loin
- Strath Duchally
- Cnoc an Alaskie
- Loch Awe and Loch Ailsh

The SSSI citations have two categories of notified ornithological features. Firstly, individual species are notified if the site supports nationally (and often internationally) significant numbers. The second tier of notification for bird interests within SSSI comprises assemblages of species. This is applied at localities supporting a particularly good range of bird species characteristic of a particular habitat. The species qualifying individually or as components of an assemblage are presented in Table 1-6. For the purposes of this assessment all species listed are considered as IOFs of national importance. The only SSSI who's features of interest are within connectivity distance to the Proposed Development is the Grudie Peatlands SSSI. Therefore, its three species are regarded as IOFs of at least national importance and form part of the ornithological assessment completed for the Proposed Development. They are however, also qualifying species of the Caithness and Sutherland Peatlands SPA/Ramsar site and so are assessed under that international level of importance. The SSSIs and features of interest of the other SSSIs in Table 1-6 were therefore scoped out of the assessment.

Table 1-6. Designated Ornithological Features of SSSIs within 20km of the Site

SSSI	Lairg and Strath Brora Lochs	Strath Carnaig and Strath Fleet Moors	Kyle of Sutherland Marshes	Grudie Peatlands	Strath a Loin	Strath Duchally	Cnoc an Alaskie	Loch Awe and Loch Ailsh
SSSI Distance from site km	11.6	11.6	**7km**	**0**	2.4	9.5	8.5	11.6
NatureScot connectivity distance for features of interest	<10km	<10km	**N/A**	**<11km**	N/A	**<11km**	<3km	<10km
Designated species								
Black-throated diver	✓							✓
Hen harrier		✓						
Dunlin				✓				
Golden Plover				✓				
Greenshank				✓			✓	

Out of the three features of interest of the Strath Duchally SSSI, only golden plover are within potential connectivity distance, albeit at the extreme upper limit of the 11km maximum range given by NatureScot (2016), and well beyond the core range of 3km. Given this is the distance between the southern tip of the SSSI and northern limit of the Proposed Development, the actual likelihood of any connectivity is extremely low, with the great majority of the SSSI's golden plover population (if not all of it) being more than 11km from the nearest proposed Achany Extension turbine location (given that at this distance, the only impact pathway would be collision risk).

The actual risk of connectivity and negative effects on Strath Duchally SSSI is therefore considered negligible in reality, and so was scoped out of the assessment.

2 ORNITHOLOGY BASELINE METHODS

2.1 Introduction

A comprehensive range of sources has been used to compile the baseline ornithological dataset, used to assess predicted effects on the IOFs from the Proposed Development.

2.1.1 Desk Study Description

In order to assess the potential effects of the Proposed Development on birds, the desk study aimed to collate pre-existing information from reliable sources, on designated sites, the site characteristics and target species.

2.1.1.1 Designated Sites

As noted above, as part of the desk study, relevant information was collated on designated sites (SPAs/Ramsar sites/SSSIs) with ornithological connectivity between their qualifying species/notified features and the Proposed Development.

A search for all designated sites within a 20km radius of the site was made utilising online sources:-

- NatureScot Sitelink[4];
- Joint Nature Conservation Committee website[5];
- Scotland Environment website[6].

SPA and SSSI designated sites were also downloaded on to Google Earth and incorporated with other data layers to show the Proposed Development in its geographical and 3D topographic context, supporting the analysis of potential connectivity and its Zone of Impact. As noted in **Chapter 8 Appendix 8.10**, and in **Chapter 9 (**paragraphs 9.9.7 to 9.9.11), an Outline Habitat Management Plan (HMP) is included as part of the Proposed Development, so its candidate HMP restoration areas were also added to this Google Earth compilation.

2.1.1.2 Existing Records

The Proposed Development and its survey buffers were previously surveyed in 2010-2012 for the Glencassley Wind Farm application. The overlap between the Proposed Development and the 2010 to 2012 survey boundaries are shown in Figure A9.1 (VPs and viewsheds), and A9.2 (breeding survey buffers).

In addition, information from both confidential and public domain survey data, scientific publications, grey literature and ES/EIA/Consultations for nearby wind farm developments were searched for further details of the bird communities in and around the site. Primary sources of contextual data include the following:

- The Birds of Scotland. Scottish Ornithologists Club (Forrester *et al.* 2007[7]);
- Population estimates of birds in Great Britain and the United Kingdom (Musgrove *et al.* 2013[8],Woodward *et al.* 2020[9]);

[4] Available at http://gateway.snh.gov.uk/sitelink/index.jsp (Accessed: 30/03/2021)

[5] Available at https://www.jncc.gov.uk (Accessed: 30/03/2021)

[6] Available at https://map.environment.gov.scot/sewebmap/ (Accessed: 30/03/2021)

[7] Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C., and Grundy, D.S. (eds). (2007) The Birds of Scotland. The Scottish Ornithologists' Club, Aberlady

[8] Musgrove, A, Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K, and Stroud, D. (2013) Population Estimates of Birds in Great Britain and the United Kingdom. British Birds 106:64-100

[9] Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, S. and Noble, D. (2020) APEP 4 - Population Estimates of Birds in Great Britain and the United Kingdom. British Birds 113: 69-104

- Bird Atlas 2007-11: The Breeding and Wintering Birds of Britain and Ireland (Balmer *et al.* 2013[10]);
- Scottish Raptor Monitoring Scheme Report 2018 (Challis *et al.* 2018[11]);
- Birds of Conservation Concern (BoCC) 4: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man (Eaton *et al.* 2015[12]);
- The Status of UK SPAs in the 2000s: The Third Network Review. JNCC (Stroud *et al.* 2016[13]); and
- Natural Heritage Zone (NHZ) bird population estimates, Scottish Wind Farms Bird Steering Group(SWBSG) commissioned report no. 1504 (Wilson *et al.* 2015[14]).

The previous survey data from the Applicant's 2012 Glencassley application was loaded on to GIS, allowing scrutiny of flight activity and territories for key species in tandem with the contemporary September 2018 to August 2020 data.

Further GIS datasets included designated sites, the Golden Eagle Topographic (GET) model, data search results, HMP information (drain blocking and candidate habitat enhancement areas), land ownership boundaries, Achany and Rosehall Wind Farm, and data from RPS (2015) (which combined the Achany and Rosehall data up to 2014 (inclusive) and bespoke survey results the Applicant commissioned at the Achany Wind Farm). Further post-construction monitoring results from the Achany (SSE 2019[15]) and Rosehall Wind Farms from the fifteenth and sixth year of post-construction monitoring respectively (RWE/E.ON Climate and Renewables 2019[16]) were also considered. In combination, this comprehensive dataset gives insights from multiple years' surveys and all stages of wind farm development other than decommissioning.

2.2 Survey Methods

2.2.1 Background

As well as this comprehensive desk study, a suite of bird surveys was commissioned by the Applicant covering the site, carried out between September 2018 to September 2020 inclusive. These were in accordance with guidance set out by NatureScot (2016), to monitor distribution and flight activity of target species. The timelines and surveys of fieldwork carried out at the Site are shown in Table 2-1.

After the initial September 2018 to March 2019 surveys, the Proposed Development footprint shifted southwards, and as a result, the original survey area (notably the VP locations), no longer provided coverage of the whole revised potential layout (just covering its northern half). New VP locations were therefore put in place (see **Chapter 9** Figure 9.7), providing coverage over two complete breeding seasons (2019 and 2020) and one non-breeding season (2019/2020) as the Proposed Development layout evolved (see **Chapter 2 Site Selection and Design Evolution**). Where target species flight activity was recorded over the September 2018/March 2019 survey period, these results have been included in the Technical Appendix Figures A9.3 to A9.40 for useful context. Flight activity data from this period have also been considered in collision risk modelling calculations, although no species other than golden eagle had more than three 'at risk' flights. Collision risk modelling was therefore only carried out for this species for its non-breeding period within September 2018 to March 2019.

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[10] Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S., and Fuller, R.J. (eds). (2013) Bird Atlas 2007–11: The Breeding and Wintering Birds of Britain and Ireland. BTO, Thetford.

[11] Challis, A., Wilson, M.W., Holling, M., Roos, S., Stevenson, A., and Stirling-Aird, P. (2018) Scottish Raptor Monitoring Scheme Annual Report 2018. BTO Scotland, Stirling

[12] Eaton, M.A., Aebischer, N.J., Brown, A.F., Hearn, R.D., Lock, L., Musgrove, A., Noble, D.G., Stroud, D. and Gregory, R.D. (2015) Birds of Conservation Concern (BoCC) 4: The Population Status of Birds in the United Kingdom, Channel Islands and the Isle of Man.British Birds, 108: 708-746

[13] Stroud, D.A., Bainbridge, I.P., Maddock, A., Anthony, S., Baker, H., Buxton, N., Chambers, D., Enlander, I., Hearn, R.D., Jennings,K.R., Mavor, R., Whitehead, S. and Wilson, J.D. – on behalf of the UK SPA & Ramsar Scientific Working Group (eds). (2016) The Status of UK SPAs in the 2000s: The Third Network Review. JNCC, Peterborough.

[14] Wilson, M.W., Austin, G.E., and Wernham, C.V. (2015) Natural Heritage Zone (NHZ) Bird Population Estimates, Scottish Wind Farms Bird Steering Group (SWBSG) Commissioned Report no. 1504 (pp72).

[15] SSE (2019) Achany Windfarm Post-construction Monitoring, unpublished report

[16] Natural Power (2019) Rosehall Wind Farm Ecology Report Operational Year 6, unpublished report

Table 2-1. Proposed Development Bird Surveys and Their Duration: 2018-2020

Survey		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
VP Surveys	2018												
	2019												
	2020												
Breeding Black Grouse	2019												
	2020												
Breeding Raptors	2019												
	2020												
Breeding Waders	2019												
	2020												

2.2.2 Field Surveyors

Surveyors had extensive ornithological field experience of Scottish uplands and experience carrying out the bird survey methods used, estimating heights and distances, recording data concisely and correctly, navigation techniques and health and safety. Surveyors carried out surveys in a systematic manner following recognised standardised survey methods. All surveyors held appropriate Schedule 1 licences.

2.2.3 Moorland Breeding Birds

The modified Brown and Shepherd (1993)[17] Moorland Breeding Bird Survey (MBBS) is the standard survey technique for moorland/upland breeding birds. It is based on a constant search method involving spending 25 minutes in each 500m x 500m quadrat, within the survey area and 500m buffer (shown in Figure 9.9 of **EIAR: Chapter 9: Ornithology)**. This equates to spending 100 minutes for every km^2. Each quadrant was walked to ensure that all parts approached to within 100m. At regular intervals, the surveyor paused, scanned the area for species and listened out for calls and songs. All registrations were marked on a 1:25,000 scale map using BTO symbols with a note of the species activity. These surveys were undertaken at least four times each breeding season during the period April to July 2019 and May to July 2020 (April 2020 being missed due to Covid 19 health and safety restrictions). The entire study area was defined as open moorland habitat and so this survey technique was used in all parts of the study area.

By comparing the location of records from each visit, the data enabled putative territory centres to be derived (Brown and Shepherd 1993). By convention, registrations/territories plotted during each period were considered separate from one another if more than 500m apart for larger species, 200m in the case of dunlin and passerines. These distances were chosen to reflect the distances birds could plausibly move between survey periods (following Brown and Shepherd's 1993 methodology). The approximate central location of relevant bird registrations recorded from different visits was used to generate a putative territory centre (the species "dot" on the relevant figure). The number of territories and distance from the Proposed Development were derived from these territory locations. Breeding territories, where present, are included in the Figures A9.3 to A9.40 (combined with flight activity survey results, for additional context).

Table 2-2 shows a breakdown of the MBBS survey effort per month during the 2019 and 2020 survey seasons. Full survey effort details are given in Appendix A.

Table 2-2. Moorland Breeding Bird Survey Dates 2019 and 2020

Month	First Date	Last Date
April 2019	10/04/2019	14/04/2019
April 2020	No survey due to Covid restrictions	No survey due to Covid restriction
May 2019	09/05/2019	29/05/2019
May 2020	12/05/2020	31/05/2020

[17] Brown, A.F. and Shepherd, K.B. (1993) A Method for Censusing Upland Breeding Waders. Bird Study 40: 189-195

Month	First Date	Last Date
June 2019	05/06/2019	25/06/2019
June 2020	09/06/2020	25/06/2020
July 2019	02/07/2019	30/07/2019
July 2020	13/07/2020	22/07/2020

2.2.4 Breeding Raptor Surveys

Breeding raptor surveys were conducted over 2019 and 2020 (Table 2-3), with target species being golden eagle, hen harrier, merlin, short-eared owl and white-tailed eagle. These surveys were based on survey methods detailed in Gilbert *et al*. (1998)[18] and Hardey *et al*. (2013)[19]. Appendix B has full breakdown of the breeding raptor survey effort. The breeding raptor bird survey area is shown in Figure 9.9 of **EIAR: Chapter 9:**

For each year of survey, observed nest sites were recorded to the highest level of accuracy possible (at least an eight-figure grid reference). If a nest site was not found but a breeding territory was considered likely, the central point of the territory was plotted on a map based on recorded activity density, numbers of observations, date and time of each observation, behaviour of individuals and habitat. Points were plotted to a six-figure grid reference accuracy level. The estimated distance of each pair/territory (as applicable) to the nearest turbine was obtained by taking the adjudged centre point of the territory.

No IOF breeding raptor territories were recorded on site or within 2km of the Proposed Development during 2019 or 2020. VP flights, together with any incidental flights recorded and any territories in the wider survey area are shown in Figures A9.3 to A9.40.

Table 2-3 shows a breakdown of breeding raptor survey dates during the 2019 and 2020 survey seasons. Golden eagle, white-tailed eagle, merlin and osprey nesting was monitored by the Highland Raptor Study Group, so care was taken to avoid duplication of effort, to minimise risk of disturbance.

Table 2-3. Breeding Raptor Survey Dates

Month	First Date	Last Date
April 2019	09/04/2019	28/04/19
April 2020	No survey due to Covid restrictions	No survey due to Covid restrictions
May 2019	20/05/2019	23/05/2019
May 2020	14/05/2020	29/05/2020
June 2019	09/06/2019	25/06/2019
June 2020	03/06/2020	29/06/2020
July 2019	08/07/2019	30/07/2019
July 2020	03/07/2020	31/07/2020

2.2.5 Targeted Water Body Surveys

Following NatureScot guidance[2], searches for nesting red or black-throated divers and other IOF waterfowl were undertaken on all potentially suitable water bodies within 1km (these waterbodies are shown in Figure 9.8 of **EIAR: Chapter 9: Ornithology).** The water bodies were visited at least twice during the breeding season if no birds were present. If the water body was occupied, sites were revisited later in the breeding season to determine nest locations and breeding success. Had diver nesting been suspected, dedicated additional vantage points watches would have been undertaken to assess foraging flight-line directions to and from the nesting loch(an). However, no breeding divers were recorded so there was no requirement to implement focal diver watches. Table 2-4 summarises survey effort per month during 2019 and 2020.

[18] Gilbert, G. Gibbons, D. W, and Evans, J. (1998) Bird Monitoring Methods. RSPB, Bedfordshire

[19] Hardey, J., Crick, H., Wernham, C., Riely, H., Etheridge, B. and Thompson, D. (2013) Raptors: a Field Guide to Survey and Monitoring. The Stationery Office, Edinburgh

Table 2-4. Water Body Survey Summary

Month	2019 breeding season	2020 breeding season
May	18:50	29:05
June	11:55	24:17
July	00:00	23:14
August	06:00	17:23
Total	36:45	93:59

2.2.6 Vantage Point Watches

Vantage Point (VP) watches were used to record flight activity and the use of the site, during the breeding bird and non-breeding season, for selected target species between September 2018 and August 2020. NatureScot guidance (NatureScot 2017[2]) was followed, which recommended that a minimum of 36 hours per VP was required per season. VP watches are designed to record target species using the study area but not necessarily breeding there; and include the collection of data on the activities and flight paths of these birds, including height from the ground, duration of flights at the set height bands, and activities of the birds. Birds recorded by this method include all raptors, all wildfowl, black grouse and waders. The resulting data enabled modelling of collision risk.

This method involves selecting VP locations which provide a good view of the development area. NatureScot guidance recommends that, where possible, VPs should be located outside of the planned study area. Given the topography of the Proposed Development and its surroundings, this was not possible in some instances. Therefore, two VP locations were unavoidably inside the study area, as highlighted in Chapter 9 paragraphs 9.5.17 to 9.5.19, and in Section 4.1 of this Technical Appendix. The locations of vantage points are shown in Figure 9.7 of **EIAR: Chapter 9: Ornithology**.

A minimum of 36 hours per VP were spent during each of season, based on visits to each VP twice per month, i.e. 6 hours each per month, each separated by approximately at least 2 weeks where practical to do so. During some of the winter periods, access was very difficult and some monthly VPs during this time were carried out closer together. Nevertheless, the minimum number of hours required was met, and exceeded in many cases. In addition to regular VP watches, additional watches at dawn and dusk were carried out during migration times (mid-March to mid-May and mid-September to mid-November).

From pre-selected vantage points, the visible area within a 180º arc was scanned for target species over a 3-hour period. Flights of target species seen from VPs were recorded within six height bands: 0-20m; 20-40m; 40-100m; 100-150m, 150-250m and > 250m. The altitudinal span of flight bands is taken account of in the collision risk modelling process. In addition, even though tip height is limited to 200m, the inclusion of flights up to 250m in collision risk modelling calculations adds a further degree of precaution to collision rate calculations.

The flight-line of the bird was also plotted onto a 1:25,000 scale field map. Flight-lines were then digitised from field maps using ArcGIS software. This was the used (when there was sufficient flight-lines) to carry out collision risk modelling (CRM), which is the recognised tool used to analyse flight-lines and potential mortality rates for key species.

An effort was made to vary the timing of each VP watch. VP surveys were conducted between daylight hours, when visibility allowed a clear view of surrounding area.

A summary table of vantage point fieldwork dates carried out during ornithological surveys of the site and study area is provided in Appendix C.

2.2.7 Black Grouse Surveys

Targeted surveys were undertaken to determine the presence of black grouse. Lek surveys were undertaken within 2 hours of dawn on several dates between mid-March and mid-May (after Gilbert *et al*. 1998[19]). Surveys were only undertaken when weather conditions were dry and calm, allowing the call of lekking males to be heard more readily. Care was taken not to disturb lekking birds, which were observed from distance and counted using a telescope. The black grouse survey area is shown in Figure 9.9 of **EIAR: Chapter 9: Ornithology**.

Table 2-5. Black Grouse Survey Timings

Month	Date	Star time	End time	Duration (hh:mm)
May	11/05/2019	04:00	07:00	03:00
	24/05/2019	03:30	06:45	03:15
May	11/05/2020	04:20	07:40	03:20
	11/05/2020	04:10	07:00	02:50
	12/05/2020	04:15	07:15	03:00
	13/05/2020	04:00	07:00	03:00
	14/05/2020	04:00	07:00	03:00
	15/05/2020	03:50	06:50	03:00

Table 2-6. Black Grouse Survey Effort

Month	2019 Breeding Season	2020 Breeding Season
May	6:15	18:10

2.2.8 Survey Limitations and Restrictions

The extent and the wide range of surveys carried out at the main site for the Proposed Development provides comprehensive contemporary coverage. However, the Covid-19 outbreak necessitated a delay to fieldwork in April 2020, for health and safety reasons and avoiding non-essential travel in accordance with UK and Scottish Government guidance. Additional survey effort in May 2020 was designed to ensure sufficient survey effort was completed in the 2020 breeding season to comply with NatureScot guidance.

The topography of the Proposed Development and its surroundings did dictate positioning of two VPs within the site but for the reasons provided in sections 9.5.17 to 9.5.19 of **EIAR: Chapter 9: Ornithology** and 2.2.6 and 4.1.1 of this Technical Appendix, these are not considered to have diminished the ability to record accurate levels of flight activity of target species.

Although VP for the initial 2018 to 2019 non-breeding season only covered the north-west of the Proposed Development area, given the limited bird activity and species present over this period, this is not considered to have significantly reduced insights into flight activity. Golden eagle is the main target species potentially present, and monitoring from the VPs used over this period is considered to have provided a sufficient sample of flight activity from which to generate a precautionary collision risk (given that evidence strongly indicates high levels of macro avoidance of wind farms by this species (see section 4.3.2 of this Technical Appendix).

3 BASELINE RESULTS

3.1 Red-throated Diver

3.1.1 Desk Study on the Wider Population Context

Red-throated divers are listed on Annex 1 of the EU Birds Directive, are a Schedule 1 species. There are estimated to be between 42,100 and 93,000 breeding pairs in Europe (BirdLife International, 2020[20]). In Great Britain, the species is confined as a breeding bird to north and west Scotland, particularly Shetland and Orkney.

A survey of the whole of Scotland in 1994 found 935 breeding pairs, with a suggested upper limit of 1,500pairs[21]. Since then, results from the 2006 sample-based national survey have shown red-throated diver numbers have increased significantly since, to 1,255 breeding pairs with an upper limit of 1,551 pairs[22].

At the time of designation (February 1999), the Caithness and Sutherland Peatlands SPA population of red-throated diver was 89 pairs (two-year mean: 1993-1994; 9.5% of British breeding population). Results from the 2006 national survey (39 pairs, 4.2% of the British breeding population) suggests a significant decline within the SPA. However, the 2006 national survey revealed a significant increase in the diver population of 33.7% since the previous survey in 1994. On mainland Scotland, this increase was by 14.1% and it is possible that the decline in the Caithness and Sutherland Peatlands SPA may be in part due to redistribution of the breeding population and inter-annual variation. The most recent site condition monitoring for the SPA (July 2006) concluded that the red-throated diver population was in Favourable Maintained condition.

The 2006 national survey estimates the Caithness and Sutherland Peatlands SPA population used in conjunction with Bird Atlas data estimated 58 breeding pairs for NHZ 5 (Caithness and Sutherland Peatlands, of which the SPA constitutes 28% of land area)[22].

3.1.2 Results of Data Collation

The RSPB data request returned no records of red-throated diver from within 6km of the proposed development. From the April 2010 to March 2012 surveys to inform the previous Glencassley Wind Farm ES (SSE 2012), no red-throated divers nested within the site. Detailed searches in the 8km study area for this species revealed two pairs nested >5km away from the site in the study area in both years. Red-throated divers were recorded flying across the site only once (on 16/03/11). A single bird was recorded on the edge of the site on Dubh Loch Mòr flying off eastwards away from the site in 2010 (SSE 2012).

3.1.3 Proposed Development Red-throated Diver Survey Results

Red-throated divers did not breed within the Proposed Development in 2019 or 2020 or within 1km at any of the loch or lochans included in the survey. Furthermore, no red-throated diver flights were recorded during vantage point surveys. Two incidental sightings of single red-throated divers were seen on Loch Sgeireach on the same day (21/07/20), firstly an individual seen with a fish on the loch, before flying north, and the other in flight over the loch (Figure A9.3).

3.2 Black-throated Diver

3.2.1 Desk Study on the Wider Population Context

Black-throated divers are listed on Annex 1 of the EU Birds Directive, are a Schedule 1 species and also an Amber-listed BoCC. The European population of black-throated diver is declining and estimated to be 53,800-87,800 pairs[23].

[20] BirdLife International. (2020) Species factsheet: *Gavia stellata.* Downloaded from http://www.birdlife.org on 20/03/2021

[21] Dillon, I., Smith, T., Williams, S., Haysom, S. and Eaton, MA. (2009) Status of Red-throated Divers *Gavia stellata* in Britain in 2006. Bird Study 56: 147-157.

[22] BirdLife International. (2004) Birds in Europe: Population Estimates, Trends and Conservation Status. BirdLife International,Cambridge

[23] BirdLife International. (2020) Species factsheet: *Gavia arctica*. Downloaded from http://www.birdlife.org on 22/03/2021

The breeding population of black-throated diver in Great Britain was surveyed in 2006 (all pairs are inScotland). Results gave a population of 217 summering territories, an increase of 16% on the revised estimate of the previous survey in 1995 (187 territories), which itself was an increase on the previous national survey (151 territories in 1985)[24].

The main strongholds include west Sutherland and the Flow Country of east Sutherland and Caithness[15].

At the time of designation, the Caithness and Sutherland Peatlands SPA population was cited at 26 pairs (16.8% of UK and 27.4% of SPA suite population). In mid-2006, the population was assessed at 29 pairs (13.2% of UK and 29.0% of SPA suite population). The most recent round of site condition monitoring for the Caithness and Sutherland Peatlands SPA (07/06/2018) concluded a condition of Favourable-Maintained for the SPA feature breeding black-throated diver.

The NHZ population for black-throated diver within the Peatlands of Caithness and Sutherland (Zone 5, ofwhich the SPA constitutes 28% of the area) is estimated at 39 pairs (range 35 to 56).

3.2.2 Results of Data Collation

The RSPB data search returned one record from within the past five years, a pair recorded on Loch Shin 6km to the north-east. From the April 2010 to March 2012 surveys to inform the previous Glencassley Wind Farm ES (SSE 2012), no black-throated divers nested within the site. Two pairs nested >6km from the site within the wider study area in both years but well away from the Proposed Development. Black-throated divers were occasionally recorded fishing on larger water bodies away from the site in the east of the wider study area e.g. Loch Shin, Loch Sgeieach and once on Lochan a' Choire and Dubh Loch Beag. No black-throated divers were recorded on or flying over the site during these 2010 and 2011 surveys (SSE 2012).

3.2.3 Proposed Development Black-throated Diver Survey Results

Black-throated divers did not breed within the site in 2019 or 2020 or within 1km on any of the lochs included in the survey. No black-throated diver flights were recorded during vantage point surveys. Only two observations were recorded over the survey period, comprising two birds on 14/05/2020 and an individual on 09/06/2020, both recorded during the 2020 MMBS surveys (Figure A9.4). There was no evidence of breeding, however.

3.3 Golden Eagle

3.3.1 Desk Study on the Wider Population Context

Golden eagles are listed on Annex 1 of the EU Birds Directive and are a Schedule 1 species. The last national survey of golden eagles in 2003[25] found 442 breeding pairs (compared to about 422 pairs in the 1992 national survey[26]), with the majority found in the Scottish Highlands and Islands. A second estimate in the 2003 survey, to allow direct comparison with previous national surveys indicated a 2.8% population increase since 1992 and a 2.4% increase since 1982-83. The UK population therefore appear to be stable.

Breeding golden eagles are a qualifying species of the Caithness and Sutherland Peatlands SPA, the five pairs forming up to 1.1% of the 2003 British population. This is equivalent to an average density of 0.3 pairs per 100km^2 in the SPA. Whitfield *et al.* (2006)[27] considered there to be 31 known or potential golden eagle territories across the Peatlands of Caithness and Sutherland NHZ, of which 13 were known to be occupied in 1992 and 9 occupied in 2003. This latter figure is considered by NatureScot (2012)[28] to best represent the current NHZ population.

[24] Holling, M. and The Rare Bird Breeding Panel. (2009) Rare Breeding Birds in the United Kingdom in 2006. British Birds 102: 158-202

[25] Eaton, M.A., Dillon, I.A., Stirling-Aird, P.K., and Whitfield, D.P. (2007) Status of Golden Eagle *Aquila chrysaetos* in Britain in 2003.Bird study. 54: 212- 220

[26] Green, R.E. (1996) The Status of the Golden Eagle in Britain in 1992. Bird Study 43: 20-27

[27] Whitfield, D P, Fielding, A H, McLeod, D R A and Haworth, P F and Watson, J. (2006) An Assessment of Potential Impacts on KeyRaptors at Dunbeath Wind Farm, Caithness, Scotland

[28] NatureScot. (2012) Regional Populations Estimates of Selected Scottish Breeding Birds. NatureScot Guidance Note

The average fledging rate for golden eagles in this NHZ, at 0.32 chicks per pair (data from 1982, 1992 and 2003 censuses), is considered to be relatively good and sufficient to maintain a stable population in this region[29].

3.3.2 Results of Data Collation

Golden eagles have not been recorded nesting at the site at any point over the survey period within 6km.

The HRSG and RSPB have continued to monitor the eyries nearest to the site in certain years. RPS has not therefore undertaken surveys of these territories in previous years to avoid duplication of effort and to minimise the risk of disturbance to the birds.

Field survey work carried out from April 2010 to March 2012 to inform the previous Glencassley Wind Farm ES (SSE 2012) confirmed no pairs of golden eagles nested within the 6km study area, with the nearest occupied territory being over 15km from the Proposed Development. An old and un-used nest over 6km [redacted] of the Proposed Development had been checked in 2009, April 2010 to March 2012 and confirmed as unoccupied.

Non-breeding golden eagles were present recorded during the April 2010 to March 2012 survey work. DNA evidence from feathers collected over 1km north-east of the Proposed Development indicated up to five individual eagles had used that location, with other individuals also identified from DNA evidence further north in the wider region. Flight activity occurred in the non-breeding and breeding seasons, generally concentrated to the north of the current Proposed Development.

The RSPB and Highland Raptor Study Group (HRSG) data searches returned no records of golden eagle.

3.3.3 Proposed Development Golden Eagle Survey Results

There were no golden eagle eyries recorded over 2019 and 2020 within the 6km survey buffer for this species. Birds were observed flying over the site in all seasons (Figures A9.5 to 9.8), and the level of flight activity within the Proposed Development's potential collision risk zone was sufficient to merit collision risk modelling (reported in Section 4.3). Golden eagle flight activity was recorded over most parts of the Proposed Development with several flights concentrated around the west, north and north-east fringes of the Proposed Development. Further details on golden eagle results are provided in Section 6.1 of this Technical Appendix.

3.4 Hen Harrier

3.4.1 Desk Study on the Wider Population Context

Hen harrier are listed on Annex 1 of the EU Birds Directive, are a Schedule 1 species and also a Red-listed BOCC. Over most of their UK range they have decreased, with the most recent national hen harrier surveys in 2016[30] showing an overall decline in territorial pairs in Scotland of 9%, from an estimated 505 territorial pairs to 460. There are regions that differ from this national picture however, and the estimated population of the Caithness and Sutherland Peatlands SPA was stable over this period, at an estimated at three pairs.

The SPA and NHZ have been difficult to survey, given the large areas of suitable habitat, relatively low density and restricted monitoring coverage possible by the HRSG. As a result, the population estimates, both for the NHZ and SPA vary considerably. At the time of designation (February 1999), the Caithness and Sutherland Peatlands SPA population was cited at 14 pairs. In 2003, the population was assessed at 19 pairs and the estimated population of the Peatlands of Caithness and Sutherland NHZ (Zone 5, of which the SPA constitutes 28% of the area) was 38 pairs (range 35 to 40). Information from NatureScot indicated that the SPA population stands at 20 pairs, whilst the NatureScot cumulative database lists the SPA population as 13 pairs, based on the results of the 2016 Site Condition Monitoring.

[29] Whitfield, D P, Fielding, A H, McLeod, D R A and Haworth, P F. (2008) A Conservation Framework for Golden Eagles: Implications forTheir Conservation and Management in Scotland. Scottish Natural Heritage Commissioned Report No.193 (ROAME No. F05AC306).

[30] Wotton, S.R., Bladwell, S., Mattingley, W., Morris, N.G., Raw, D., Ruddock, M., Stevenson, A. and Eaton, M.A. (2018) Status of the Hen Harrier *Circus cyaneus* in the UK and Isle of Man in 2016, Bird Study, 65:2, 145-160.

As well as establishing the number of nesting pairs there are also numbers of immature (non-breeding) hen harriers within the population. The Caithness and Sutherland Peatlands SPA population is estimated to contain around 46 individual hen harriers from a total NHZ hen harrier population of around 264 individuals.

The most recent round of site condition monitoring for the Caithness and Sutherland Peatlands SPA (June 2016) concluded a condition of Favourable-Maintained status for the SPA feature hen harrier.

3.4.2 Results of Data Collation

No pairs of hen harriers were recorded nesting within or adjacent to the study area in 2010 or 2011 during fieldwork for the Glencassley ES (SSE 2012). Hen harriers were seldom seen from VPs and only four flight lines were recorded across the site during two years of ornithological surveys.

The RSPB data search returned eight records of hen harrier from 2016. These records were localised to an area of plantation approximately 6km [redacted] of the site. The HRSG data search returned no hen harrier records within 6km.

3.4.3 Proposed Development Hen Harrier Survey Results

The results of the hen harrier surveys completed for the Proposed Development are shown in Figures A9.9.

For both years, from the combination of raptor-specific surveys, VP and incidental records collected during other surveys, no hen harriers were recorded breeding within the Proposed Development or within 2km. There were no hen harrier flights recorded in 2019 and five flights in 2020, all during VP surveys. Of these, four were within the PCZ (Figure A9.9), but only three at risk (one flight being below collision risk height). Flight activity over the site was therefore insufficient to merit collision risk modelling.

3.5 Merlin

3.5.1 Desk Study on the Wider Population Context

Merlin is listed Annex I of the EU Birds Directive and Schedule 1 and is a Red-listed BoCC.

The most recent national survey of merlin in 2008[31] estimates the Scottish breeding population at 783 pairs,a decline of 7% (which was not statistically significant) from the 1993-4 national survey[32] .

The Caithness and Sutherland Peatlands SPA population was cited at 54 pairs at the time of designation (February 1999). In 2008, the population was assessed at 11 pairs (using data collected during the national survey) The population estimate for the Peatlands of Caithness and Sutherland Natural Heritage Zone (Zone 5, of which the SPA constitutes 28% of the area) is estimated at 71 pairs (range 55 to 86).

The most recent round of site condition monitoring for the Caithness and Sutherland Peatlands SPA (31/07/2004) concluded a condition of Favourable-Maintained for this species.

3.5.2 Results of Data Collection

Targeted nest searches completed for the Glencassley wind farm application (SSE 2012) recorded no merlin nesting within the site in 2010 or 2011. One pair nested beyond the edge of the 2km survey buffer in 2011. The RSPB returned no recent records of merlin from the Proposed Development but did return a record from 2008 for a single bird approximately 2km north of the Proposed Development. The HRSG data search returned one regularly used nesting site but beyond 1km from the Proposed Development (further details are provided in Section 6.1).

3.5.3 Proposed Development Survey Results

The results of the merlin surveys completed for the Proposed Development are shown in Figures A9.10 – A9.12. No merlin were recorded breeding on the Proposed Development during the 2019 and 2020. Two nests were

[31] Ewing, S.R., Rebecca, G.W., Heavisides, A., Court, I.R., Lindley, P., Ruddock, M., Cohen, S. and Eaton, M.A. (2011) Breeding Statusof Merlins *Falco columbarius* in the UK in 2008, Bird Study, 58:4, 379-389

[32] Rebecca, G. and Bainbridge, I. (1998) The Breeding Status of the Merlin *Falco columbarius* in Britain 1993-1994. Bird Study 45:172-187

recorded within the 2km buffer of the site but at significantly lower altitude in Glen Cassley, and therefore well away from the Proposed Development. The nest furthest north was located in a gully [redacted]. The outcome of the breeding attempts were not confirmed at this nest. The second nest was located further south-west down Glen Cassley [redacted]. This general area supported an occupied nest in the 2019 and 2020 breeding season. The 2019 breeding attempt failed but the 2020 success was categorised as successful after there was a sighting of three juveniles with the adult pair.

Flight activity, particularly within the Proposed Development, remained relatively low throughout 2018-20. Collision risk modelling was not merited therefore, given the lack of 'at risk' flights recorded, and collision risk for this species was negligible.

3.6 Osprey

3.6.1 Desk Study Data

Osprey is listed Annex I of the EU Birds Directive and Amber-listed BoCC due to status as a rare breeding bird in the UK (less than 300 pairs).

The latest estimate of the UK breeding population of osprey is 240 pairs[10], based on the five year mean of the totals reported by the Rare Breeding Bird Panel (2013-17). This is, however, believed to be an underestimate with the population believed to be still increasing. Changes in distribution between the most recent Bird Atlas (2007-11) and the previous atlas (1968-72) also show significant expansion into Caithness and Sutherland. The population estimate for the Peatlands of Caithness and Sutherland Natural Heritage Zone (Zone 5, of which the SPA constitutes 28% of the area) is estimated at 8 pairs (range 6 to 9) In June 2013 NatureScot provided a figure in its cumulative spreadsheet of 36 individual birds for the NHZ5 area which Achany Extension falls within,dated as June 2009.

3.6.2 Results of Data Collection

No pairs of ospreys were recorded nesting within 2km of the Proposed Development in April 2010 to March 2012 during the surveys for the Glencassley ES (SSE 2012). The surveys did record osprey flying across the site on an average of five occasions during each year of ornithological surveys. The RSPB returned no recent records of osprey from within 6km of the site, however, it did return a historic record from 2004 of pair over 6km [redacted] of the site. The HRSG data search returned regular used nesting but beyond 2km from the Proposed Development (further details are provided in Section 6.1).

3.6.3 Proposed Development Osprey Survey Results

The results of the osprey surveys completed for the Proposed Development are shown in Figures A9.13 and A9.14. Osprey activity was very low in 2019 with one incidental flight being recorded. In 2020, flight activity was greater, with a particular concentration of incidental flights recorded approximately 3km [redacted] from the Proposed Development. This activity was predominantly associated with an occupied nest identified [redacted]. Flight behaviour observed was of adults provisioning the nest with fish, territorial dispute with another osprey and a juvenile observed in flight with the two adults. Osprey activity over the site remained low however, with only two VP flights recorded within the Proposed Development and collision risk modelling therefore not merited.

3.7 Peregrine

3.7.1 Desk Study Data

Peregrine are an Annex 1 and Schedule 1 species. From comparisons of the two most recent national peregrine surveys in 2002[33] and 2014[34], numbers of breeding territories have increased 22% throughout the UK but

[33] Banks, A.N., Crick, H.Q.P., Coombes, R., Benn, S., Ratcliffe. D.A., & Humphreys, E.M. (2010) The Breeding Status of PeregrineFalcons *Falco peregrines* in the UK and Isle of Man in 2002. Bird Study 57: 421-436

[34] Wilson, M. W., Balmer, D. E., Jones, K. , King, V. A., Raw, D., Rollie, C. Rooney, J., E., Ruddock, M. Smith, G.D., Stevenson A., Stirling-Aird, P. K., Wernham, C. V., Weston, J. M. and Noble, D. G. (2018) The Breeding Population of Peregrine Falcon *Falco peregrinus* in the United Kingdom, Isle of Man and Channel Islands in 2014'. Bird Study, 65:1, 1-19

declined in Scotland by 8%. The decrease,particularly widespread in upland areas, is considered to be from a combination of illegal persecution and decrease in food supply. This helps account for the 22% decline in the Highland region, where estimate number of territorial pairs decreased from 117 in 2002 to 91 in 2017. The population estimate for the Peatlands of Caithness and Sutherland NHZ is estimated at 15 pairs.

The nearest SPA with peregrine qualifying interest is the North Caithness Cliffs, a distance of roughly 67km from the main site and therefore well beyond connectivity range of this species (NatureScot 2016).

3.7.2 Results of Data Collection

The RSPB and HRSG data searches returned no records of peregrine within 6km of the site. No pairs of peregrines were recorded nesting within the study area over the April 2010 to March 2012 surveys for the Glencassley wind farm (SSE 2012). Peregrines were seldom seen from VPs and were recorded flying across the site only five times during two years of ornithological surveys, twice during the 2011 breeding season, once during the 2010 to 2011 winter and twice during 2011 to 2012 winter (SSE 2012).

3.7.3 Proposed Development Peregrine Survey Results

The results of the peregrine falcon surveys completed for the Proposed Development are shown in Figure A9.15. Given the absence of suitable nesting habitat, there was no evidence of peregrine breeding within the survey area in either 2019 or 2020 or within 2km. In keeping with previous survey results, peregrine were only recorded rarely, with just one VP flight in 2020.

3.8 Red Kite

3.8.1 Desk Study Data

The European breeding population of red kite is estimated to be up to 25,000 birds[35]. The UK population was nearly extinct by the 1930s, however reintroduction schemes have caused the population to increase to around 1,800 pairs[36]. Reintroduction into Scotland began in 1989 at four different sites. In 2013 a population census of Scottish red kites found 244 breeding pairs which was the highest number since monitoring began[37].

3.8.2 Results of Data Collection

The RSPB and HRSG data searches returned no records of red kite within 6km of the site. No pairs of red kite were recorded nesting within the study area in April 2010 to March 2012 or within 2km of the Proposed Development. No red kites were recorded flying within the site either, but a single bird was recorded flying across the study area once during two years of ornithological surveys (SSE 2012).

3.8.3 Proposed Development Red Kite Survey Results

No breeding red kite were recorded at the site or within 2km. Red kite flight activity was rare at Proposed Development with only one flight being recorded in 2020 as shown in Figure A9.16.

[35] BirdLife International (2013). *Milvus milvus*. IUCN Red List of Threatened Species

[36] Stevens, M., Murn, C., and Hennessey, R. (2020) Population Change of Red Kites *Milvus milvus* in Central Southern England between 2011 and 2016 Derived from Line Transect Surveys and Multiple Covariate Distance Sampling. Acta Ornithologica, 54(2), 243-254,

[37] Challis, A., Holling, M., Stevenson, A., Roos, S., Stirling-Aird, P., Wilson, M. (2014). Scottish Raptor Monitoring Scheme Report 2013. BTO Scotland/SRMS, Stirling

3.9 Short-eared owl

3.9.1 Desk Study Data

The estimated short-eared owl breeding population in Great Britain is estimated to be between 620-2,200 breeding pairs[38]. There are no BTO population trends published for this species.

The population of the Caithness and Sutherland Peatlands SPA is estimated to be 30 pairs, derived in surveys from the 1990s. In terms of the Peatlands of Caithness and Sutherland Natural Heritage Zone (Zone 5, of which the SPA constitutes 28% of the area) the published NHZ population is an estimated 55 pairs (95% confidence limits18-98 pairs).

3.9.2 Results of Data Collection

The data searches carried out from RSPB and the HRSG to 6km of the Site boundary returned no records of this species within the last 10 years. Field survey work carried out from April 2010 to March 2012 to inform the previous Glencassley Wind Farm ES identified no evidence of this species breeding within 2km of the Proposed Development, and no flight activity was recorded over the two years of survey (SSE 2012).

3.9.3 Proposed Development Short-eared Owl Survey Results

Field survey results from September 2018 to August 2020 corroborate previous results, confirming no occupied territories within 2km of the Proposed Development and no flights recorded.

3.10 White-tailed Eagle

3.10.1 Desk Study Data

White-tailed eagle is an Annex I species under the Birds Directive and Amber-listed BoCC due to its status as a rare breeding bird in the UK (less than 300 pairs). White-tailed eagle are not a SPA-qualifying species but are protected, as are its nest sites out of the breeding season.

White-tailed eagle became extinct in the UK in 1918 due to human persecution but has been reintroduced in two phases, back to the UK, first in western Scotland (1975-85 and 1993-98) and more recently in eastern Scotland (2007-12). Other re-introductions have occurred elsewhere in England. In Scotland, the west coast remains the stronghold and the species is expanding its range. If not limited by continued persecution it is anticipated that the breeding success and rate of range expansion will improve as the demography of the population changes to comprise a higher proportion of wild-bred and older individuals[39].

There has been no designated national survey for this species, although annual population monitoring is near-complete for the UK population (primarily undertaken by contributors to the Scottish Raptor Monitoring Scheme). The UK population (as of 2016) was recorded as 65 confirmed pairs, and up to 104 pairs when possible/probable territories are included.

The population estimate for the Peatlands of Caithness and Sutherland Natural Heritage Zone (of which the SPA constitutes 28% of the area) is one pair (based on surveys during 2013, believed to be comprehensive)[25]. In 2019, four pairs were believed to be within the Highland Raptor Study Group area (Scottish Raptor Monitoring Scheme – unpublished data) with three pairs reported in 2018 (Challis *et al.* 2018)[38].

3.10.2 Results of Data Collection

As reported in SSE (2012), no pairs of white-tailed eagles were recorded nesting within the study area between April 2010 to March 2012. White-tailed eagles were recorded flying across the site only once during two years of

[38] Burns F, Eaton M, Balmer D., Banks A, Caldow R, Donelan J., Douse A, Duigan C, Foster S, Frost T, Grice .P, Hall C, Hanmer H., Harris S., Johnstone I, Lindley P, McCulloch N, Noble D., Risely K, Robinson R. and Wotton S (2020) The State of the UK's birds 2020. The RSPB, BTO, WWT, DAERA, JNCC, NatureScot, NE and NRW, Sandy, Bedfordshire.

[39] Evans, R.J., Wilson, J.D., Amar, A., Douse, A., Maclennan, A., Ratcliffe, N. and Whitfield, D.P. (2009) Growth and Demography of a Re-introduced Population of White-tailed Eagle *Haliaeetus albacilla*. Ibis 151: 244-254

ornithological survey. Winter surveys of potential roost sites were conducted and none were found within 6km of the proposed Glencassley wind farm (SSE 2012). The RSPB data search returned no records of white-tailed eagle within 6km of the proposed development. The data from the HRSG confirmed no nesting within 2km of the Proposed Development, although a sub-adult pair were associated with an osprey nest beyond this distance in 2020, and successful breeding reported in early 2021. (Further details are provided in Section 6.1).

3.10.3 Proposed Development White-tailed Eagle Survey Results

The results of the white-tailed eagle surveys completed for the Proposed Development are shown in Figures A9.17 – A9.19. White-tailed eagle were scarcely recorded within the study area in 2019 and 2020. A total of twelve flights were recorded during the 2019 and 2020 surveys. Of these, seven were recorded over the September 2018 to March 2019 period, with only one of these over the Proposed Development and 'at risk', skirting its northern edge. The one flight recorded in the 2019 breeding season was to the north-west of the Proposed Development. Of the three VP flights recorded in the 2019/2020 non-breeding season, one crossed the proposed turbine array (the only flight to do so out the twelve VP flights recorded). Due to a lack of 'at risk' flight activity over any season therefore, collision risk modelling was not performed for white-tailed eagle. Breeding raptor surveys found no white-tailed eagle nests and no winter roosts within 2km of the Proposed Development. A sub-adult pair were present in 2020 beyond this distance, and the HRSG report successful nesting in 2021, with a single chick raised (as of April 2021). Further details are provided in Section 6.1.

3.11 Curlew

3.11.1 Desk Study Data

Curlew are a Red-listed BoCC, primarily due to their declining breeding population. The UK breeding population was most recently estimated to be 66,000 pairs[10]. This number has a long term decline of 64% and a ten year decline of 13%. The Peatlands of Caithness and Sutherland NHZ population of curlew stands at 1,737 breeding pairs. Curlew are also designated on the Caithness and Sutherland Peatland Ramsar designation which underpins the SPA designation. The Ramsar estimated population is 517 breeding pairs.

3.11.2 Results of Data Collection

The RSPB data search returned no records of curlew from within 2km of the site. However, during the April 2010-March 2012 surveys a single pair of curlew nested in the study area just to the north of Loch Langwell. Curlews were recorded only once in the proposed 2012 Glencassley Wind Farm site during ornithological surveys (on the edge of the Proposed Development over Dubh Loch Mòr) (SSE 2012).

3.11.3 Proposed Development Curlew Survey Results

No curlew were recorded breeding within the site. However, in 2020 two curlew territories were recorded within the survey buffer area and are shown in Figure 9.20. One of these territories was recorded on the red line boundary of the site in the south-east, close to the proposed access track, but the other was outside to the north-west and over 1km from the Proposed Development. No curlew flights across the site were recorded during vantage point surveys at the site.

3.12 Dunlin

3.12.1 Desk Study Data

As reported in Wilson *et al.* (2015)[15,] Musgrove *et al.* (2013)[9] take their estimate of 8,000 - 10,000 pairs of dunlin from Forrester *et al.* (2007)[4] who in turn, derived this from various regional studies. Forrester *et al.* (2007) acknowledge the 8,000 – 10,000 figure is likely to be an under-estimate. This is born out the abundance estimate of 13,871 dunlin pairs for Scotland by Wilson *et al.* (2015)[15] which as these authors note, may also be too low as many multi-species surveys that are not focussed on finding nests underestimate numbers of breeding dunlin.

The potential underestimate of population estimates may be counter-balanced to an extent however, by the fact that, breeding dunlin populations have declined recently in several regions of Scotland (Forrester *et al.* 2007[8]). The RSPB's Repeat Upland Bird Survey, which resurveyed nine study areas in 2000 and 2002, that

were first surveyed between 1980 and 1991, found widespread population declines of dunlin (Sim *et al.,* 2005[40]). These were large enough to suggest a population decline of at least 50% over the last 25 years.

Regional studies have also demonstrated declines. In the Flow Country, numbers of dunlin were estimatedto have fallen by 17% due to the afforestation that has occurred there since 1945 (Ratcliffe and Oswald 1988), and numbers have continued to decline following the cessation of active afforestation in the area. Whitfield (1997)[41] found that numbers fell on five of 12 sites in Caithness and Sutherland surveyed in the period between 1979 and 1987, and in 1993-94, and the overall numbers fell by 2.4% per year.

A previous estimate of 2,627 breeding dunlin pairs for NHZ 5 was based on intensive stratified sampling (Bellamy and Eaton 2009[49]). The NHZ estimate produced by Wilson *et al.* (2015)[15] is 2,196 breeding pairs (671-3,722) but as they explain, this species is difficult to survey, and poor understanding of dunlin abundance is underscored by the very large confidence intervals around most of the estimates produced.

The SPA population represents an estimated 1,860 pairs, equivalent to at least 16.9% of the breeding Baltic/UK/Ireland population (Count as of 1994[5]). This is equivalent to an average density of 1.3 pairs perkm^2 in the SPA. Although trends are not available, the SPA population is in Favourable Maintained condition.

3.12.2 Results of Data Collection

RSPB data for the site did not return any historic records for the species using the site for nesting, feeding or rearing young. However, previous surveys have shown that dunlin regularly hold territories for nesting, feeding or chick-rearing within and adjacent the Proposed Development. Eight pairs of dunlin were recorded at the site and site buffer during the 2010 survey and 7 pairs were recorded during the 2011 surveys. One territory was within the site in 2010 and 2 were within the site in 2011 (SSE 2012).

3.12.3 Proposed Development Dunlin Survey Results

The results of the dunlin surveys completed for the Proposed Development are shown in Figures A9.21 – A9.22. The surveys confirmed there were breeding dunlin within the main site in both 2019 and 2020. This was consistent with previous years. Including the area within 500m of the Proposed Development, 12 territories were recorded in 2019, five of which are within the Proposed Development. Eight territories were present in this area in 2020, one of which was within the Proposed Development. A total of 27 dunlin flights were recorded during surveys which is enough flight activity to merit carrying out collision risk modelling.

3.13 Golden Plover

3.13.1 Desk Study Data

Golden plover is listed on Annex I of the EU Birds Directive and Green-listed on the BoCC.

Massimino *et al.* (2011)[42] produced a national estimate of golden plover, with predicted values giving 37,475 pairs. This is in line with the 95% C.I. of 27,468–42,647, generated by applying the Atlas-derived Scottish proportion of the GB population to the GB estimate for golden plover given by Musgrove *et al.* (2013)[9].

Woodward *et a*l (2020)[6] produced an estimate of golden plover for the UK, with predicted values giving the range of between 32,500 – 50,500 pairs. Evidence does suggest population declines and range contraction over past decades (Bright *et al.* 2006[43]).

[40] Sim, I. M. W., Gregory, R. D., Hancock, M. H. and Brown, A. F. (2005) Recent Changes in the Abundance of British Upland Breeding Birds. Bird Study 52: 261-275

[41] Whitfield, P. (1997) Waders (Charadrii) on Scotland's Blanket Bogs: Recent Changes in Numbers of Breeding Birds. In: Conserving Peatlands (Eds. L. Parkyn, R. Stoneman and H. Ingram). pp.103-111.CAP International, Wallingford

[42] Massimino, D., Johnston, A., Pearce-Higgins, J.W. (2011) Producing Regional Population Estimates for Upland Wader. BTOResearch Report 58. BTO, Thetford

[43] Bright, J., Langston, R., Bullman, R., Evans, R., Gardner, S., Pearce-Higgins, J. and Wilson, E. (2006) Bird Sensitivity Map to Provide Locational Guidance for Onshore Wind Farms in Scotland. RSPB. Sandy

A site-condition monitoring census in 2004, covering 19 survey plots across the constituent SSSIs forming the Caithness and Sutherland Peatlands SPA, found 254 pairs of golden plover. The current SPA citation gives a figure of 1,064 pairs (5% of the GB population) as of 1993 and 1994.

Golden plovers are known to spend much time feeding and moving between areas at night and nocturnal feeding areas may differ from the sites used by day[44]. The nocturnal feeding distribution and behaviour of golden plovers breeding within the Caithness and Sutherland Peatlands was previous unknown but SPA breeding and non-breeding adults also spend time foraging on heavily-grazed, rushy pastures just outside the designated area where the damp conditions favour high densities of leatherjacket (*tipulid* larvae) prey[45].

As reported in Wilson *et al.* (2015)[15], NHZ-specific population estimates were generated by Massimino *et al.* (2011)[44] using predictive models based on the relationship between BBS-derived densities in 2009, and a suite of habitat and other environmental explanatory variables. Also, an estimate of breeding golden plover numbers in NHZ 5, assembled as part of a study on wader populations in and around protected areas and reserves (Bellamy and Eaton 2009[49]), is 3,628 breeding pairs, which is broadly similar to the estimate of 3,125 pairs generated by the model (Massimino *et al.* 2011[44]). It is also broadly comparable with the 3,760 pairs estimated (average density of 1.43 pairs per km^2) in the Peatlands of Caithness and Sutherland by NatureScot in 1996.

3.13.2 Results of Data Collection

RSPB data for the site did not return any records for the species using the site for nesting, feeding or rearing young. Seventeen golden plover territories were recorded within the Proposed Development and buffer during the 2010 survey and 18 pairs were recorded during the 2011 surveys. Seven territories were within the site in 2010 and five were within the site in 2011 (SSE 2012).

3.13.3 Proposed Development Golden Plover Survey Results

The results of the golden plover surveys completed for the Proposed Development are shown in Figures A9.23 – A9.26. The surveys completed at the Proposed Development and its 500m buffer confirmed there were breeding in both 2019 and 2020. In the Proposed Development and its 500m buffer, 14 territories were recorded in 2019 and 10 in 2020. Flight activity was relatively limited, comprising four VP flights over September 2018 to March 2019, 22 flights in the 2019 breeding season, six flights over September 2019 to March 2020, and 17 flights in the 2019 breeding season. The number of VP flight merited collision risk modelling to be carried out.

3.14 Greenshank

3.14.1 Desk Study Data

The estimated greenshank breeding population in Great Britain is derived from Hancock *et al.* (1997)[46], at 1,100 breeding pairs (95% confidence limits 570-1200). The survey method used was designed as a low- cost readily repeatable approach to monitor greenshank population trends over the long term, across its UK breeding range. It has not been repeated however. Furthermore, there are no BTO population trends for greenshank (presumably because the remote locations of the greenshank population are inadequately covered by this survey for statistically meaningful data to be derived).

The results of the national survey suggest 480 pairs (44% of the UK population) in Caithness and Sutherland (based on the number of territories method), with an estimated 256 pairs of these (53%) in the Caithness and Sutherland Peatlands SPA. This figure of 256 pairs was used in the February 1999 SPA citation.

Apart from the national survey, other regional studies provide other population estimates. In 2009, a survey by RSPB/NatureScot of the Caithness and Sutherland Peatlands SPA breeding waders (Bellamy and Eaton

[44] Gillings, S., Fuller, R.J. and Sutherland, W.J. (2005) Diurnal Studies do not Predict Habitat Choice and Site Selection of European Golden-Plovers (*Pluvialis apricaria*) and Northern Lapwings (*Vanellus vanellus*). Auk 122: 1249-1260.

[45] NatureScot (1996) Habitat Requirements of Breeding Waders on Blanket Bogs, Northern Scotland. NatureScot Information and Advisory Note 53.http://www.snh.org.uk/publications/on-line/advisorynotes/53/53.pdf.

[46] Hancock, M.H., Gibbons, D.W. and Thompson, P.S. (1997) The Status of Breeding Greenshank *Tringa nebularia* in the UnitedKingdom in 1995. Bird Study 44: 290-302

2010[49]), produced an estimate of 653 greenshank pairs (95% confidence limits 389–917). Set against the SPA population from the national survey, this was a population increase of 155% (although it is worth noting that the Bellamy and Eaton survey method differed to the Hancock *et al.* (1997[48]) national survey, so part ofthe difference may result from that). Even taking this into account, given such an increase the most recent site condition monitoring for the Caithness and Sutherland Peatlands SPA (30/06/2015) concluded a condition of Favourable-Maintained for the SPA feature greenshank.

In terms of the Peatlands of Caithness and Sutherland Natural Heritage Zone (Zone 5, of which the SPA constitutes 28% of the area) the published NHZ population is an estimated 421 pairs (95% confidence limits 273-587 pairs)[15]. This estimate is based on the national survey results, adjusted for any known population trends and apportioned to Bird Atlas data for relative abundance. The 2009 SPA survey however, estimated that the NHZ greenshank population to be much higher, at 1,052 pairs (95% confidence limits 465-1,700 pairs). Although there is a small overlap with the lower confidence limits, the 2009 surveys estimate a far larger population than the NHZ modelling. The authors make no conclusion as to whether the 2009 figure is an over-estimate, or the other methods have underestimated the greenshank population.

If using the Bellamy and Eaton (2010)[47] estimate of 653 pairs, the Caithness and Sutherland SPA, in combination with the only other SPA for greenshank (Lewis Peatlands; 171 pairs) collectively support 74.9%of the UK population (estimate of 1,100 pairs). As such a high proportion of the UK population is localised within just two sites, greenshank are Amber-listed Birds of Conservation Concern.

3.14.2 Results of Data Collection

RSPB data for the site did not return any historic records for the species using the site for nesting, feeding or rearing young. No pairs of greenshank bred within the previously proposed Glencassley Wind Farm site in 2010 or 2011 (SSE 2012).

3.14.3 Proposed Development Greenshank Survey Results

The results of the greenshank surveys completed for the Proposed Development are shown Figures A9.27 – A9.28. Five territories were recorded in 2019 and one in 2020 within the Proposed Development and its 500m buffer. Flight activity was relatively limited in both years, with 18 and10 flights recorded in 2019 and 2020 respectively. There were more than three flights in the PCZ each year, meriting collision risk modelling.

3.15 Wood Sandpiper

3.15.1 Desk Study Data

Wood sandpiper are an Amber-listed BoCC, primarily due to their small UK breeding population, most recently estimated to be 30 pairs[10]. This number has a long-term increase of 632% and a 10 year increase of 89%. There is no specific estimate for the wood sandpiper population of the Peatlands of Caithness and Sutherland NHZ. The Caithness and Sutherland Peatlands SPA population was estimated to be five breeding pairs.

3.15.2 Results of Data Collection

The data search carried out from RSPB to 6km of the Site boundary returned no records of this SPA qualifying species within the last 10 years. The only records were from 2003 and 2004, of birds in suitable breeding habitat (the dates of observations were not included), one of which was within 1km of the Proposed Development.

Field survey work carried out from April 2010 to March 2012 to inform the previous Glencassley Wind Farm ES included specifically targeted surveys but no sightings of wood sandpiper were made in the study area during two years of ornithological surveys (SSE 2012).

[47] Bellamy, P. E., and Eaton, M. A. 2010. 2009 SCM Bird Monitoring of Caithness and Sutherland Peatlands SPA. Unpublished Reportto NatureScot

3.15.3 Proposed Development Wood Sandpiper Survey Results

No observations of wood sandpiper were made during the two further to years of field survey from 2018 to 2020.

3.16 Greylag Goose

3.16.1 Desk Study Data

The Caithness and Sutherland Peatlands Ramsar site is predominantly coincidental in extent with the SPA boundary and qualifies under Criterion 3c by supporting internationally important breeding populations of Northwest Scottish greylag goose (30 pairs, 5% of total world population).

Recently both the northwest Scotland population and more southern breeding populations have increased greatly in number and range. In some parts of Scotland, the populations overlap and are therefore indistinguishable. As a consequence, since 2010 greylag geese breeding throughout Britain have been treated as one population (Mitchell *et al.* 2012[48]), with the current population considered to be 140,000 pairs,and in favourable condition[49].

Greylag geese breeding in the UK were largely regarded as sedentary, with ringed recoveries in the Uists showing dispersal of up to 30km[50]. Birds from the native breeding population in Sutherland move up to 50km towards the coastal plains of north and southeast Sutherland, and low-lying parts of central Caithness during the non-breeding season, returning to inland straths from mid-February. Most birds moult close to the breeding areas, although large numbers of non-breeders are known to gather to moult and small gatherings may occur in remote upland areas.

3.16.2 Results of Data Collection

The RSPB data search returned no records of greylag goose at the Proposed Development. Relatively low numbers of greylag geese flights were recorded within the site's airspace during the April 2010 to March 2012 surveys and these were insufficient to carry out collision risk modelling. No geese flight lines were obtained from dawn and dusk surveys. This indicated a lack of important roost sites in the vicinity of the study area (SSE 2012).

3.16.3 Proposed Development Greylag Geese Survey Results

The results of the greylag goose surveys completed for the Proposed Development are shown in Figures A9.29 – A9.31. No breeding greylag geese were recorded on site or within 1km. Flight activity over the Site was negligible in both the 2019 and 2020 breeding seasons, limited to one flight (not 'at risk') over the Proposed Development in 2019 and one 'at risk' flight in 2020. No flights were recorded during the 2018/2019 winter season, and a total of three flights were recorded over the 2019/2020 winter season over the Proposed Development. Due to a lack of flight activity potential collision risk modelling was not merited.

3.17 Pink-footed goose

3.17.1 Desk Study Data

Despite population growth, pink-footed geese are an Amber-listed BoCC, primarily due to high localisationof the wintering population in the UK.

The European breeding population of pink-footed geese is estimated at 57,000-74,000 pairs, which equates to 114,000-148,000 mature individuals[51], out of a flyway population estimated at 540,000 individuals, with the

[48] Mitchell, C., Hearn R. and Stroud, D. (2012) The Merging of Populations of Greylag Geese Breeding in Britain. British Birds 105: 498-505

[49] http://monitoring.wwt.org.uk/species.php?url=research/monitoring/species.asp (last accessed 30/03/20)

[50] Wernham, C.V., Thoms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M., and Baillie, S.R. (eds.) (2002) The Migration Atlas: Movements of the Birds of Britain and Ireland. T. and A.D. Poyser, London

[51] BirdLife International. (2020) Species factsheet: *Anser brachyrhynchus*. Downloaded from http://www.birdlife.org on 06/05/2020

wintering population estimated at 510,000 individuals in Great Britain[52]. The count of 540,000 wintering birds is the average British count for October 2015 and 2016; earlier data are not used because pink-footed geese have undergone a rapid population increase.

Almost the entire breeding population of Icelandic pink-footed goose winter in Great Britain and Ireland. Population change of UK wintering Icelandic geese is well understood due to the annual Icelandic grey goose census, which is a coordinated effort to count migrating geese in the UK, Ireland and Southwest Norway. The 2017 count recorded a maximum of 515,852 pink-footed geese[53], an increase of 43.29% from the estimated count of 360,000 individuals in 2009[54]. Based on the Icelandic goose count data, the State of the UK's Birds (2017) reports that the population has shown 25 year trend of +120% (1989/90-2014/15) and a ten year trend of +51% (2004/05-2014/15). The population estimate for the Peatlands of Caithness and Sutherland NHZ is estimated at 2,070 birds(based on Wetland Bird Survey counts).

The nearest SPA with pink-footed goose as a qualifying species (Moray and Nairn Coast) is over 71km fromthe site, therefore well beyond any connectivity distance (NatureScot 2016).

3.17.2 Results of Data Collection

The RSPB data search returned no records of pink-footed goose from within 6km of the site. Pink-footed geese are predominantly a migrant species in the Highlands, passing through the area in autumn and spring. Over 2010 to 2012, occasional flights were recorded across the study area airspace in each of the two years monitored. There were insufficient flight lines across the site to carry out collision risk modelling. Most other pink-footed goose sightings were skeins recorded either outside the survey area, adjacent to and parallel with Loch Shin or the River Cassley, or flying high, well over the study area (SSE 2012).

3.17.3 Proposed Development Pink-footed Geese Survey Results

The results of the pink-footed goose surveys completed for the Proposed Development are shown in Figures A9.32 – A9.35. Pink-footed goose flight activity was infrequently recorded. There were three VP flights recorded crossing the site in the 2018/2019 non-breeding season, one in the 2019 breeding season, three in the 2019/2020 non-breeding season and none in the 2020 breeding season, Of all these flights, only one in each period was at collision risk. Given the limited number of 'at risk' flights, collision risk modelling was not merited.

3.18 Teal

3.18.1 Desk Study Data

Teal are an Amber-listed BoCC. The UK breeding population was most recently estimated to be 2,100 pairs[55]. This number has a 10-year increase of 55%. The Peatlands of Caithness and Sutherland NHZ population of teal is unassessed.

3.18.2 Results of Data Collection

The RSPB data search returned no records of teal from within 6km of the site. However, during the Glencassley ES 2010-11 surveys (SSE 2012), teal were noted as breeding in the study area in low numbers, although no further details were provided on numbers or locations.

[52] Frost, T., Austin, G., Hearn, R., McAvoy, S. Robinson, A., Stroud, D., Woodward, I., and Wotton, S. (2019) Population Estimates of Wintering Waterbirds in Great Britain' British Birds, 112: 130-145.

[53] Mitchell, C. and Brides, K. (2017) Status and Distribution of Icelandic-breeding Geese: Results of the 2016 International Census.Wildfowl & Wetlands Trust Report, Slimbridge

[54] Mitchell, C. (2010) Status and Distribution of Icelandic-breeding Geese: Results of the 2009 international Census. Wildfowl &Wetlands Trust Report, Slimbridge

[55] RSPB (2021) Teal: Available from: Teal Duck Facts | Anas Crecca - The RSPB

3.18.3 Proposed Development Teal Survey Results

The results of the teal surveys completed for the Proposed Development are shown in Figure A9.36. A female teal with six chicks was recorded on Loch Sheila in July 2020. No previous signs of breeding behaviour by the species was recorded at the site so it is unclear if the species bred on the site or migrated to the site to rear chicks. No teal flights were recorded during vantage point surveys at the Proposed Development although two incidental flights were recorded in Glen Cassley.

3.19 Whooper Swan

3.19.1 Desk Study Data

Whooper swan is listed on Annex I of the EU Birds Directive and an Amber-listed BoCC, primarily due to high localisation of the wintering population in the UK, with the majority of the population restricted to Important Bird Areas.

The European population is estimated at 25,300-32,800 pairs, with the estimated Great Britain wintering population being 16,100[56]. The population estimate for the Peatlands of Caithness and Sutherland Natural Heritage Zone (Zone 5, of which the SPA constitutes 28% of the area) is estimated at 190 birds (based on Wetland Bird Survey counts).

3.19.2 Results of Data Collection

The RSPB data search returned no records of whooper swan. Whooper swans were a rare winter visitor to the study area in April 2010 to March 2012 and were very occasionally recorded flying across the study area. There were only two flight lines recorded across the site in two years of ornithological surveys for the Glencassley ES (SSE 2012).

3.19.3 Proposed Development Whooper Swan Survey Results

The whooper swan records from surveys completed for the Proposed Development are shown in Figures A9.37 – A9.39. Whooper swan were also a rare scare winter visitor to the study area in 2019 and 2020. A total of four whooper swan flights were recorded, although only the latter crossed into the PCZ. A further single flight outside of the survey area was recorded during the 2019 breeding season. Due to a lack of flight activity potential collision risk modelling was not merited.

3.20 Wigeon

3.20.1 Desk Study Data

The UK breeding population is estimated to be 200 pairs, with the estimated Great Britain wintering population being 45,000. The breeding population estimate for the Peatlands of Caithness and Sutherland Natural Heritage Zone has not been estimated however, the breeding population of the Caithness and Sutherland Peatlands SPA is estimated to be 43 pairs[5].

3.20.2 Results of Data Collection

The data search carried out from RSPB to 6km of the Proposed Development returned no records of this species within the last 10 years.

Field survey work carried out from April 2010 to March 2012 to inform the previous Glencassley Wind Farm ES identified no evidence of this species breeding within 2km of the Proposed Development, and no flight activity was recorded over two years of survey (SSE 2012).

[56] Data from Wildfowl and Wetlands Trust species accounts: https://monitoring.wwt.org.uk/our-work/goose-swan-monitoring-programme/species-accounts/ (accessed 30/03/2021).

3.20.3 Proposed Development Wigeon Swan Survey Results

Field survey results from September 2018 to August 2020 corroborate previous results, confirming no nesting within 2km of the Proposed Development and no flights recorded.

3.21 Black Grouse

3.21.1 Desk Study Data

Black grouse are a Red-listed BoCC, primarily due to their small localised breeding population. The European breeding population of black grouse is estimated to be up to 1.8 million birds[57]. The UK population was most recently estimated to be 6,510 lekking males in 1995/96 [58]. The Scottish populations was estimated to be 3,314 lekking males and is believed to be in decline.

3.21.2 Results of Data Collection

The most recent records of black grouse from the RSPB data search were from 2009. These records are from [redacted]t approximately 5km [redacted] of the Proposed Development.

Black grouse is a resident species in the Highlands and therefore present all year round. Coordinated and targeted lek (communal display arena) surveys were made within the study area in 2010 or 2011. No lekking males or female black grouse nested within the site and a 1km buffer in either year. The maximum count of black grouse at leks in the study area was 17 birds (all males) in April 2010 and 24 birds (22 males and 2 females) in April 2011.

3.21.3 Proposed Development Black Grouse Survey Results

Field survey results from September 2018 to August 2020 recorded no flight activity over the Proposed Development in either year and there were no leks within 1km of the Proposed Development. Lekking males were recorded in Glen Cassley, shown in Figures A9.39-A9.40. Given the absence of at risk flights, no collision risk modelling was carried out.

[57] Black Grouse UK. (2020) Black grouse UK - Published in support of the UK Biodiversity Action Plan for Black Grouse; [accessed 30/03/2021]

[58] Hancock, M., Baines, D., Gibbons, D., Etheridge, B. [redacted] Shepherd, M. 1999. Status of Male Black Grouse *Tetrao tetrix* in Britain in 1995-96. *Bird Study* 46: 1-15

4 FLIGHT ACTIVITY INFORMATION AND COLLISION RISK MODELLING

4.1 Flight Activity (Vantage Point) Surveys

4.1.1 Survey Methodology

In total, flight activity (VP) surveys were conducted between September 2018 and August 2020 . In March 2019, as highlighted, the Proposed Development location moved south-east, at which point new VPs were selected to cover the revised potential developable area (see **Chapter 9** Figure 9.7). The resulting flight activity surveys then covered two breeding seasons (2019 and 2020), and the intervening non-breeding season (September 2019 to March 2020).

Seven VPs were used to provide effective coverage of the Proposed Development (Table 4-1) (see **Chapter 9** Figure 9.7). Through these VP locations, the Proposed Development's rotor swept airspace has been assessed, using 2km viewsheds.

Table 4-1. Details of March 2019 to August 2020 Vantage Point Locations

VP	Easting	Northing	View Bearing
1	245883	907123	50°
2	248578	905147	310°
3	245154	909771	0°
4	244377	912594	225°
5	245322	909529	50°
6	247362	909773	225°
7	247782	906974	135°

As highlighted in **Chapter 9** (paragraph 9.5.19), the particular topography of the Proposed Development and its surroundings constrained the location of VPs to a substantial degree. The Proposed Development straddles the intersected ridge of an escarpment, the slope of which drops very steeply down to Glen Cassley to the west. To the east, slopes also drop into a basin, before descending more steeply down to Loch Shin.

NatureScot's guidance notes that 'It is important to minimise the observer's effect on bird behaviour so VPs are best located outside the survey area, where possible' (emphasis added). As NatureScot's guidance does also note however, there are other measures that can be taken to minimise observers' effects on birds.

Therefore, taking account of NatureScot's other stipulations, VP 3 and 5 were located within the site to secure coverage of the northern part of the Proposed Development (see **Chapter 9,** Figure 9.7 a to d). These were selected, taking into account paragraphs 3.8.1 to 3.8.4 of NatureScot's (2017[2]) guidance, in particular. Firstly, in order minimise the risk of the surveyor's presence influencing flight activity, VPs were also located away from sensitive sites for target species, i.e. away from nest, roost or lek sites. The field surveyors used were also highly experienced professional ornithologists, with strong field craft skills that helped ensure they were inconspicuous during the VP duration. Surveyors positioned themselves as inconspicuously as possible to minimise their effects on the birds' natural behaviour.

VPs were also located as close to the survey area as possible, as detection of flight activity decreases with distance. In relation to this feature, it is also notable that whilst the guidance highlights that the survey area (viewshed) 'should extend to 500m beyond the outermost proposed turbines to deal with inaccuracies of position for flight line observations' it is reasonable to assume, that where VPs are closer to turbines, the accuracy of flight mapping increases, and so the need for a 500m buffer diminishes. This is particularly the case where there are distinct landscape features that surveyors can use to relate bird flight paths to, helping to further increase the positional accuracy of flight recording. Therefore, maintaining the 500m buffer around turbines is not a uniform requirement to ensure precautionary measurement of flight activity. VPs were also chosen to achieve maximum visibility with the minimum number of points.

As noted in the guidance (NatureScot, 2017[2]) 'Being able to view all or most of the site to ground level can be helpful in gauging overall bird activity and usage of the site but is not as important as being able to view the collision risk volume'. All VPs were selected to ensure visibility of rotor swept volume of all turbines, as a minimum.

Each flight activity survey was undertaken by a single observer in conditions of good visibility, and effort was spread evenly throughout the survey period.

During each flight activity survey, the landscape within an 180˚ arc from the VP was continuously scanned until a target species was detected. Once detected, the focal bird was observed until it landed or flew out of sight. The time of first detection was noted, and its flight height band was recorded for each 15 second period that the bird was in view.

Surveys generally lasted three hours, which corresponds with NatureScot (2017[12]) guidance.

The paths of all observed flights were drawn as accurately as possible onto 1:10 000 scale maps in the field. Flight lines of target species were then digitised and compiled onto a GIS, while the associated flight duration and height data were entered into a linked Microsoft Access database. These details were then fed into the collision risk modelling process.

Through the combination of the above, comprehensive flight activity survey data were collected for the Proposed Development, sufficient to robustly feed into collision risk modelling.

4.1.2 Flight Height Recording

Flights were recorded and assigned to height bands, to identify flights that where below, at or above potential collision risk height. The height bands used are shown in Table 4-2.

Table 4-2. Flight Height Bands

Height Band	Height Above Ground (m)
1	0-20
2	20-40
3	40-100
4	100-150
5	150-250
6	>250

4.1.3 Flight Activity Survey Effort

Standard flight activity VPs were carried out over 2019 and 2020, with the monthly coverage shown in Table 4-4, Table 4-5, Table 4-5 and Table 4-6.

Table 4-3. VP Survey Effort in the 2018-19 Non-breeding Season

	Survey Effort (hrs)							
VP	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	06:00	00:00	00:00	00:00	00:00	00:00	03:00	09:00
2	06:00	00:00	00:00	00:00	00:00	00:00	03:00	09:00
3	03:00	00:00	00:00	00:00	00:00	00:00	03:00	06:00
4	06:00	06:00	06:00	06:00	00:00	12:00	09:00	45:00
5	03:00	06:00	06:00	06:00	00:00	12:00	09:00	42:00
6	03:00	00:00	00:00	00:00	00:00	00:00	03:00	06:00
7	03:00	06:00	06:00	06:00	06:00	06:00	09:00	42:00
8	03:00	00:00	00:00	00:00	00:00	00:00	00:00	03:00
9	03:00	06:00	06:00	06:00	06:00	06:00	06:00	39:00
10	06:00	06:00	00:00	00:00	00:00	00:00	00:00	12:00
11	06:00	06:00	00:00	00:00	00:00	00:00	00:00	12:00
Total	48:00	36:00	24:00	24:00	12:00	36:00	45:00	225:00

The initial mobilisation of fieldwork started with eleven vantage points but was rationalised for the proposed turbine array being considered at the time, leading to suspension of VPs 1, 2 3, 6, 8, 10, and 11 from October 2018 onwards. The flights collect from these has VPs, nevertheless, been included in Figures A9.3 to A9.40 for completeness.

Due to continued poor weather through January 2019 combined with the high altitude of the site prolonged snow cover made it inaccessible to surveyors. Therefore, survey effort for VPs 4 and 5 through January was limited but completed in February and split between early and late in the month,

Table 4-4. VP Survey Effort in the 2019 Breeding Season

	Survey Effort (hrs)					
VP	Apr	May	Jun	Jul	Aug	Total
1	09:00	09:00	09:00	09:00	09:00	45:00
2	09:00	09:00	09:00	09:00	08:00	44:00
3	09:00	08:00	09:00	09:00	09:00	44:00
4	09:00	09:00	09:00	12:00	09:00	48:00
5	09:00	09:00	09:00	09:00	09:00	45:00
6	09:00	09:00	09:00	09:00	09:00	45:00
7	09:00	09:00	09:00	09:00	09:00	45:00
Total	63:00	62:00	63:00	66:00	62:00	316:00

Table 4-5. VP Survey Effort in the 2019-2020 Non-breeding Season

	Survey Effort (hrs)							
VP	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	06:00	06:00	09:00	06:00	09:00	06:00	03:00	45:00
2	06:00	06:00	09:00	06:00	09:00	06:00	03:00	45:00
3	06:00	06:00	09:00	06:00	09:00	06:00	03:00	45:00
4	06:00	06:00	09:00	06:00	09:00	06:00	03:00	45:00
5	06:00	06:00	09:00	06:00	09:00	06:00	03:00	45:00
6	06:00	06:00	09:00	06:00	09:00	06:00	03:00	45:00
7	06:00	06:00	09:00	06:00	09:00	06:00	03:00	45:00
Total	42:00	42:00	63:00	42:00	63:00	42:00	21:00	315:00

Table 4-6. VP Survey Effort in the 2020 Breeding Season

	Survey Effort (hrs)					
VP	Apr	May	Jun	Jul	Aug	Total
1	N/A	15:00	09:00	09:00	09:00	42:00
2	N/A	15:00	09:00	09:00	09:00	42:00
3	N/A	15:00	09:00	09:00	09:00	42:00
4	N/A	15:00	09:00	09:00	09:00	42:00
5	N/A	15.00	09:00	09:00	09:00	42:00

			Survey Effort (hrs)			
6	N/A	15:00	09:00	09:00	09:00	42:00
7	N/A	15:00	09:00	09:00	09:00	42:00
Total	N/A	105.00	63:00	63:00	63:00	294:00

4.1.4 Flight Activity Survey Results

Full details of the results of the flight activity surveys can be found in Annex E, F, G and H.

4.2 Collision Risk Modelling

4.2.1 Introduction

This section contains details of the collision risk modelling (CRM) used to predict estimated bird collisions from the Proposed Development, using the methodology set out in NatureScot (2000)[59]. All CRM in this report are based on the 20-turbine layout for the Proposed Development. The CRM analysis was implemented in the Python programming language[60] and utilised ArcGIS[61] andPostgreSQL/PostGIS relational database management system[62].

4.2.2 Choice of Directional or Non-directional Models

For each target species, a collision rate was predicted for a relevant period of interest (breeding or non- breeding season). The choice of modelling method was based on the flight behaviour of a given species within the proposed wind farm area. The direction model is appropriate for species which move across the wind farm area in a particular direction. This type of flight behaviour is characteristic of species on migration or making regular movements between feeding, roosting or nesting sites. NatureScot normally advocates the use of the directional model for groups such as divers, geese, swans and ducks. A non-directional model is more appropriate where the flights of a particular species are not predominantly in any direction. This is usually the case for birds moving around within a breeding or hunting territory that is wholly or partially within the site of interest. This approach, which assumes that the direction of flights is more or less random, is usually deemed as appropriate for raptors and waders. The main difference between the directional and non- directional methods concerns whether it is more appropriate to consider:

- a two-dimensional risk area in front of a bird as it flies towards the wind farm area with the intention of continuing on through it in the same direction (directional mode); or
- within a three-dimensional risk volume as a bird flies around within the wind farm area, in no consistent direction (non-directional).

4.2.3 Determining Wind Farm Polygon for Analysis

The approach to defining the wind farm polygon was to use the area enclosed by the tips of the outermost turbine rotors (i.e. the convex hull of the extremities of turbines).

[59] NatureScot. (2000) Wind Farms and Birds: Calculating a Theoretical Collision Risk Assuming No Avoiding Action. Battleby

[60] Python.org. (2013) Python Programming Language – Official Website. (online) Available at: http://python.org/ (Accessed: 30/03/2021).

[61] ESRI. (2013) ArcGIS Mapping and Spatial Analysis for Understanding Our World. (online) Available at:http://www.esri.com/software/arcgis (Accessed: 30 March 2021).

[62] Postgresql.org. (2013) PostgreSQL: The World's Most Advanced Open Source Database. (online) Available at:http://www.postgresql.org/ (Accessed: 30 March 2021).

4.2.4 Seasons of Analysis

The numbers of collisions were estimated separately for breeding and non-breeding seasons for each species. Generic dates of these seasons are provided in Table 4-7, taken from NatureScot (2009[63]).

Table 4-7. Seasons Used in Collision Risk Analysis for Achany Extension Wind Farm

Season	Start date	End date
Raptor breeding (excl. golden eagle)	16-Mar	31-Aug
Raptor non-breeding (excl. golden eagle)	01-Sep	15-Mar
Golden eagle breeding	01-Feb	31-Aug
Golden eagle non-breeding	01-Sep	31-Jan
Diver breeding	01-April	15-Sep
Wader breeding	01-Apr	31-Jul
Greenshank breeding	14-Apr	31-Jul
Geese breeding	01-Apr	15-Aug
Geese non-breeding	16-Aug	31-Mar

4.2.5 Calculation of Effort

The zone of theoretical visibility was calculated to a maximum distance of 2km from each VP using ESRI's ArcGIS Spatial Analyst extension with Ordnance Survey's Panorama digital terrain data[64] (Ordnance Survey 2013). For each VP the area of visible extent within the wind farm polygon was multiplied by the sum of observed time to give effort in terms of time observed per unit area.

4.2.6 Selection of Flights for Inclusion

A flight selection polygon for each VP was defined as the intersection of the polygon of theoretical visibility with the wind farm polygon buffered. The flights were selected or excluded from the analysis according to the following rules:

1. flights are rejected from the analysis if they are beyond 2km from their respective VP (i.e. they are wholly outwith the 2km viewshed);
2. to be included in analysis, flights must intersect their respective flight selection polygon and be observed in a height band that overlaps with rotor height.

Four species were selected for further analysis; golden eagle, dunlin, golden plover and greenshank. Other species were not analysed due to a lack of 'at risk' flights. Fewer than three flights recorded in a season from many hours of observation indicates collision risk being negligible, and collision risk modelling from such a small sample size is unlikely to produce dependable results.

4.2.7 Time at Potential Collision Height

For each flight selected by the process above, the time observed at each height band was adjusted by multiplying by the proportion of overlap of the height band with the turbine rotors. These times were then summed to give a value of time at potential collision height (PCH) for each entire flight line (both within and outside the wind farm polygon). This value was then multiplied by the proportion of the total flight's length (distance) within the flight selection polygon to give an estimate of time at PCH within the wind farm polygon.

4.2.8 Rate of Bird Activity

Time at PCH within the wind farm polygon was summed for each species at each VP. Rate of activity interms of seconds of activity per hour of observation per km^2 was calculated by dividing by the VP's respective effort.

[63] NatureScot (2009) Bird Breeding Seaons in Scotland

[64] Ordnance Survey. (2013) Land-Form PANORAMA - small-scale height data of Great Britain. (online) Available at: http://www.ordnancesurvey.co.uk/oswebsite/products/land-form-panorama/index.html (Accessed: 30/032021)

From these values a single rate for the wind farm polygon was derived by summing the product of the rate of activity and the proportion of effort at each VP.

4.2.9 Calculation of the Number of Rotor Transits

The number of transits of the rotor was calculated following the method described in Band *et al.* (2007)[65]. The potentially active time period was assumed to be daylight hours which were calculated using the CBM model described in Forsythe *et al.* (1995[66]).

4.3 Golden Eagle

4.3.1 Survey Effort

Duration of non-breeding season flight activity surveys are provided in Table 4-8.

Table 4-8. Total Vantage Point Hours during the Golden Eagle non-breeding Season (September to January Inclusive)

Vantage Point (VP)	2018-19	2019-20
1	6:00	36:00
2	6:00	36:00
3	3:00	36:00
4	24:00	36:00
5	21:00	36:00
6	3:00	36:00
7	27:00	36:00

Duration of breeding flight activity surveys are provided in Table 4-9.

Table 4-9. Total Vantage Point Hours during the Golden Eagle Breeding Season (February to August Inclusive)

Vantage Point (VP)	2019	2020
1	48:00	51:00
2	47:00	51:00
3	47:00	51:00
4	69:00	51:00
5	66:00	51:00
6	48:00	51:00
7	60:00	51:00

4.3.2 Flight Activity and Collision Risk: Golden Eagle

Table 4-10 gives the golden eagle flight activity recorded each season and Table 4-11 predicted collision rate for golden eagle for the Proposed Development.

Table 4-10. Golden Eagle Flight Activity Each Season

Season	Number of Flights	Number of Birds	Flight Duration	Time at PCH	No. of flights (birds) within PCZ
2018-19 non-breeding season	26	26	2,490	1,650	8 (8)

[65] Band, W., Madders,M. and Whitfield, D.P. (2007) Developing Field and Analytical Methods to Assess Avian Collision Risk at WindFarms. In :de Lucas, M., Janss, G and Ferrar, M. (eds). Birds and Wind Power. Lynx Edicions, Barcelona

[66] Forsythe, W., Rykiel , E.J., Stahl, R.S., Wu, H, Schoolfield, R.M. (1995) A Model Comparison for Day Length as a Function of Latitude and Day of Year. Ecological Modelling. 80: 87 – 95.

Season	Number of Flights	Number of Birds	Flight Duration	Time at PCH	No. of flights (birds) within PCZ
2019 breeding season	24	26	3,150	2,625	10 (12)
2019-20 non-breeding season	6	6	960	885	4 (4)
2020 breeding season	10	10	1,290	990	6 (6)

Table 4-11. Predicted Golden Eagle Collision Risk from 2018 to 2020 VP Results

Collision risk modelling	2018-19 non-breeding season	2019 breeding season	2019/2020 non-breeding season	2020 breeding season	Mean (mean breeding season + non-breeding)
Golden eagle collisions per year (99% avoidance rate)	0.07	0.11	0.03	0.02	0.115
Equivalent to 1 bird every X years (99% avoidance)	14	9	36	53	8.7
Predicted number of collisions over 50 years	3	5	1	<1	6

The avoidance rate of 99% was used as recommended by NatureScot[67]. The annual collision rate (mean of the two breeding seasons plus the non-breeding season) is relatively low, predicting one collision every 9 years therefore the Proposed Development would result in up to five eagle collision over a 50-year operational lifetime**.**

The emerging evidence from Whitfield *et al.* (2019[68]) and Whitfield and Fielding (2018) (the latter provided in Annex J: see Section 2 in particular) highlights the high levels of macro-avoidance of wind farms by golden eagles. On the basis of these data, it is reasoned that current collision risk modelling (including the use of a 99% avoidance rate) is not appropriate as it gives highly over-precautionary rates of predicted collisions. On this basis, the actual collision rate from the Proposed Development is therefore predicted to be negligible, and significantly lower than 0.115 birds a year.

4.4 Waders

4.4.1 Wader Survey Effort

Flight activity survey details used for collision risk modelling for wader species are provided in Table 4-12.

Table 4-12. Total VP Hours During the Wader Breeding Season (April to July Inclusive)

Vantage Point (VP)	2019	2020
1	36.00	33.00
2	36.00	33.00
3	35.00	33.00
4	39.00	33.00
5	36.00	33.00
6	36.00	33.00
7	36.00	33.00

[67] https://www.nature.scot/doc/wind-farm-impacts-birds-use-avoidance-rates-naturescot-wind-farm-collision-risk-model (Accessed 30/03/2021)

[68] Fielding , A., Haworth, F., Benn, S., Dennis, R., Weston, E., Etheridge, B. and Whitfield, P. (2019a) Response of satellite tagged golden eagles to wind farms in Scotland. Macro-avoidance rather than risk of collision. Proceedings of the Conference on Wind Energy and Wildlife Impacts 27th-30th August, Stirling, Scotland.

4.4.2 Flight Activity and Collision Risk: Dunlin

Table 4-13 gives the dunlin flight activity recorded each season.

Table 4-13. Dunlin Flight Activity Each Season

Season	Number of Flights	Number of Birds	Flight Duration (seconds)	Time at PCH (seconds)	No. of flights (birds) within PCZ
2018-19 non-breeding season	0	0	0	0	0 (0)
2019 breeding season	8	11	285	30	3 (4)
2019-20 non-breeding season	0	0	0	0	0 (0)
2020 breeding season	19	19	360	0	0 (0)

Using the 98% avoidance rate in accordance with NatureScot[69], the mean breeding season collision rate is estimated to be one collision every 1,000 years. Therefore, the Proposed Development would result in up to <1 dunlin collision **over a 50-year operational lifetime (**Table 4-14**).**

Table 4-14. Predicted Dunlin Collision Risk from 2018 to 2020 VP Results: Proposed Development

Collision risk modelling	2018-19 non-breeding season	2019 breeding season	2019/2020 non-breeding season	2020 breeding season	Mean (mean breeding season + non-breeding)
Dunlin collisions per year (98% avoidance rate)	0.0	0.002	0.0	0.0	0.001
Equivalent to 1 bird every X years (98% avoidance)	0.0	500	0.0	0.0	1,000
Predicted number of collisions over 50 years	0.0	<1	0.0	0.0	<1

4.4.3 Flight Activity and Collision Risk: Golden Plover

Table 4-15 gives the golden plover flight activity recorded each season.

Table 4-15. Golden Plover Flight Activity Each Season

Season	Number of Flights	Number of Birds	Flight Duration (seconds)	Time at PCH (seconds)	No. of flights (birds) within PCZ
2018-19 non-breeding season	1	7	45	30	1 (7)
2019 breeding season	2	37	1,155	360	14 (19)
2019-20 non-breeding season	1	2	75	45	2 (2)
2020 breeding season	21	25	780	315	4 (5)

Using the 98% avoidance rate in accordance with NatureScot[69], the mean breeding season collision rate predicted is 0.03 birds, giving one collision every 50 years and equating to an estimated two collisions from the Proposed Development **over a 50-year operational lifetime** (Table 4-16).

Table 4-16. Predicted Golden Plover Collision Risk from 2018 to 2020 VP Results: Proposed Development

Collision risk modelling	2018-19 non-breeding season	2019 breeding season	2019/2020 non-breeding season	2020 breeding season	Mean (mean breeding season + non-breeding)
Golden Plover collisions per year (98% avoidance rate)	0.1	0.036	0.0088	0.018	0.081
Equivalent to 1 bird every X years (98% avoidance)	10	28	114	56	12

Collision risk modelling	2018-19 non-breeding season	2019 breeding season	2019/2020 non-breeding season	2020 breeding season	Mean (mean breeding season + non-breeding)
Predicted number of collisions over 50 years	5	2	<1	<1	4

4.4.4 Flight Activity and Collision Risk: Greenshank

Table 4-17 gives the greenshank flight activity recorded each season.

Table 4-17. Greenshank Flight Activity Each Season

Season	Number of Flights	Number of Birds	Flight Duration (seconds)	Time at PCH (seconds)	No. of flights (birds) within PCZ
2018-19 non-breeding season	0	0	0	0	0 (0)
2019 breeding season	18	39	1,530	1,050	8 (9)
2019-20 non-breeding season	0	0	0	0	0 (0)
2020 breeding season	10	11	435	240	5 (6)

Using the 98% avoidance rate in accordance with NatureScot[69], the mean breeding season collision rate is 0.04, predicting one collision every 24 years from the Proposed Development, equating to approximately two greenshank collisions **over a 50-year operational lifetime** (Table 4-18).

Table 4-18. Predicted Greenshank Collision Risk from 2018 to 2020 VP Results: Proposed Development

Collision risk modelling	2018-19 non-breeding season	2019 breeding season	2019/2020 non-breeding season	2020 breeding season	Mean (mean breeding season + non-breeding)
Greenshank collisions per year (98% avoidance rate)	0.0	0.069	0.0	0.015	0.042
Equivalent to 1 bird every X years (98% avoidance)	0.0	14	N/A	67	24
Predicted number of collisions over 50 years	0.0	3	0.0	<1	2

5 CUMULATIVE AND IN-COMBINATION EFFECTS

5.1 Introduction

The above sections have considered the implications of the wind farm in isolation from potential effects of other developments. The EIA Regulations require cumulative impacts to be assessed, to determine whether or not joint effects are significant. The Habitats Regulations also require proposed development impacts to be assessed together, taking into account relevant plans and projects (in what is generally referred to as an 'in combination' assessment). This is so that combined effects on the Caithness and Sutherland Peatlands SPA conservation objectives and therefore the SPA's integrity can be identified.

To identify which developments to consider for inclusion into the cumulative/in combination assessment, potential connectivity with the SPA was used, based on target species' core foraging ranges (NatureScot 2016). In addition, the Zone of Influence[69] (ZoI) of effects from developments was also considered. This generated a potential 'long list' of developments to consider. Then in each case, a search of any relevant documentation (notably Environmental Statements and post-construction monitoring reports) was made to extract quantitative or qualitative information on predicted effects (or monitoring results). These insights were then considered and a judgement made as to whether there was a potential cumulative/in combination effect with the Proposed Development (including whether developments formed part of the baseline conditions, where they were already in construction or operational).

Predicted collision mortality, displacement, barrier effects and disturbance (construction, operational and decommissioning) from the Proposed Development has therefore been considered in combination with other developments (presented in Technical Appendix 9.2). This includes operational projects, projects under construction (and whose impacts are therefore not part of the baseline) and projects in the planning process.

The scales at which cumulative/in combination effects have been assessed are Peatlands of Caithness and Sutherland NHZ, and the Caithness and Sutherland Peatlands SPA (shown in **Chapter 9 Figure 9.2)**. A spreadsheet of the predicted mortality from windfarms within or with connectivity to both of these areas is maintained by NatureScot. This was provided in February 2021, along with the prompt that for some of the wind farms listed, up-dates were needed to adjust the spreadsheet values for current avoidance rates and to reflect turbine layouts and revised applications. The cumulative list of developments and associated effects on relevant target species are given in Annex I of this Technical Appendix. The cumulative collision rate information provided by NatureScot and up-dated accordingly is summarised in Table 5-1. The first row 'All wind farms' includes the wind farms with connectivity to the Caithness and Sutherland Peatlands SPA that have a predicted collision rate greater than zero.

Table 5-1. Predicted Current Cumulative Collision Risk for Key Species: Proposed Development

	Golden Eagle	Greenshank	Golden Plover	Dunlin
All wind farms NHZ	0.52	0.32	50.05	0
All wind farms SPA	0.40	0.31	4.77	0
Proposed Development	0.12	0.04	0.08	0.002
All Wind Farms including Proposed Development NHZ	0.64	0.36	50.13	0.002
All Wind Farms including Proposed Development SPA	0.52	0.35	4.85	0.002

5.2 Golden Eagle

Of the designated population of 10 individuals, the 0.52 cumulative birds a year would equate to 5.2% of the SPA population, assuming 99% avoidance rate and that all collisions are SPA birds. Given that neither of

[69] The Zone of Influence (ZoI) in this context is the area over which an individual ornithological feature may be subject to a potentially significant effect resulting from changes in the baseline environment due to developments.

these assumptions are considered to apply, and there are no SPA golden eagle territories in connectivity range of the Proposed Development, this level of added annual mortality specifically from the Proposed Development is not considered to be significant (in EIA terms, on the NHZ population) or to have an adverse impact on the viability of the population or integrity of the SPA.

5.3 Greenshank

Of the designated population of 653 pairs, the 0.36 cumulative birds a year equates to 0.03% of the SPA population. This level of added annual mortality is not considered to be significantor to have an adverse impact on the viability of the population or integrity of the SPA or significant effect in EIA terms, on the NHZ population.

5.4 Golden Plover

Of the designated population of 1,922 pairs, the 4.77 cumulative/combined birds a year equates to 0.12% of the SPA population, before mitigation. This level of added annual mortality is not considered to be significant or to have an adverse impact on the viability of the population or integrity of the SPA or significant effect in EIA terms, on the NHZ population.

5.5 Dunlin

Of the designated population of 1366 pairs, the 0.002 cumulative/combined birds a year equates to <0.001% of the SPA population, before mitigation. This level of added annual mortality is not considered to be significantor to have an adverse impact on the viability of the population or integrity of the SPA or significant effect in EIA terms, on the NHZ population.

5.6 Other Cumulative Effects

Other than collision, no effects from displacement, barrier effects, construction or operational disturbance are sufficient to cause significant negative effects on any species of the Caithness and Sutherlands Peatlands SPA/Ramsar site, or on any of its constituent SSSIs. There are also no significant cumulative effects in EIA terms predicted on the NHZ populations of any other target species.

6 CONFIDENTIAL ORNITHOLOGICAL INFORMATION

Nature Scot's 2016 "*Environmental Statements and Annexes of Environmentally Sensitive Bird Information*", provides detailed guidance on how to present sensitive ES information in a way that does not compromise or threaten the sensitive species under consideration. Where possible, all non-sensitive information is provided in the main ES chapter. However, all sensitive information and are presented in the separate Confidential Annex and associated figures, rather than the main ES chapter.

All fieldwork information gathered on protected species was done so under an appropriate NatureScot Animal Conservation Licence. The following sensitive information is linked to the relevant ES section where it would appear were it not for its confidential nature.

6.1 Additional Desk Study and Field Survey Results

6.1.1 Golden Eagle

Three locations were recorded during breeding raptor surveys where golden eagle pellets or feathers were found, indicative of locations were birds had been on the ground. These locations were recorded on 22nd June 2019, with fresh pellets and feathers at NC454095 (in a peat hag gully), on 5th July 2019, with three pellets at NC448131 (near the head of a small burn in an area of peat hags), and on 15th May 2020, with fresh feathers and a single pellet in a heathery hag/bank at NC436136. Birds were not present at these locations during any fieldwork, and these locations appear to be used only once in each instance.

6.1.2 Merlin

In 2019 and 2020, a nest was located in Glen Cassley on a small tributary of the Allt Bad a Chreamha burn at NC441085. In 2019 it was believed to have failed. In 2020 there was a sighting of three juveniles with the adult pair and therefore it is assumed that the nest successfully fledged three young. Merlins were an infrequent visitor to the site with only six recorded flights over the site (see Figure A9.10 to A9.12).

6.1.3 Osprey

One pair of ospreys nested atop a lone mature Scots pine tree identified along a tributary of the River Cassley, the Allt Langwell, in a gully at NC416122 during 2020. The nest is over 3km [redacted] of the nearest proposed turbine. According to the HRSG data, osprey have historically used this site as far back as 2009. Osprey were infrequent visitors to the site.

6.1.4 White-Tailed Eagle

Sub-adult birds have been present in Glen Cassley since 2016, and in 2020 made use of an old osprey nest (repaired but no eggs thought to be laid) at NC412115. The HSRG data reply included 2021 observations that a pair is breeding, feeding a least one small chick on 10 May 2021.

Annex A – Moorland Breeding Bird Surveys

Month	Date	Surveyor	Start time	End time	Duration (hh:mm)
April	10/04/19	AF	08:00	15:00	07:00
	10/04/19	HC	08:00	15:00	07:00
	11/04/19	AF	08:20	15:00	06:40
	11/04/19	HC	08:20	15:00	06:40
	12/04/19	AF	08:10	14:05	05:55
	12/04/19	HC	08:10	14:05	05:55
	14/04/19	AF	08:30	15:00	06:30
	14/04/19	HC	08:30	15:00	06:30
May	09/05/19	AF	07:50	15:50	08:00
	09/05/19	AC	08:15	16:45	08:30
	10/05/19	AC	07:55	16:10	08:15
	10/05/19	AF	08:20	16:20	08:00
	16/05/19	AF	08:30	16:10	07:40
	16/05/19	AC	09:40	16:10	06:30
	29/05/19	AC	07:40	15:10	07:30
	29/05/19	AF	07:30	15:00	07:30
June	05/06/19	AC	08:15	11:00	02:45
	13/06/19	AF / HC	07:00	15:00	08:00
	14/06/19	AF	07:15	15:00	07:45
	15/06/19	AF / HC	07:20	14:40	07:20
	25/06/19	AF	08:30	14:00	05:30
	25/06/19	AC	08:40	12:35	03:55
July	02/07/19	AF	08:00	14:00	06:00
	02/07/19	AC	08:20	14:45	06:25
	03/07/19	AF	11:30	14:30	03:00
	06/07/19	AF	08:30	14:00	05:30
	07/07/19	AF	07:20	13:00	05:40
	08/07/19	AC	08:05	16:10	08:05
	16/07/19	AC	07:55	14:05	06:10
	22/07/19	AC	09:15	15:10	05:55
	30/07/19	AC	10:40	15:30	04:50
May	12/05/20	GMa	08:30	14:00	05:30
	12/05/20	Aco	07:40	14:55	07:15
	14/05/20	Aco	08:05	15:20	07:15
	14/05/20	Gma	09:40	15:30	05:50
	16/05/20	Gma	09:30	15:00	05:30
	18/05/20	Aco	10:55	17:10	06:15
	21/05/20	Aco	08:15	14:50	06:35
	25/05/20	Emu	13:12	16:23	03:11
	25/05/20	Emu	11:24	12:05	00:41
	26/05/20	Gma	09:50	13:50	04:00
	27/05/20	AF	07:45	14:00	06:15
	28/05/20	Gma	09:40	13:15	03:35
	28/05/20	Emu	11:09	20:14	09:05
	31/05/20	Emu	10:44	17:29	06:45
	31/05/20	AF	06:30	12:30	06:00
June	09/06/20	Gma	08:45	14:50	06:05
	10/06/20	Emu	11:35	17:44	06:09

Month	Date	Surveyor	Start time	End time	Duration (hh:mm)
	11/06/20	Gma	09:00	15:00	06:00
	12/06/20	Gma	08:55	15:05	06:10
	12/06/20	Emu	11:41	15:54	04:13
	15/06/20	Emu	10:11	17:38	07:27
	15/06/20	Gma	09:00	14:50	05:50
	25/06/20	Gma	08:50	14:30	05:40
	25/06/20	Emu	10:20	17:08	06:48
July	13/07/20	Gma	08:50	14:30	05:40
	14/07/20	Emu	10:32	19:18	08:46
	14/07/20	Gma	09:00	14:45	05:45
	15/07/20	Emu	12:21	18:03	05:42
	16/07/20	Gma	08:30	14:30	06:00
	18/07/20	Emu	11:51	17:51	06:00
	19/07/20	Emu	13:49	17:57	04:08
	21/07/20	Emu	11:26	18:20	06:54
	22/07/20	Emu	11:57	17:54	05:57

Surveyors: Aco – Andrew Cole; AF – Adam Fraser; HC – Helen Chance; Emu – Ewan Munro; Gma – Gareth Marshall

Annex B – Breeding Raptor Survey

Month	Date	Surveyor	Start time	End time	Duration (hh:mm)
April	09/04/19	AF	09:00	15:00	06:00
	20/04/19	AF	08:00	14:00	06:00
	20/04/19	HC	08:00	14:00	06:00
	27/04/19	HC	09:30	15:30	06:00
	27/04/19	AF	09:30	15:30	06:00
	28/04/19	AF	08:30	14:30	06:00
	28/04/19	HC	08:30	14:30	06:00
May	20/05/19	AF	08:00	16:00	08:00
	21/05/19	AF	10:00	18:00	08:00
	22/05/19	AF	08:00	16:00	08:00
	23/05/19	AC	07:00	15:00	08:00
June	09/06/19	AF / HC	08:15	14:00	05:45
	16/06/19	AF / HC	14:30	18:00	03:30
	22/06/19	AF / HC	08:00	15:15	07:15
	23/06/19	AF	07:40	14:00	06:20
	25/06/19	AC	13:00	16:00	03:00
July	08/07/19	AF	08:00	13:30	05:30
	09/07/19	AF	08:50	14:20	05:30
	11/07/19	AF	07:30	13:00	05:30
	12/07/19	AC	08:40	14:45	06:05
	18/07/19	AE	08:05	14:20	06:15
	28/07/19	AC	09:15	16:10	06:55
	30/07/19	AC	16:40	18:30	01:50
May	14/05/20	Emu	09:58	17:58	08:00
	15/05/20	Aco	08:10	14:45	06:35
	19/05/20	Emu	10:31	17:31	07:00
	20/05/20	Gma	09:00	15:00	06:00
	21/05/20	AF	10:00	16:00	06:00
	22/05/20	Gma	10:00	14:30	04:30
	22/05/20	AF	11:00	17:00	06:00
	25/05/20	AF	08:30	14:30	06:00
	26/05/20	Aco	07:50	15:00	07:10
	29/05/20	Emu	13:19	20:47	07:28
June	03/06/20	HC	09:10	16:00	06:50
	06/06/20	Gma	09:00	15:00	06:00
	12/06/20	Emu	15:54	19:49	03:55
	16/06/20	Gma	08:50	14:55	06:05
	21/06/20	Aco	10:00	16:20	06:20
	29/06/20	Emu	15:47	19:47	04:00
	29/06/20	Gma	09:00	15:00	06:00
July	03/07/20	Emu	10:05	18:08	08:03
	05/07/20	AF	08:00	14:30	06:30
	12/07/20	Emu	11:10	19:10	08:00
	12/07/20	AF	10:00	16:00	06:00
	24/07/20	AF	11:40	18:00	06:20
	28/07/20	Emu	09:11	17:11	08:00
	31/07/20	Emu	10:44	18:44	08:00

Surveyors: Aco – Andrew Cole; AF – Adam Fraser; HC – Helen Chance; Emu – Ewan Munro; Gma – Gareth Marshall

Annex C – Vantage Point Survey Effort

Month	Survey Date	Vantage Point	Observer	Start Time	End Time	Duration
September	27/09/18	4	TGr	16:05	19:05	03:00:00
	29/09/18	1	NG	10:05	13:05	03:00:00
	29/09/18	2	NG	13:35	16:35	03:00:00
	29/09/18	4	TGr	12:05	15:05	03:00:00
	29/09/18	6	JBB	10:15	13:15	03:00:00
	30/09/18	1	NG	13:55	16:55	03:00:00
	30/09/18	2	NG	10:25	13:25	03:00:00
	30/09/18	3	JBB	09:15	12:15	03:00:00
	30/09/18	5	TGr	12:40	15:40	03:00:00
	30/09/18	7	TGr	09:05	12:05	03:00:00
October	10/10/18	4	TGr	15:45	17:45	03:00:00
	11/10/18	5	TGr	13:50	16:50	03:00:00
	11/10/18	7	TGr	10:20	13:20	03:00:00
	20/10/18	4	TGr	11:50	14:50	03:00:00
	20/10/18	4	TGr	15:05	16:05	03:00:00
	21/10/18	5	TGr	14:45	17:45	03:00:00
	21/10/18	7	TGr	11:15	14:15	03:00:00
November	07/11/18	4	TGr	09:20	12:20	03:00:00
	07/11/18	4	TGr	12:50	15:50	03:00:00
	09/11/18	5	TGr	09:05	12:05	03:00:00
	09/11/18	5	TGr	12:35	15:35	03:00:00
	10/11/18	7	TGr	09:20	12:20	03:00:00
	10/11/18	7	TGr	12:50	15:50	03:00:00
December	19/12/18	7	TGr	09:05	12:05	03:00:00
	19/12/18	7	TGr	12:35	15:35	03:00:00
	20/12/18	5	TGr	09:15	12:15	03:00:00
	20/12/18	5	TGr	12:45	15:45	03:00:00
	21/12/18	4	TGr	09:20	12:20	03:00:00
	21/12/18	4	TGr	12:45	15:45	03:00:00
January	16/01/19	7	JBB	09:25	12:25	03:00:00
	16/01/19	7	JBB	12:55	15:55	03:00:00
February	02/02/19	4	JBB	11:30	14:30	03:00:00
	11/02/19	4	JBB	11:00	14:00	03:00:00
	12/02/19	5	JBB	09:10	12:10	03:00:00
	12/02/19	5	JBB	12:40	15:40	03:00:00
	13/02/19	7	TGr	09:45	12:45	03:00:00
	13/02/19	7	TGr	13:15	16:15	03:00:00
	22/02/19	4	TGr	10:55	13:55	03:00:00
	22/02/19	4	TGr	14:25	17:25	03:00:00
	23/02/19	5	TGr	10:20	13:20	03:00:00
	23/02/19	5	TGr	13:50	16:50	03:00:00
March	05/03/19	7	TGr	11:30	14:30	03:00:00
	05/03/19	7	TGr	15:00	18:00	03:00:00
	15/03/19	5	JBB	12:55	15:55	03:00:00

Month	Survey Date	Vantage Point	Observer	Start Time	End Time	Duration
	15/03/19	5	JBB	09:25	12:25	03:00:00
	25/03/19	4	JBB	10:00	13:00	03:00:00
	25/03/19	4	JBB	13:30	16:30	03:00:00
April	05/04/19	1	AF	08:45:00	11:45:00	03:00:00
	05/04/19	7	AF	13:00:00	16:00:00	03:00:00
	06/04/19	5	AF	08:20:00	11:20:00	03:00:00
	06/04/19	6	AF	12:30:00	15:30:00	03:00:00
	07/04/19	3	AF	09:00:00	12:00:00	03:00:00
	07/04/19	4	AF	13:05:00	16:05:00	03:00:00
	08/04/19	2	AF	08:30:00	11:30:00	03:00:00
	15/04/19	3	AF	08:15:00	11:15:00	03:00:00
	15/04/19	4	AF	12:20:00	15:20:00	03:00:00
	16/04/19	1	AF	12:30:00	15:30:00	03:00:00
	16/04/19	7	AF	08:15:00	11:15:00	03:00:00
	17/04/19	5	AF	12:50:00	15:50:00	03:00:00
	17/04/19	6	AF	08:50:00	11:50:00	03:00:00
	18/04/19	2	AF	09:50:00	12:50:00	03:00:00
	22/04/19	2	AF	14:50:00	17:50:00	03:00:00
	23/04/19	1	AF	09:15:00	12:15:00	03:00:00
	23/04/19	7	AF	13:15:00	16:15:00	03:00:00
	24/04/19	3	AF	14:00:00	17:00:00	03:00:00
	24/04/19	4	AF	10:00:00	13:00:00	03:00:00
	25/04/19	5	AF	12:55:00	15:55:00	03:00:00
	25/04/19	6	AF	08:50:00	11:50:00	03:00:00
May	04/05/19	2	AF	16:00:00	19:00:00	03:00:00
	05/05/19	1	AF	07:45:00	10:45:00	03:00:00
	05/05/19	7	AF	12:05:00	15:05:00	03:00:00
	06/05/19	3	Aco	19:10:00	21:10:00	02:00:00
	06/05/19	4	Aco	14:30:00	17:30:00	03:00:00
	07/05/19	3	Aco	11:20:00	14:20:00	03:00:00
	07/05/19	5	Aco	07:50:00	10:50:00	03:00:00
	11/05/19	2	AF	14:50:00	17:50:00	03:00:00
	12/05/19	1	AF	12:10:00	15:10:00	03:00:00
	12/05/19	7	AF	07:45:00	10:45:00	03:00:00
	13/05/19	4	Aco	16:00:00	19:00:00	03:00:00
	13/05/19	4	Aco	12:30:00	15:30:00	03:00:00
	14/05/19	6	Aco	19:30:00	22:30:00	03:00:00
	14/05/19	6	Aco	16:00:00	19:00:00	03:00:00
	15/05/19	5	Aco	07:30:00	10:30:00	03:00:00
	15/05/19	6	Aco	03:45:00	06:45:00	03:00:00
	17/05/19	2	AF	15:30:00	18:30:00	03:00:00
	17/05/19	3	Aco	15:05:00	18:05:00	03:00:00
	18/05/19	1	AF	13:05:00	16:05:00	03:00:00
	18/05/19	7	AF	17:00:00	20:00:00	03:00:00
	27/05/19	5	Aco	12:00:00	15:00:00	03:00:00
June	01/06/19	1	AF	06:50:00	09:50:00	03:00:00

Month	Survey Date	Vantage Point	Observer	Start Time	End Time	Duration
	01/06/19	7	AF	10:55:00	13:55:00	03:00:00
	02/06/19	5	AF	12:45:00	15:45:00	03:00:00
	02/06/19	6	AF	08:30:00	11:30:00	03:00:00
	03/06/19	4	Aco	08:10:00	11:10:00	03:00:00
	03/06/19	6	Aco	12:50:00	15:50:00	03:00:00
	06/06/19	2	HC	13:30:00	16:30:00	03:00:00
	06/06/19	4	HC	08:50:00	11:50:00	03:00:00
	07/06/19	1	AF	11:20:00	14:20:00	03:00:00
	07/06/19	7	AF	15:30:00	18:30:00	03:00:00
	19/06/19	3	AF	08:20:00	11:20:00	03:00:00
	19/06/19	4	AF	12:35:00	15:35:00	03:00:00
	20/06/19	5	AF	06:20:00	09:20:00	03:00:00
	20/06/19	6	AF	11:00:00	14:00:00	03:00:00
	21/06/19	2	AF	07:05:00	10:05:00	03:00:00
	21/06/19	3	AF	11:00:00	14:00:00	03:00:00
	27/06/19	2	AF	11:45:00	14:45:00	03:00:00
	27/06/19	7	AF	07:45:00	10:45:00	03:00:00
	28/06/19	5	AF	15:00:00	18:00:00	03:00:00
	29/06/19	1	AF	12:30:00	15:30:00	03:00:00
	29/06/19	3	AF	16:45:00	19:45:00	03:00:00
July	01/07/19	1	Aco	10:50:00	13:50:00	03:00:00
	01/07/19	1	Aco	14:25:00	17:25:00	03:00:00
	03/07/19	2	AF	08:10:00	11:10:00	03:00:00
	04/07/19	3	AF	08:25:00	11:25:00	03:00:00
	04/07/19	4	AF	12:40:00	15:40:00	03:00:00
	05/07/19	5	AF	08:30:00	11:50:00	03:20:00
	05/07/19	6	AF	13:05:00	16:05:00	03:00:00
	14/07/19	7	Aco	07:40:00	10:40:00	03:00:00
	14/07/19	7	Aco	11:10:00	14:10:00	03:00:00
	19/07/19	5	AF	11:40:00	14:40:00	03:00:00
	19/07/19	6	AF	07:25:00	10:25:00	03:00:00
	20/07/19	3	AF	07:50:00	10:50:00	03:00:00
	20/07/19	4	AF	12:00:00	15:00:00	03:00:00
	20/07/19	4	AF	12:00:00	15:00:00	03:00:00
	23/07/19	1	Aco	08:00:00	11:00:00	03:00:00
	23/07/19	7	Aco	12:05:00	15:05:00	03:00:00
	25/07/19	3	AF	12:10:00	15:10:00	03:00:00
	25/07/19	4	AF	07:45:00	10:45:00	03:00:00
	26/07/19	5	AF	15:30:00	18:30:00	03:00:00
	26/07/19	6	AF	11:10:00	14:10:00	03:00:00
	27/07/19	2	AF	13:40:00	16:40:00	03:00:00
	27/07/19	2	AF	06:40:00	09:40:00	03:00:00
August	03/08/19	1	AF	16:40:00	19:40:00	03:00:00
	03/08/19	7	AF	12:30:00	15:30:00	03:00:00
	04/08/19	2	AF	13:20:00	15:20:00	03:00:00
	04/08/19	6	AF	08:40:00	11:40:00	03:00:00

Month	Survey Date	Vantage Point	Observer	Start Time	End Time	Duration
	06/08/19	3	AF	07:40:00	10:40:00	03:00:00
	06/08/19	5	AF	11:40:00	14:40:00	03:00:00
	07/08/19	4	AF	08:10:00	11:10:00	03:00:00
	10/08/19	3	AF	10:15:00	13:15:00	03:00:00
	10/08/19	5	AF	14:15:00	17:15:00	03:00:00
	12/08/19	1	AF	09:30:00	12:30:00	03:00:00
	12/08/19	6	AF	13:30:00	16:30:00	03:00:00
	13/08/19	2	AF	06:40:00	09:40:00	03:00:00
	13/08/19	7	AF	10:45:00	13:45:00	03:00:00
	14/08/19	4	AF	09:10:00	12:10:00	03:00:00
	21/08/19	3	AF	14:00:00	17:00:00	03:00:00
	21/08/19	4	AF	10:00:00	13:00:00	03:00:00
	22/08/19	5	AF	07:45:00	10:45:00	03:00:00
	22/08/19	6	AF	12:00:00	15:00:00	03:00:00
	25/08/19	1	AF	10:40:00	13:40:00	03:00:00
	25/08/19	7	AF	06:30:00	09:30:00	03:00:00
	26/08/19	2	AF	07:30:00	10:30:00	03:00:00
September	22/09/19	4	AF	13:05:00	16:05:00	03:00:00
	22/09/19	3	AF	08:45:00	11:45:00	03:00:00
	24/09/19	5	AF	08:00:00	11:00:00	03:00:00
	24/09/19	6	AF	12:00:00	15:00:00	03:00:00
	25/09/19	7	AF	12:15:00	15:15:00	03:00:00
	25/09/19	1	AF	08:10:00	11:10:00	03:00:00
	26/09/19	2	AF	07:50:00	10:50:00	03:00:00
	26/09/19	2	AF	11:50:00	14:50:00	03:00:00
	27/09/19	4	AF	07:30:00	10:30:00	03:00:00
	27/09/19	3	AF	11:30:00	14:30:00	03:00:00
	28/09/19	6	AF	07:45:00	10:45:00	03:00:00
	28/09/19	5	AF	12:00:00	15:00:00	03:00:00
	30/09/19	1	AF	12:30:00	15:30:00	03:00:00
	30/09/19	7	AF	08:30:00	11:30:00	03:00:00
October	21/10/19	1	AF	08:45:00	11:45:00	03:00:00
	21/10/19	7	AF	13:00:00	16:00:00	03:00:00
	23/10/19	3	AF	08:40:00	11:40:00	03:00:00
	23/10/19	6	AC	12:45:00	15:45:00	03:00:00
	24/10/19	4	AF	12:50:00	15:50:00	03:00:00
	24/10/19	4	AF	08:50:00	11:50:00	03:00:00
	26/10/19	5	AF	13:30:00	16:30:00	03:00:00
	26/10/19	3	AF	09:20:00	12:20:00	03:00:00
	27/10/19	5	AF	13:00:00	16:00:00	03:00:00
	27/10/19	6	AF	09:00:00	12:00:00	03:00:00
	28/10/19	2	AF	12:45:00	15:45:00	03:00:00
	28/10/19	2	AF	08:45:00	11:45:00	03:00:00
	29/10/19	1	AF	09:00:00	12:00:00	03:00:00
	29/10/19	7	AF	13:00:00	16:00:00	03:00:00
November	05/11/19	3	AF	08:05:00	11:05:00	03:00:00

Month	Survey Date	Vantage Point	Observer	Start Time	End Time	Duration
	05/11/19	5	AF	12:15:00	15:15:00	03:00:00
	08/11/19	6	AF	12:05:00	15:05:00	03:00:00
	08/11/19	4	AF	07:55:00	10:55:00	03:00:00
	09/11/19	1	AF	12:00:00	15:00:00	03:00:00
	09/11/19	7	AF	08:00:00	11:00:00	03:00:00
	11/11/19	2	AF	12:30:00	15:30:00	03:00:00
	11/11/19	2	AF	08:10:00	11:10:00	03:00:00
	13/11/19	4	AF	12:20:00	15:20:00	03:00:00
	13/11/19	6	AF	08:15:00	11:15:00	03:00:00
	14/11/19	1	AF	08:30:00	11:30:00	03:00:00
	14/11/19	7	AF	12:30:00	15:30:00	03:00:00
	15/11/19	3	AF	12:30:00	15:30:00	03:00:00
	15/11/19	5	AF	08:30:00	11:30:00	03:00:00
	18/11/19	2	AF	10:15:00	13:15:00	03:00:00
	21/11/19	6	AF	12:45:00	15:45:00	03:00:00
	21/11/19	4	AF	08:45:00	11:45:00	03:00:00
	25/11/19	7	AF	08:30:00	11:30:00	03:00:00
	25/11/19	1	AF	12:30:00	15:30:00	03:00:00
	29/11/19	5	AF	08:45:00	11:45:00	03:00:00
	29/11/19	3	AF	12:45:00	15:45:00	03:00:00
	29/11/19	3	AF	12:45:00	15:45:00	03:00:00
December	01/12/19	3	AF	13:00:00	16:00:00	03:00:00
	01/12/19	3	AF	08:45:00	11:45:00	03:00:00
	03/12/19	5	AF	09:00:00	12:00:00	03:00:00
	03/12/19	6	AF	13:00:00	16:00:00	03:00:00
	06/12/19	1	AF	12:45:00	15:45:00	03:00:00
	06/12/19	7	AF	08:45:00	11:45:00	03:00:00
	09/12/19	4	AF	08:55:00	11:55:00	03:00:00
	09/12/19	4	AF	12:30:00	15:30:00	03:00:00
	15/12/19	7	AF	12:45:00	15:45:00	03:00:00
	15/12/19	1	AF	08:50:00	11:50:00	03:00:00
	17/12/19	6	AF	09:00:00	12:00:00	03:00:00
	17/12/19	5	AF	13:00:00	16:00:00	03:00:00
	18/12/19	2	AF	09:00:00	12:00:00	03:00:00
	18/12/19	2	AF	13:00:00	16:00:00	03:00:00
January	05/01/20	3	AF	09:00:00	12:00:00	03:00:00
	05/01/20	5	AF	12:30:00	15:30:00	03:00:00
	06/01/20	2	AF	09:00:00	12:00:00	03:00:00
	06/01/20	2	AF	12:45:00	15:45:00	03:00:00
	09/01/20	6	AF	09:00:00	12:00:00	03:00:00
	09/01/20	6	AF	09:00:00	12:00:00	03:00:00
	09/01/20	6	AF	12:50:00	15:50:00	03:00:00
	10/01/20	7	AF	12:55:00	15:55:00	03:00:00
	10/01/20	1	AF	09:00:00	12:00:00	03:00:00
	13/01/20	3	AF	13:40:00	16:40:00	03:00:00
	13/01/20	5	AF	08:55:00	11:55:00	03:00:00

Month	Survey Date	Vantage Point	Observer	Start Time	End Time	Duration
	16/01/20	6	AF	12:50:00	15:50:00	03:00:00
	16/01/20	4	AF	08:50:00	11:50:00	03:00:00
	20/01/20	4	AF	09:55:00	12:55:00	03:00:00
	20/01/20	4	AF	13:30:00	16:30:00	03:00:00
	21/01/20	7	AF	12:10:00	15:10:00	03:00:00
	21/01/20	1	AF	08:20:00	11:20:00	03:00:00
	24/01/20	5	AF	08:45:00	11:45:00	03:00:00
	24/01/20	3	AF	12:45:00	15:45:00	03:00:00
	27/01/20	1	AF	12:50:00	15:50:00	03:00:00
	27/01/20	7	AF	08:50:00	11:50:00	03:00:00
	31/01/20	2	AF	09:30:00	12:30:00	03:00:00
February	06/02/20	5	AF	12:40:00	15:40:00	03:00:00
	06/02/20	3	AF	08:30:00	11:30:00	03:00:00
	08/02/20	2	AF	08:45:00	11:45:00	03:00:00
	08/02/20	2	AF	12:45:00	15:45:00	03:00:00
	16/02/20	5	AF	10:40:00	13:40:00	03:00:00
	16/02/20	6	AF	14:40:00	17:40:00	03:00:00
	18/02/20	3	AF	12:35:00	15:35:00	03:00:00
	18/02/20	6	AF	08:30:00	11:30:00	03:00:00
	20/02/20	7	AF	13:00:00	16:00:00	03:00:00
	20/02/20	1	AF	08:50:00	11:50:00	03:00:00
	25/02/20	4	AF	10:05:00	13:05:00	03:00:00
	25/02/20	4	AF	14:05:00	17:05:00	03:00:00
	26/02/20	7	AF	08:40:00	11:40:00	03:00:00
	26/02/20	1	AF	12:45:00	15:45:00	03:00:00
	03/02/20	7	AF	08:30:00	11:30:00	03:00:00
	03/02/20	1	AF	12:30:00	15:30:00	03:00:00
	05/02/20	6	AF	08:45:00	11:45:00	03:00:00
	05/02/20	4	AF	13:00:00	16:00:00	03:00:00
	08/02/20	5	AF	08:20:00	11:20:00	03:00:00
	08/02/20	3	AF	12:20:00	15:20:00	03:00:00
	09/02/20	2	AF	08:30:00	11:30:00	03:00:00
May	11/05/20	5	Aco	12:00:00	15:00:00	03:00:00
	11/05/20	3	Aco	08:30:00	11:30:00	03:00:00
	13/05/20	4	Aco	12:35:00	15:35:00	03:00:00
	13/05/20	4	Aco	09:05:00	12:05:00	03:00:00
	13/05/20	7	Emu	15:23:00	18:23:00	03:00:00
	13/05/20	1	Emu	11:37:00	14:37:00	03:00:00
	15/05/20	5	Emu	14:26:00	17:26:00	03:00:00
	15/05/20	3	Emu	10:53:00	13:53:00	03:00:00
	18/05/20	6	Emu	11:35:00	14:35:00	03:00:00
	18/05/20	6	Emu	15:06:00	18:06:00	03:00:00
	19/05/20	3	Aco	12:15:00	15:15:00	03:00:00
	19/05/20	5	Aco	08:45:00	11:45:00	03:00:00
	19/05/20	2	HC	08:20:00	11:20:00	03:00:00
	19/05/20	2	HC	12:20:00	15:20:00	03:00:00

Month	Survey Date	Vantage Point	Observer	Start Time	End Time	Duration
	20/05/20	6	Emu	09:57:00	12:57:00	03:00:00
	20/05/20	2	HC	15:15:00	18:15:00	03:00:00
	20/05/20	6	Emu	13:28:00	16:28:00	03:00:00
	21/05/20	4	Emu	14:31:00	17:31:00	03:00:00
	21/05/20	4	Emu	11:00:00	14:00:00	03:00:00
	24/05/20	7	Emu	11:51:00	14:51:00	03:00:00
	24/05/20	1	Emu	07:59:00	10:59:00	03:00:00
	25/05/20	3	Gma	07:50:00	10:50:00	03:00:00
	25/05/20	5	Gma	11:20:00	14:20:00	03:00:00
	26/05/20	7	Emu	15:06:00	18:06:00	03:00:00
	26/05/20	1	Emu	18:41:00	21:41:00	03:00:00
	27/05/20	5	Emu	09:22:00	12:22:00	03:00:00
	27/05/20	3	Emu	05:50:00	08:50:00	03:00:00
	28/05/20	1	AF	14:30:00	17:30:00	03:00:00
	28/05/20	7	AF	11:00:00	14:00:00	03:00:00
	29/05/20	2	AF	17:50:00	20:50:00	03:00:00
	29/05/20	2	AF	14:20:00	17:20:00	03:00:00
	30/05/20	4	Aco	07:45:00	10:45:00	03:00:00
	30/05/20	6	Aco	11:45:00	14:45:00	03:00:00
	30/05/20	1	Gma	07:35:00	10:35:00	03:00:00
	30/05/20	7	Gma	11:10:00	14:10:00	03:00:00
June	01/06/20	7	Emu	19:27:00	22:27:00	03:00:00
	01/06/20	1	Emu	15:52:00	18:52:00	03:00:00
	02/06/20	4	Emu	10:30:00	13:30:00	03:00:00
	02/06/20	4	Emu	06:59:00	09:59:00	03:00:00
	04/06/20	5	Gma	12:05:00	15:05:00	03:00:00
	04/06/20	3	Gma	08:30:00	11:30:00	03:00:00
	12/06/20	2	HC	07:15:00	10:15:00	03:00:00
	17/06/20	1	AF	10:00:00	13:00:00	03:00:00
	17/06/20	7	AF	13:30:00	16:30:00	03:00:00
	18/06/20	5	Gma	11:20:00	14:20:00	03:00:00
	18/06/20	3	Gma	07:50:00	10:50:00	03:00:00
	19/06/20	6	Emu	14:58:00	17:58:00	03:00:00
	19/06/20	6	Emu	18:29:00	21:29:00	03:00:00
	20/06/20	5	AF	09:40:00	12:40:00	03:00:00
	20/06/20	3	AF	06:10:00	09:10:00	03:00:00
	22/06/20	4	Emu	10:13:00	13:13:00	03:00:00
	22/06/20	1	Gma	07:40:00	10:40:00	03:00:00
	22/06/20	6	Emu	14:38:00	17:38:00	03:00:00
	22/06/20	7	Gma	11:15:00	14:15:00	03:00:00
	23/06/20	2	Gma	11:20:00	14:20:00	03:00:00
	23/06/20	2	Gma	07:45:00	10:45:00	03:00:00
July	01/07/20	2	AF	15:40:00	18:40:00	03:00:00
	02/07/20	4	Emu	10:56:00	13:56:00	03:00:00
	02/07/20	4	Emu	14:27:00	17:27:00	03:00:00
	06/07/20	2	Gma	07:35:00	10:35:00	03:00:00

Month	Survey Date	Vantage Point	Observer	Start Time	End Time	Duration
	06/07/20	2	Gma	11:05:00	14:05:00	03:00:00
	08/07/20	3	Emu	16:17:00	19:17:00	03:00:00
	08/07/20	5	Emu	12:46:00	15:46:00	03:00:00
	09/07/20	1	Gma	07:45:00	10:45:00	03:00:00
	09/07/20	7	Gma	11:20:00	14:20:00	03:00:00
	10/07/20	6	Emu	13:41:00	16:41:00	03:00:00
	10/07/20	6	Emu	17:12:00	20:12:00	03:00:00
	18/07/20	5	AF	09:30:00	12:30:00	03:00:00
	18/07/20	3	AF	06:00:00	09:00:00	03:00:00
	25/07/20	6	AF	11:15:00	14:15:00	03:00:00
	25/07/20	4	AF	07:10:00	10:10:00	03:00:00
	26/07/20	7	AF	06:20:00	09:20:00	03:00:00
	26/07/20	1	AF	09:50:00	12:50:00	03:00:00
	29/07/20	5	Emu	13:45:00	16:45:00	03:00:00
	29/07/20	3	Emu	17:16:00	20:16:00	03:00:00
	30/07/20	7	Emu	13:09:00	16:09:00	03:00:00
	30/07/20	1	Emu	16:40:00	19:40:00	03:00:00
August	03/08/20	5	Emu	14:48:00	17:48:00	03:00:00
	03/08/20	3	Emu	11:17:00	14:17:00	03:00:00
	04/08/20	4	Emu	15:49:00	18:49:00	03:00:00
	04/08/20	4	Emu	12:18:00	15:18:00	03:00:00
	09/08/20	7	AF	11:30:00	14:30:00	03:00:00
	09/08/20	1	AF	07:50:00	10:50:00	03:00:00
	13/08/20	7	Emu	16:38:00	19:38:00	03:00:00
	13/08/20	1	Emu	13:01:00	16:01:00	03:00:00
	14/08/20	5	Emu	17:40:00	20:40:00	03:00:00
	14/08/20	3	Emu	14:09:00	17:09:00	03:00:00
	20/08/20	2	Gma	10:15:00	13:15:00	03:00:00
	21/08/20	7	Emu	17:15:00	20:15:00	03:00:00
	21/08/20	1	Emu	13:22:00	16:22:00	03:00:00
	23/08/20	6	Emu	11:39:00	14:39:00	03:00:00
	23/08/20	6	Emu	15:10:00	18:10:00	03:00:00
	24/08/20	2	Gma	07:30:00	10:30:00	03:00:00
	24/08/0	2	Gma	11:00:00	14:00:00	03:00:00
	25/08/20	3	Emu	14:04:00	17:04:00	03:00:00
	25/08/20	5	Emu	10:33:00	13:33:00	03:00:00
	27/08/20	6	Emu	16:28:00	19:28:00	03:00:00
	27/08/20	4	Emu	12:05:00	15:05:00	03:00:00

Annex D – Black Grouse Surveys

Month	Date	Surveyor	Star time	End time	Duration (hh:mm)
May	11/05/19	AF	04:00	07:00	03:00
	24/05/19	AF	03:30	06:45	03:15
	12/05/20	Aco	04:20	07:40	03:20
	12/05/20	AF	04:10	07:00	02:50
	12/05/20	AF	04:15	07:15	03:00
	13/05/20	AF	04:00	07:00	03:00
	14/05/20	AF	04:00	07:00	03:00
	15/05/20	AF	03:50	06:50	03:00

Surveyors: AF – Adam Fraser ACO – Andrew Cole

Annex E – 2018/19 Non-breeding Season Flight Activity Results

Month	Date	Start time	Species	No. of Birds	Flight Duration (sec)	Time at PCH (sec)
September	27/09/2018	12:50	PG	75	75	0
	27/09/2018	17:19	EA	1	75	75
	28/09/2018	11:21	EA	1	150	150
	28/09/2018	12:14	EA	1	75	45
	28/09/2018	14:10	EA	1	60	60
	28/09/2018	14:21	EA	1	30	0
	28/09/2018	14:23	EA	1	45	0
	28/09/2018	14:27	EA	1	45	15
	28/09/2018	14:30	EA	1	45	30
	28/09/2018	14:45	EA	1	30	15
	29/09/2018	09:37	EA	1	45	45
	29/09/2018	11:01	EA	1	90	90
	30/09/2018	09:54	PG	100	90	0
	30/09/2018	11:30	PG	57	90	0
	30/09/2018	10:43	WS	6	60	0
October	10/10/2018	17:25	EA	1	45	30
	10/10/2018	17:36	EA	1	45	30
	10/10/2018	17:41	EA	1	75	60
	10/10/2018	17:23	EA	1	15	0
	12/10/2018	11:41	WE	2	150	150
	12/10/2018	12:24	EA	1	165	45
	19/10/2018	12:33	GP	7	45	30
	19/10/2018	13:30	WS	6	120	120
	19/10/2018	16:42	GD	1	195	0
	20/10/2018	12:43	WE	1	270	255
	20/10/2018	12:44	WE	1	45	45
	20/10/2018	17:28	WE	1	30	30
	21/10/2018	12:09	WE	1	45	15
	21/10/2018	12:14	WE	1	45	45
	21/10/2018	13:02	EA	1	15	0
	21/10/2018	13:31	WE	2	75	75
November	09/11/2018	12:37	EA	1	45	45
	10/11/2018	12:04	EA	1	150	15
December	18/12/2018	13:01	EA	1	315	270
	18/12/2018	13:33	EA	1	390	165
	19/12/2018	11:04	EA	1	45	0
	19/12/2018	14:56	EA	1	210	210
January	15/01/2019	13:50	EA	1	120	75
	15/01/2019	13:57	EA	1	105	90
	16/01/2019	14:17	EA	1	60	60
February	12/02/2019	09:52	GP	3	30	30
	23/02/2019	12:58	GD	2	30	0

Month	Date	Start time	Species	No. of Birds	Flight Duration (sec)	Time at PCH (sec)
	23/02/2019	15:04	EA	1	45	15
	23/02/2019	15:36	EA	1	105	75
	23/02/2019	16:14	EA	1	135	0
March	05/03/2019	11:31	GP	1	30	30
	06/03/2019	14:50	EA	1	30	30
	25/03/2019	10:42	WS	17	90	60
	25/03/2019	11:19	EA	1	135	60
	25/03/2019	11:27	EA	1	15	15
	26/03/2019	14:21	EA	1	45	0
	31/03/2019	13:04	GP	2	15	0

Notes: PCH – Potential collision risk height (see above text for details).

Annex F – 2019 Breeding Season Flight Activity Results

Month	Date	Start time	Species	No. of Birds	Flight Duration (sec)	Time at PCH (sec)
	05/04/19	15:40	GK	2	60	45
	05/04/19	14:55	GP	1	45	0
	08/04/19	11:22	PG	22	75	75
	08/04/19	10:40	EA	1	90	90
	08/04/19	11:15	PG	14	120	120
	17/04/19	08:57	GK	1	75	30
	17/04/19	09:20	GK	3	90	90
	17/04/19	11:37	GP	2	45	0
	23/04/19	11:24	GK	2	30	0
	23/04/19	10:21	PG	50	105	105
	23/04/19	10:01	GK	1	240	195
	23/04/19	10:58	GK	1	150	120
April	24/04/19	11:42	EA	1	165	165
	04/05/19	17:10	DN	1	45	0
	04/05/19	17:30	DN	2	60	30
	04/05/19	18:05	GP	1	45	0
	05/05/19	14:08	GP	2	75	60
	05/05/19	14:36	GK	1	45	15
	07/05/19	08:50	GP	1	15	0
	07/05/19	13:26	GK	1	240	225
	07/05/19	12:00	GP	1	75	60
	12/05/19	08:14	GP	2	30	0
	12/05/19	08:06	GK	1	45	30
	12/05/19	09:42	DN	1	45	0
	12/05/19	07:45	GK	1	75	30
	15/05/19	07:34	GK	1	90	90
	18/05/19	15:47	GK	1	45	0
May	27/05/19	14:31	GK	1	105	105
	01/06/19	12:40	GK	1	60	0
	01/06/19	13:10	EA	1	120	120
	02/06/19	12:50	EA	1	75	75
	02/06/19	15:00	EA	1	45	45
	03/06/19	13:14	GP	2	60	0
	03/06/19	15:10	GP	1	75	60
	03/06/19	13:30	DN	2	15	0
	03/06/19	09:10	GP	2	15	0
	03/06/19	13:00	GP	1	15	0
	03/06/19	10:10	GP	1	15	0
	07/06/19	15:52	GK	2	60	30
	07/06/19	17:08	GK	17	30	0
	07/06/19	16:50	GP	1	45	0
	07/06/19	16:04	DN	1	30	0
	07/06/19	13:36	GK	1	45	45
	07/06/19	13:09	DN	2	30	0
	07/06/19	13:05	DN	1	30	0
	07/06/19	16:41	GP	2	60	60
	19/06/19	13:08	WE	1	135	135
	20/06/19	12:49	GP	1	60	30
	20/06/19	11:58	EA	1	150	150
	20/06/19	11:40	EA	1	105	105
	20/06/19	06:50	GP	1	60	30
June	20/06/19	07:06	GP	1	30	0

Month	Date	Start time	Species	No. of Birds	Flight Duration (sec)	Time at PCH (sec)
	21/06/19	13:05	EA	1	165	0
	28/06/19	16:08	GP	1	45	0
	28/06/19	17:30	GP	1	75	0
	28/06/19	17:46	DN	1	30	0
	01/07/19	11:09	EA	1	135	90
	01/07/19	13:36	EA	1	195	195
	01/07/19	16:58	EA	1	195	195
	04/07/19	10:55	EA	1	165	165
	04/07/19	08:46	GP	2	45	0
	05/07/19	10:05	PG	3	105	105
	19/07/19	12:41	EA	2	210	210
	19/07/19	12:08	EA	1	165	165
	20/07/19	08:01	GK	1	45	0
	20/07/19	08:26	GP	2	75	0
	20/07/19	08:40	GP	1	30	0
	20/07/19	12:52	ML	1	60	60
	20/07/19	14:06	GJ	15	150	150
	20/07/19	14:32	GJ	8	105	105
	23/07/19	14:06	GJ	7	45	30
July	25/07/19	12:50	EA	1	165	165
	03/08/19	17:10	EA	2	225	225
	03/08/19	18:48	GP	1	45	0
	13/08/19	12:06	EA	1	270	270
August	21/08/19	15:10	ML	1	60	0

Notes: PCH – Potential collision risk height (see above text for details).

Annex G – 2019/2020 Non-breeding Season Flight Activity Results

Month	Date	Start time	Species	No. of Birds	Flight Duration (sec)	Time at PCH (sec)
September	22/09/19	14:52	PG	15	180	180
	22/09/19	14:48	PG	22	135	135
	24/09/19	10:33	GJ	28	225	225
	27/09/19	11:56	GJ	25	150	150
	27/09/19	12:14	EA	1	135	135
	27/09/19	14:12	GJ	18	75	75
	30/09/19	15:08	PG	40	120	0
	30/09/19	15:15	PG	33	165	165
October	29/10/19	10:08	WS	8	105	105
November	05/11/19	13:08	EA	1	330	330
	08/11/19	09:36	WE	1	150	150
	08/11/19	10:04	GJ	22	195	135
	09/11/19	10:10	EA	1	75	75
	09/11/19	10:46	EA	1	150	150
	13/11/19	10:35	WE	1	165	165
	15/11/19	14:47	EA	1	225	165
	25/11/19	08:50	PG	30	90	0
	25/11/19	09:03	PG	26	165	0
December	03/12/19	10:45	WE	4	75	0
	03/12/19	11:52	EA	1	45	30
January	16/01/20	15:00	GP	2	75	45
	21/01/20	12:31	SN	1	105	45
February	16/02/20	16:10	GP	1	45	0
	18/02/20	14:12	GP	1	60	30
March	03/03/20	13:06	GP	1	60	45
	03/03/20	13:48	GP	2	30	0
	08/03/20	10:42	EA	1	150	150

Notes: PCH – Potential collision risk height (see above text for details).

Annex H – 2020 Breeding Season Flight Activity Results

Month	Date	Start time	Species	No. of Birds	Flight Duration (sec)	Time at PCH (sec)
May	11/05/20	12:06	GP	1	30	15
	13/05/20	12:51	EA	1	30	30
	18/05/20	13:04	EA	1	150	45
	18/05/20	13:08	EA	1	75	45
	19/05/20	13:02	SN	1	75	60
	19/05/20	13:38	SN	1	105	30
	19/05/20	15:14	GP	1	60	45
	20/05/20	12:26	GK	1	60	135
	20/05/20	15:26	OS	1	105	45
	20/05/20	16:22	SN	1	165	60
	20/05/20	16:34	SN	1	45	30
	20/05/20	17:27	GK	1	75	75
	20/05/20	18:06	SN	1	60	75
	24/05/20	14:41	DN	1	15	0
	25/05/20	07:59	GP	1	45	0
	25/05/20	08:11	ML	1	15	45
	25/05/20	12:55	OS	1	45	0
	25/05/20	13:56	HH	1	45	15
	27/05/20	06:33	SN	1	225	225
	27/05/20	09:52	Unknown	1	15	0
	27/05/20	11:00	EA	1	360	360
	28/05/20	14:50	GP	1	30	0
	28/05/20	16:55	HH	1	120	120
	29/05/20	18:02	DN	1	45	30
	29/05/20	19:44	GK	1	45	0
	30/05/20	08:02	GP	1	45	30
	30/05/20	08:04	GK	2	45	15
	30/05/20	08:11	GP	2	30	0
	30/05/20	08:38	GJ	26	60	30
	30/05/20	09:13	SN	1	45	45
	30/05/20	09:41	GP	2	15	30
	30/05/20	14:06	KT	1	30	30
June	01/06/20	16:56	HH	1	60	15
	01/06/20	16:57	OS	1	45	30
	01/06/20	20:43	CG	6	45	45
	04/06/20	11:02	EA	1	60	30
	04/06/20	14:25	GK	1	45	60
	12/06/20	07:34	SN	1	255	255
	12/06/20	08:21	GP	1	45	45
	12/06/20	08:29	SN	1	75	30
	12/06/20	08:57	SN	1	105	105
	17/06/20	13:43	GP	1	30	0
	17/06/20	14:05	GK	1	60	30
	17/06/20	14:35	GK	1	30	0
	18/06/20	14:07	GK	1	45	0
	19/06/20	17:27	DN	1	15	0
	19/06/20	17:27	DN	1	15	0
	19/06/20	17:29	DN	1	15	0
	19/06/20	17:32	DN	1	15	0
	19/06/20	17:33	DN	1	15	0
	19/06/20	17:36	DN	1	15	0
	19/06/20	17:39	DN	1	15	0

Month	Date	Start time	Species	No. of Birds	Flight Duration (sec)	Time at PCH (sec)
	19/06/20	17:41	DN	1	15	0
	19/06/20	17:41	DN	1	15	0
	19/06/20	17:42	DN	1	15	0
	19/06/20	17:43	DN	1	15	0
	19/06/20	17:44	DN	1	15	0
	19/06/20	17:46	GK	1	15	0
	19/06/20	17:46	DN	1	15	0
	19/06/20	19:50	DN	1	15	0
	19/06/20	19:51	DN	1	15	0
	22/06/20	11:15	GP	1	30	0
	22/06/20	11:15	GP	1	15	165
	22/06/20	12:41	DN	1	30	15
	22/06/20	16:35	GP	1	255	0
	23/06/20	07:48	GP	2	30	15
	23/06/20	09:25	SN	1	45	0
	23/06/20	13:28	HH	1	135	0
July	02/07/20	13:12	OS	1	15	15
	06/07/20	12:43	EA	1	45	0
	09/07/20	11:42	GP	1	30	30
	10/07/20	17:36	GK	1	15	0
	18/07/20	06:48	GP	1	30	0
	18/07/20	08:36	EA	1	120	0
	18/07/20	10:18	GP	1	45	120
	25/07/20	11:38	HH	1	90	120
	25/07/20	13:20	OS	1	120	90
	26/07/20	06:48	GP	1	30	0
	26/07/20	07:12	GP	1	45	0
	26/07/20	07:22	DN	1	45	0
	29/07/20	18:20	EA	1	45	15
	29/07/20	18:20	ML	1	45	15
	29/07/20	18:53	ML	1	15	0
August	14/08/20	20:22	ML	1	195	195
	20/08/20	10:59	PE	1	195	0
	20/08/20	12:35	PE	1	30	90

Notes: PCH – Potential collision risk height (see above text for details).

Annexe I – Cumulative Development Compilation

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
Achairn	Constructed (NS)	3	93km	Conifer plantation	No effects found to be of significance to ornithological features.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Achany	Constructed (NS)	19	4km	Conifer plantation, blanket bog and wet heath mosaic	No effects found to be of significance to ornithological features.	No collision risk to target species.	One pair of greenshank Five pairs of golden plover.	Low	Minor significant – displacment of golden plover and greenshank is also expected at the Proposed Development however the numbers of bird being displaced are not expected to impact the population, with no detectable decline in population. Therefore, effect of displacement is of Negligible magnitude of change which for a high sensitivity receptor is of Minor significance
Ackron	Planning (EIA)	12	68km	Pasture, blanket bog anf wet heath mosaic	The effects on ornithologial features is the collision risk of 1 curlew every 52 years and 1 golden plover every 59 years.	SPA and NHZ GP: 0.017 CU: 0.019	One pair of golden plover..	Low	Minor significant – displacment of golden plover and greenshank is also expected at the Proposed Development however the numbers of bird being displaced are not expected to impact the population, with no detectable decline in population. Therefore, effect of displacement is of Negligible magnitude of change which for a high sensitivity receptor is of Minor significance

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
Armadale	Scoping (scoping document)	23	60km	Pasture, blanket bog and wet heath mosaic	No effects found to be of significance to ornithological features.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Bad a Cheo	Constructed (NS)	13	66km	Conifer plantation, blanket bog and wet heath mosaic	The effects on ornithologial features.	SPA and NHZ GP: 0.51	No territories found to be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Bad Fearn	Constructed (NS)	6	70km	Dry and wet heath, acid grassland and blanket bog	The effects on ornithological features is the collision risk of 1 curlew every 12 years, 1 golden eagle every 70 years, 1 golden plover every 4 years.	SPA and NHZ EA: 0.014 GP: 0.28 CU: 0.08	EA: N/A GP: up to two pairs lost in the wider area CU: N/A	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Baillie Hill	Constructed (NS)	21	80km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the risk to golden plover of one bird every 25 years.	NHZ GP: 0.04	No territories found to be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Beinn nan Oighrean	Constructed	2	28km	Dry and wet heath, acid grassland and blanket bog	N/A	No collision risk to target species.	No territories found to be displaced.	N/A	N/A

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
Beinn Tharsuinn	Constructed	17	29km	Dry and wet heath, acid grassland and blanket bog	Negligible impacts on all species recorded.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Bettyhill	Constructed (NS)	2	57km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found but there is a risk to golden eagle of one bird every 250 years.	SPA and NHZ EA: 0.004	No territories found to be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Braemore	Constructed (NS)	18	7km	Conifer plantation, blanket bog and wet heath mosaic	No effects found to be of significance to ornithological features.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Buolfurich	Constructed (NS)	15	75km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Burn of whilk	Constructed (NS)	9	90km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the risk to golden eagle of 1 bird each 100 years.	SPA and NHZ EA: 0.01	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
Camster	Constructed (NS)	25	87km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Camster II	Withdrawn (NS)	55 (scoping document)	87km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the risk to greenshank of 1 bird every 100 years.	SPA and NHZ GK: 0.01	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Causeymire	Constructed (NS)	21	80km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	3 curlew territories lost.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Coire na Cloiche	Constructed (NS)	13	29km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the collision risk to golden eagle of 1 bird every 134 years.	SPA and NHZ EA: 0.0075	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Corriemoillie	Consented (NS)	19	41km	Blanket bog and wet heath mosaic	No significant effects to ornithological	SPA and NZ EA: 0.005	No territories	None	Not significant – there are no effects from this wind farm that will cumulatively impact

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
					features found. The impact of the development is the collision risk to 1 golden eagle every 200 years, 1 golden plover every 125 years and 1 greenshank every 100 years.	GK: 0.01 GP: 0.008	found to be displaced.		ornithological features of the Proposed Development
Creag Riabhach	Consented (NS)	22	19km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the collision risk to golden eagle of 1 bird every 25 years.	SPA and NHZ EA: 0.04	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Creag Riabhach Grid Connection	Consented (EIA)	N/A	18km	Blanket bog and wet heath mosaic	Negligible impact on all species covered.	No CRM performed.	Potential to displace 1 golden plover territory.	None	Not significant – there are no effects from this development that will cumulatively impact ornithological features of the Proposed Development
Drum Hollistan	Appeal (NS)	17	70km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the	SPA and NHZ GP: 0.054	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
					development is the collision risk to 1 golden plover every 18 years.				
Forss 2	Constructed (NS)	4	82km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No CRM performed.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Forss ext 3	Planning (EIA)	2	82km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found	SPA and NHZ GP: 0.012	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Golticlay	Consented (EIA)	19	81km	Connifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Gordonbush	Constructed (NS)	35	38km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the displacement of between 6 and 12 golden plover and collision risk to golden plover of 1.27 birds each years and	NHZ EA: 0.066 GP: 1.27	Between 6 and 12 golden plovers could be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
					golden eagle of 1 bird every 15 years.				
Gordonbush Extension	Constructed (NS)	11	38km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Halsary	Constructed (NS)	15	84km	Conifer plantation	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Kilbraur	Constructed (NS)	19	33km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Kilbraur Extension	Constructed (EIA)	8	32km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Kintradwell	Application (NS)	15	42km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the collision risk to golden eagle of 1 bird every 5 years and 1 golden	SPA and NHZ EA: 0.19 GP: 0.03	Up to 12 GP territories could be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
					plover every 33 years.				
Lairg	Constructed (NS)	3	14km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the displacement of between 14 and 28 golden plover pairs and the collision risk to golden eagle of 1 bird every 71 years.	NHZ EA: 0.014	Between 14 and 28 golden plover pairs could be displaced, however this is over a large area of 10km^2.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Lairg Extension	Consented (NS)	10	14km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	Ge: 0.031 HH: 0.018 Me: 0.006 Pe: 0.005 GP: 0.006 .	No territories found to be displaced (0 to 4 territories, depending on displacement distance and HMP benefit	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Lairg to Loch Buidhe overhead line	Scoping (EIA)	N/A	14km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this development that will cumulatively impact ornithological features of the Proposed Development

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
Limekiln	Consented (NS)	24	71km	Mainly conifer plantation with areas of bog and wet heath.	Negligible impacts on golden plover.	No CRM performed for golden plover.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Limekiln Extension	Application (EIA)	5	71km	Mainly conifer plantation with areas of bog and wet heath.	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Limekiln Grid Connection	Consented (EIA)	N/A	71km	Mainly conifer plantation with areas of bog and wet heath.	Negligible and low impacts recorded for all species,	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this development that will cumulatively impact ornithological features of the Proposed Development
Lochluichart	Constructed (NS)	17	43km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the collision risk to golden eagle of 1 bird every 200 years.	SPA and NHZ EA: 0.005	No territories found to be displaced.	None	Not significant – there are no effects from this development that will cumulatively impact ornithological features of the Proposed Development
Lochluichart Extension	Constructed (EIA)	6	42km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the collision risk to golden	SPA and NHZ EA: 0.005	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
					eagle of 1 bird every 200 years				
Lochluichart Extension II	Consented (EIA)	17	40km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Meall Buidhe	Application	9	12km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the collision risk to golden eagle of 1 bird every 20 years, greenshank of 1 bird every 77 years and golden plover of 1 bird every 12 years.	NHZ EA: 0.081 GK: 0.013 GP: 0.081	No displacement is predicted.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Melness	Constructed (NS)	3	51km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the collision risk to golden plover of 2	NHZ GP: 2	4 golden plover territories displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
					birds every year.				
Novar	Constructed (Post-construction monitoring)	34	34km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found.	CRM not performed, but the fifth year post construction monitoring report recorded no turbine collisions for golden eagle, greenshank, golden plover, dunlin or curlew.	Due to a lack of breeding in the area occupied by the wind farm pre-construction no displacement was recorded.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Novar extension	Constructed	16	36km	Conifer plantation, blanket bog and wet heath mosaic	N/A	N/A	N/A	N/A	N/A
Rosehall	Constructed (NS)	19	3km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced during the 6th year of post-construction monitoring.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Slickly	Constructed (NS)	11	100km	Mainly conifer plantation with areas of bog and wet heath	No significant effects to ornithological features found. The impact of	SPA and NHZ GP: 0.13	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
					the development is the loss of 1 golden plover every 7 years.				
South Kilbraur	Application (NS)	7	30km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the loss of 1 curlew territory and 1 golden plover territory. Collision risk modelling found 1 golden eagle every 13 years, 1 golden plover every 3 years.	SPA and NHZ EA: 0.07 GP: 0.33	1 curlew territory and 1 golden plover territory will be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Spaceport	Consented (Scoping report)	N/A	55km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	CRM not performed.	No territories found to be displaced.	None	Not significant – there are no effects from this development that will cumulatively impact ornithological features of the Proposed Development
Strathrory	Application (NS)	8	33km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Strath Tirry	Application (EIA)	4	12km	Conifer plantation, blanket bog	No significant effects to	No collision risk to target species.	No territories	None	Not significant – there are no effects from this wind farm that will cumulatively impact

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
				and wet heath mosaic	ornithological features found.		found to be displaced.		ornithological features of the Proposed Development
Strathy North	Constructed (NS)	33	58km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the risk to golden eagle of 1 bird every 25 years and greenshank of 1 bird every 10 years.	SPA and NHZ EA: 0.04 GK: 0.1	PCM has found no long term decline in Golden Plover, Dunlin or Greenshank .	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Strathy South	Consented (NS)	39	50km	Conifer plantation, blanket bog and wet heath mosaic	No significant effects to ornithological features found. The impact of the development is the risk to greenshank of 1 bird every 8 years and golden eagle of 1 bird every 117 years	SPA and NHZ EA: 0.0085 GK:0.29	Potential for 3 Greenshank , 4 Golden Plover and 3 2 Dunlin territories could be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Strathy Wood	Planning (NS)	16	59km	Conifer plantation	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development

Site	Stage (information source)	Number of turbines	Distance	Main Habitats	Significant effects	Annual collision rate (SPA / NHZ)	Number of territories displaced	Potential cumulative effects	Effect significance
Strathy Wood Grid Connection	Consented (EIA)	6.5 km a 132 kilovolt (kV) overhead cable	59km	Conifer plantation, blanket bog and wet heath mosaic	Potential to displace large raptors. Potential collision risk to greenshank.	No specific CRM performed but potential collision risk to greenshank.	Potential to displace large raptors such as golden eagle.	None	Not significant – there are no effects from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Stroupster	Constructed (NS)	13	103km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Wathegar	Constructed (NS)	5	92km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Wathergar 2	Constructed (EIA)	9	92km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development
Water Treatment Works Achvraie Achiltibuie	Constructed (NS)	1	40km	Blanket bog and wet heath mosaic	No significant effects to ornithological features found.	No collision risk to target species.	No territories found to be displaced.	None	Not significant – there are no effect from this wind farm that will cumulatively impact ornithological features of the Proposed Development

Annexe J – Evidence Relating to Golden Eagle Macro-Avoidance

Potential effects of the proposed Gordonbush Extension Wind Farm on golden eagles

D.P. Whitfield & A.H. Fielding

December 2018

Natural Research Ltd, Banchory, Scotland

Contents

Summary

- Evidence from recent Scottish research on golden eagles indicates that wholesale displacement ('macro-avoidance' of) wind farms is the substantive likely effect of wind farms against which the impact of new proposals should be assessed. The prospect of collision fatality is unlikely, and its inclusion in an assessment of potential impacts is not justified evidentially.
- Visual observations gathered and repeatedly reported by Northern Ecological Services (NES) to SSE, around the operational Gordonbush Wind Farm (GB) cannot directly inform, due to selected vantage points (VPs) and their viewsheds, the use of the proposed Gordonbush Extension Wind Farm (GBX) by golden eagles.
- Recent NES field observations of golden eagle flight activity in the vicinity of GB and GBX are, nevertheless, potentially useful in other contexts.
- Visual observations around GB illustrate that the habitat within the wind farm was not suitable and/or that eagles were disturbed by working turbines (confirming wider recent research).
- [redacted]
- PAT (Predicting Aquila Territory) modelling of prospective habitat loss (via a displacement effect) in the known relevant territory due to GB and GBX were negligible.
- Golden Eagle Topography (GET) modelling also revealed that predicted habitat losses via a displacement effect were negligible due to GB and GBX.
- [redacted]

1. Background

This Confidential Annex is designed to inform an assessment of the potential effects and impacts of the proposed Gordonbush Extension Wind Farm on golden eagles *Aquila chrysaetos* by considering: the most recent research on golden eagle interactions with wind farms; local observations of eagles in the vicinity of the Gordonbush Wind Farm (and its proposed extension); and outlining results from two predictive models of golden eagle habitat use as they apply to the operational Gordonbush Wind Farm and the proposed Gordonbush Extension Wind Farm (individually and cumulatively). Subsequent sections cover:

- Likely adverse effect of wind farms on golden eagles in Scotland (displacement vs collision).
- Relevance of EA flight observations collected around Gordonbush Wind Farm (and its proposed extension).
- PAT model predictions.
- GET predictions.
- Conclusions.

2. Likely adverse effect of wind farms on golden eagles in Scotland (displacement vs collision)

Wind farms may have two broad potential adverse effects on birds. These two effects, which are largely mutually exclusive and antagonistic processes, involve displacement from the vicinity of wind turbines (macro-avoidance: May 2015), or birds dying through collision with rotating turbine blades (Madders & Whitfield 2006).

The golden eagle has received substantial research attention over its relationship with wind farms (e.g. Fielding et al. 2006, Martínez et al. 2010), because of its apparent vulnerability to turbine blade strikes (Watson et al. 2018) and demographic sensitivity to increased mortality in older birds (Whitfield et al. 2004, Hunt et al. 2017). This attention was initially prompted, and has been continued, by research at the Altamont Pass Wind Resource Area (APWRA) in California, USA; a particularly large facility where scores of golden eagles are killed by collision each year (Hunt et al. 1999, 2017, Hunt 2002, Smallwood & Thelander 2008, Smallwood et al. 2009, Watson et al. 2018). Although not explicitly studied, any displacement from (macro-avoidance of) the APWRA's turbine arrays appears to be minimal (Hunt 2002, Madders & Whitfield 2006, Whitfield 2009, Watson et al. 2018).

Many other turbine installations across USA have recorded golden eagle collisions, and if not apparently approaching the fatality levels at APWRA, they imply a widespread comparable absence of macro-avoidance (Erickson 2002, Pagel et al. 2013, Smallwood 2013, USFWS 2016, Hunt & Watson 2016, Watson et al. 2018). Johnson et al. (2014) noted, however, a displacement response in migrating eagles, through flight altitude, to a wind farm in western USA.

Several studies of golden eagle habitat use have presumed collision with turbine blades, even when these studies were not based at operational facilities (Tapia et al. 2009, Katzner et al. 2012, Johnston et al. 2013, Sandgren et al. 2014, Watson et al. 2014, Péron et al. 2017). Models to predict collision rates of golden eagles have also been formulated (Whitfield 2009, New et al. 2015).

By potential contrast (although see Johnston et al. 2014), in Scotland Walker et al. (2005) suggested that a pair of resident golden eagles may have been displaced wholesale from an operational wind farm but could not distinguish between macro-avoidance and attraction to alternative areas due to habitat management away from the wind farm.

Whitfield & Fielding (2017) examined relationships between wind farms and satellite tagged golden eagles during the years of juvenile dispersal in Scotland. Taking account of tag record dates and wind farm operational dates, only 125 of the 360,711 (0.03 %) tag records were within 500 m of an operational turbine. Only 17 (0.005 %) and 57 (0.016 %) records were within 150 m and 250 m of operational wind turbines, respectively. Unlike other studies, which have been based at single wind farms (e.g. Walker et al. 2005, Johnson et al. 2014) there were 39 wind farms involved in the research of Whitfield & Fielding (2017), and the database of individual eagles was over 100 birds.

Given that the habitat selection of wind farm developers and golden eagles frequently coincides (Madders & Whitfield 2006, Fielding et al. 2006, Tapia et al. 2009, Martínez et al. 2010, Katzner et al. 2012, Johnston et al. 2013, Sandgren et al. 2014, Watson et al. 2014, Péron et al. 2017) the results of Whitfield & Fielding (2017) indicate that in Scotland dispersing golden eagles are typically displaced by ('macro-avoid') wind farms. This is in contrast to most results from the USA, for example (Pagel et al. 2013, Watson et al. 2018).

Consistent with the response to wind farms being displacement (macro-avoidance) rather than collision fatality, Whitfield & Fielding (2017) also noted that there were no records of satellite tagged birds being found dead or which had a 'suspicious' final location ('stopped no malfunction fate' indicative of likely sudden anthropogenic-caused death) within 1 km of any of the hundreds of wind turbines considered. Overall, there was no evidence that wind farms were a direct or indirect agent of anthropogenic influence on the sudden tag failures of many young golden eagles. The reverse was more evidentially likely – that young golden eagles appeared to avoid operational wind farms.

Whitfield & Fielding (2017) did not consider the responses of territorial golden eagles to wind farms. There are unpublished data, however, involving two territorial golden eagles which have been satellite tagged within Scottish territories which encompass wind farms in SW Scotland. In both these examples it appears that territorial birds avoid the airspace occupied by operational wind turbines (Whitfield et al. unpubl.data). At one of these territories not only did the resident territory holder apparently avoid the An Suidhe Wind Farm (Fig. 1) but so also did an intruding satellite tagged younger bird (Fig. 2). The An Suidhe Wind Farm was commissioned in 2010 and so there is no evidence that eagles had habituated to its disturbing presence several years hence. Similarly, the other wind farm (Cruach Mhor) in another territory was commissioned in 2004 and records of responses from a tagged territorial eagle over a decade later also, therefore, revealed no signs of habituation.

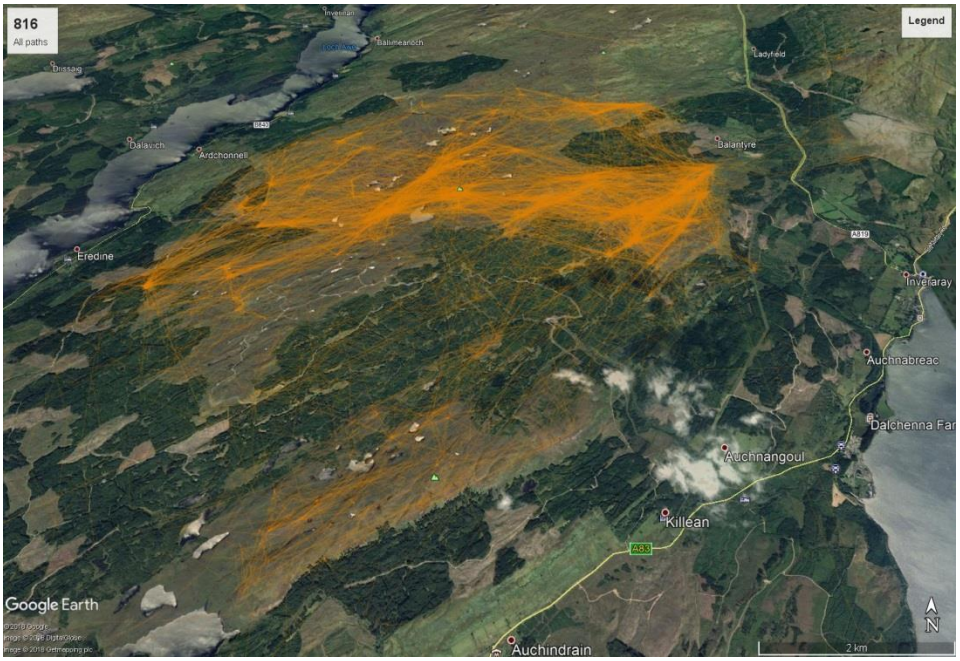


Fig. 1. Satellite tagging records up to early January 2018 from a male territorial eagle (816: tagged 1 March 2017). Note the apparent macro-avoidance of the An Suidhe Wind Farm (and large tracts of commercial forestry at upper elevations).

The finding of Walker et al. (2005) on displacement of territorial eagles from the Beinn an Tuirc Wind Farm in Kintyre was potentially confounded by the deliberate creation of suitable habitat away from the wind farm as part of a habitat management package. Any success of this management package may have drawn the eagles to better prey supplies away from the wind farm. Such possibilities did not apply to the two wind farms within tagged eagle territories (An Suidhe and Cruach Mhor), however, because neither development included any positive management for eagles away from the

wind farm. Rather, for Cruach Mhor, the complete clearance of commercial forest from within and in the vicinity of the turbine array, creating open moorland as part of the wind farm's construction, could have potentially been attractive for eagles.

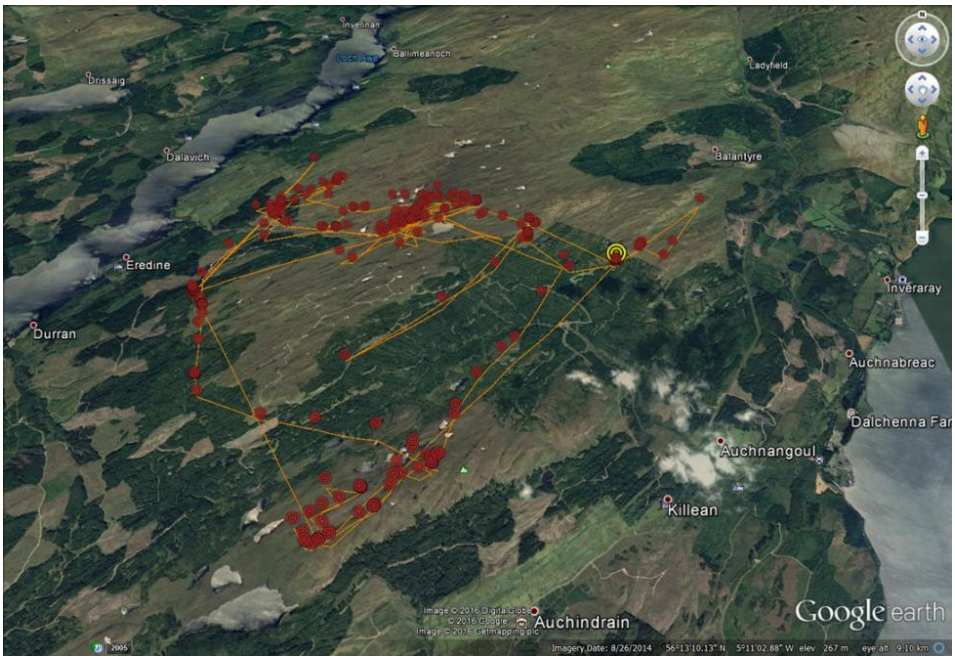


Fig. 2. A weekly snapshot of satellite tagging data from a young eagle, tagged as a nestling, which temporarily intruded into the territory occupied by 816 during dispersal movements. The An Suidhe Wind Farm was conspicuously circumnavigated at upper and lower elevations during this territorial intrusion.

Since the habitat use of dispersing and territorial golden eagles in Scotland appears to be similar (Fielding et al. unpubl data), this concordance on reaction to wind farms between birds of different age and territorial status is not surprising. The apparent substantive effect of wind farms on golden eagles of all ages and territorial status appears to be displacement (macro-avoidance) and there should be no or minimal expectation of collision fatality events at the proposed Gordonbush Extension Wind Farm (hereafter referred to as GBX) regardless of pre-construction use.

Assessment of the potential adverse effects of the proposal and consequent impacts on golden eagle due to GBX should therefore only consider displacement (macro-avoidance) and not a risk of collision fatality.

Use of collision risk models (e.g. Whitfield 2009) to explore potential impacts of collision fatalities would be evidentially inappropriate.

3. Relevance of golden eagle flight observations collected around GB and GBX

Since the operation of Gordonbush Wind Farm (hereafter termed GB) there have been several observations of eagle flight activity collected from vantage points in the vicinity of GB and GBX (Northern Ecological Services 2016, 2017, 2018a, 2018b). The area covered by GBX was not part of the vantage points' viewsheds covered by these observations, unfortunately. Notably the area was

not included in dedicated efforts to record golden eagle activity in 2017 and 2018 (Northern Ecological Services 2018a, b).

Nevertheless, these observations do provide local context to desk-based evaluations on how important GB and, potentially, GBX are to golden eagles. They also allow a local insight into predictions of macro-avoidance based on national datasets from satellite tagged birds (Whitfield & Fielding 2017). It should be noted, however, that these national datasets are based on remote data with a high degree of spatial accuracy (± 18 m, or less, on (X, Y) geography, and ± 22 m on (Z) height in space) which will be far more accurate than can be achieved by a field observer recording a moving bird from up to several hundred metres distance (as in NES reports).

3.1 Northern Ecological Services reports to SSE: abstracts

The report of Northern Ecological Services (2016) was not dedicated to surveys of golden eagle flights. It documented records of two golden eagle flights within the northeastern extremity of the GB survey area (turbines with 500 m buffer) which appeared to involve flying birds turning away from the location of T35.

Northern Ecological Services (2017) reported on visual surveys from vantage points which noted an increase in records of golden eagle flights within the 'wind farm survey area' from previous years (back to the 201/11 winter). Eleven flights were reported from this survey area, although all were outside the turbine array, and some appeared to be reactive directionally to the turbines. A further 13 flights were recorded "just outside the south-east boundary of the survey area", well away from the GB turbines.

Northern Ecological Services (2018a) noted that the survey in winter 2017/18 recorded 48 flights by golden eagles in the area around GB, but of these, only five flights were within 500 m of the turbines, a considerable reduction from the 11 flights recorded in the same area in winter 2016/17 (Northern Ecological Services 2017). Of the five flights within 500 m of the turbines, four were at turbine height, but came no closer than 230m from the nearest turbine. The only eagle seen to fly over part of the wind farm did so well above turbine height.

Northern Ecological Services (2018b) documented that the golden eagle survey at GB in spring and summer 2018 recorded 51 flights, of which 43 (84.3 %) were more than 500 m from the wind farm turbines. Of the eight flights that came within 500 m of the turbines, only two eagles (flying together) passed over the wind farm. They did so on a day when the rotors were not turning. One eagle which initially was flying towards the turbines, turned away when 160 m from them, flew parallel to them, then turned away.

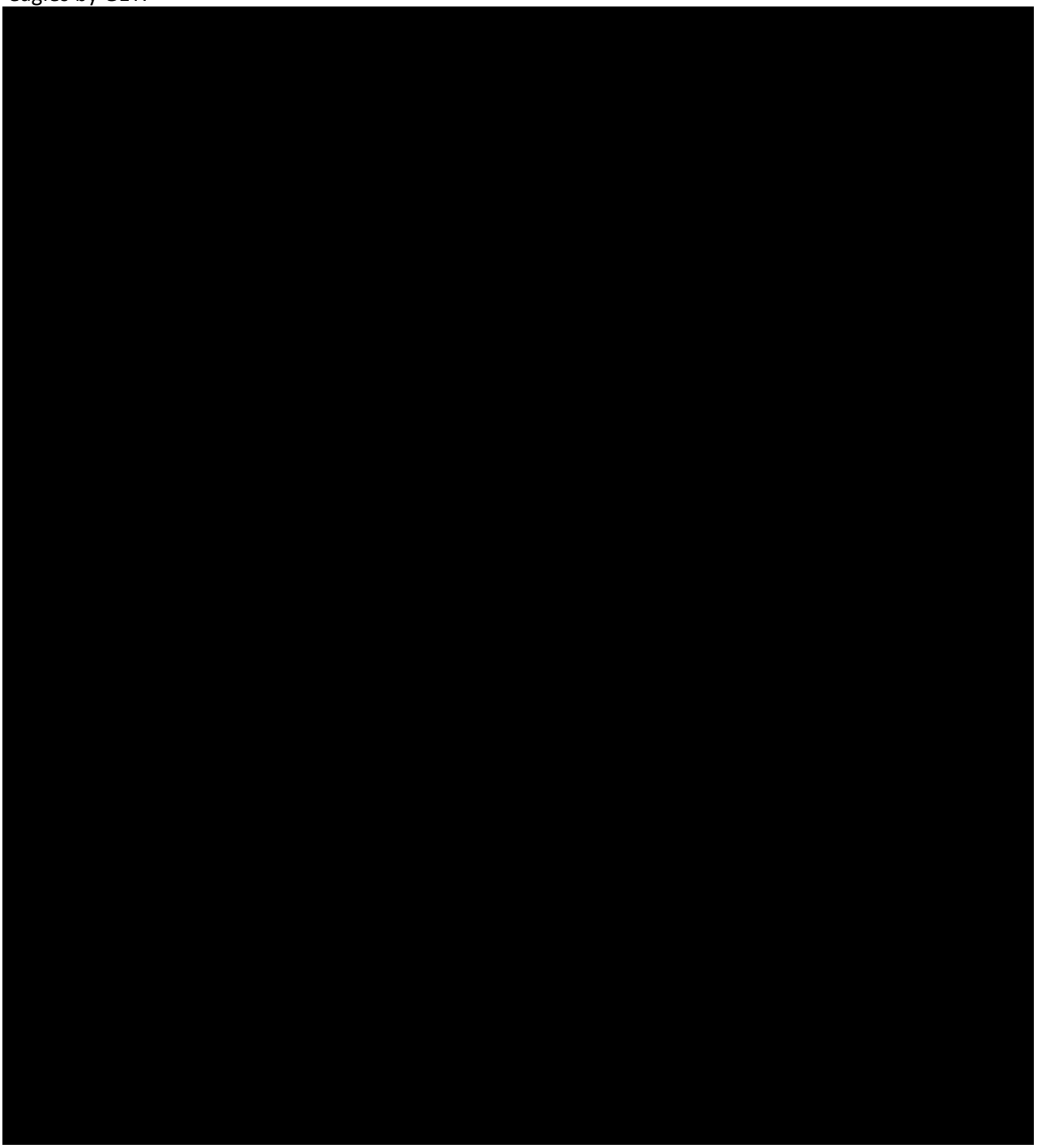
3.2 Summary of NES reports' relevance

The Northern Ecological Services (NES) vantage points (VPs) were ill-designed to record potential use of GBX by golden eagles, and so cannot inform this aspect of assessment of the impacts of GBX. This shortcoming does not mean, however, that an assessment of the potential use of GBX cannot be undertaken, since there are other avenues available to examine the likelihood and intensity of use.

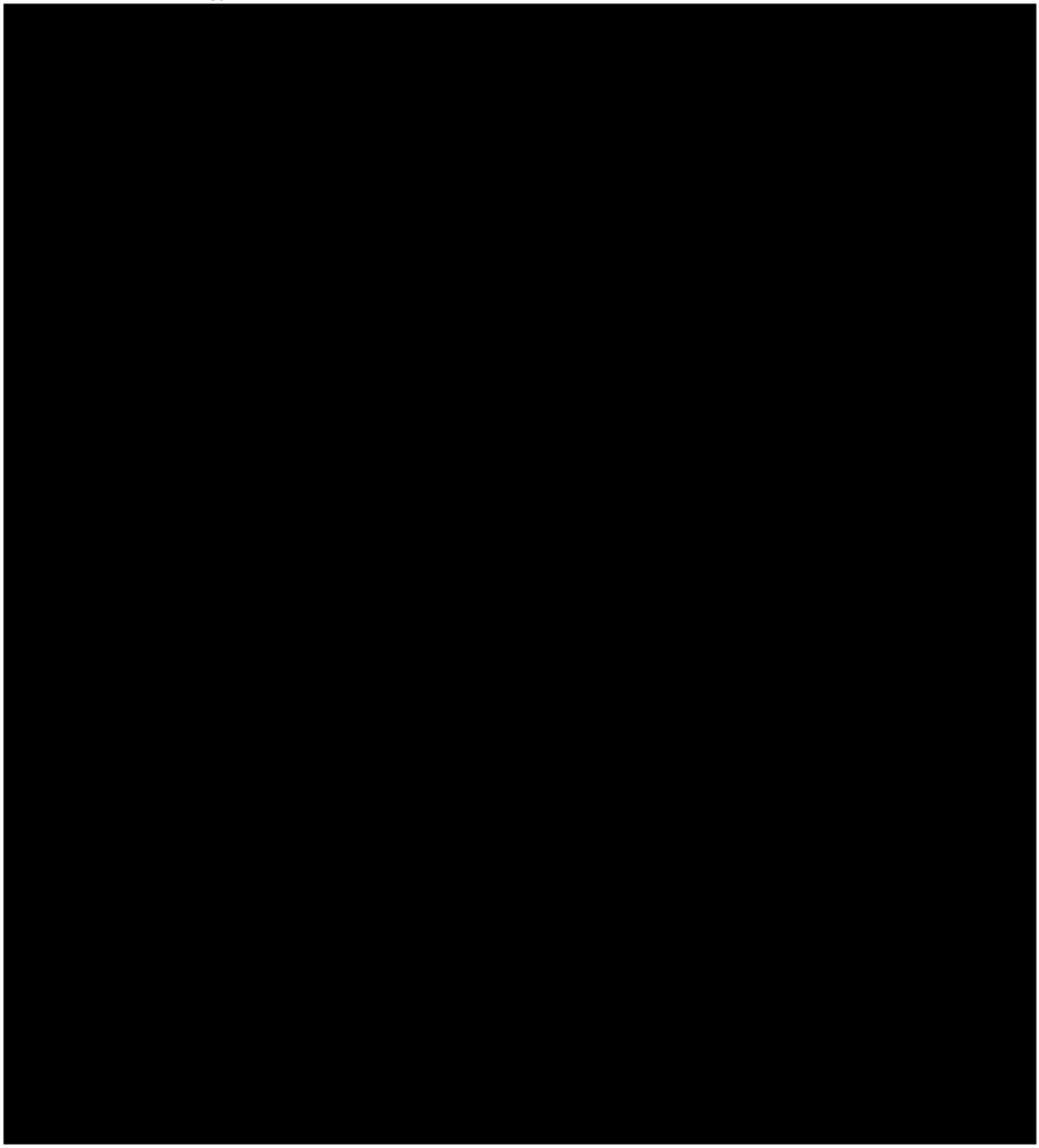
[redacted]

On likelihood of use, the NES eagle observations in the vicinity of GB and GBX provide important local context to more generic predictions, which will be covered additionally in more detail later.

Eagle flights recorded in recent reports from NES were overlaid on Golden Eagle Topography model (GET: Fielding et al. in press) habitat use predictions (Fig. 3). The near-absence of records from within GBX can be entirely due to the viewsheds and limitations of the NES vantage points i.e. even if birds had flown within GBX and its 500 m buffer more frequently, the NES VPs were ill-equipped to have been able to record this. Such limitations did not apply so far as eagles' use of the higher elevation surroundings of GB, however, and so these records can provide context to modelled predictions; as well as reactions to an operational wind farm. This apparently indicated that flight activity has been primarily recorded in areas predicted to be of preferential importance for golden eagles by GET.



Similarly, eagle flights recorded by recent reports from NES have been overlaid on PAT model (McLeod et al. 2002) habitat use predictions for the relevant known territory, [redacted] This, too, indicated that the NES observations tended to be concentrated in areas of higher predicted use; although less obviously so than for GET predictions (Fig.3). The subjective differences on 'better' GET predictions likely relate to failings of the PAT model in assuming degraded use with distance from the territory centre (see later: section 4) and that many of the flights probably involved non-territorial bird activity, as noted earlier.



Overall, the observations from these GB post-construction reports from NES to SSE suggest that:

- Golden eagles apparently did not use the airspace occupied by operational GB wind turbines. This could be because either they were disturbed (displaced) by the working

turbines (see above section) or that (see later) the habitat within GB was largely unsuitable. Likely both explanations played a part, since there were some (albeit relatively few, in total) records of flying birds actively turning away from working turbines, and that records were far more frequent in areas predicted to be more suitable by habitat preference models.

- [redacted]

4. PAT model predictions

The PAT (Predicting Aquila Territory: McLeod et al. 2002) model is based on several parameters of expected habitat use by territorial golden eagles:

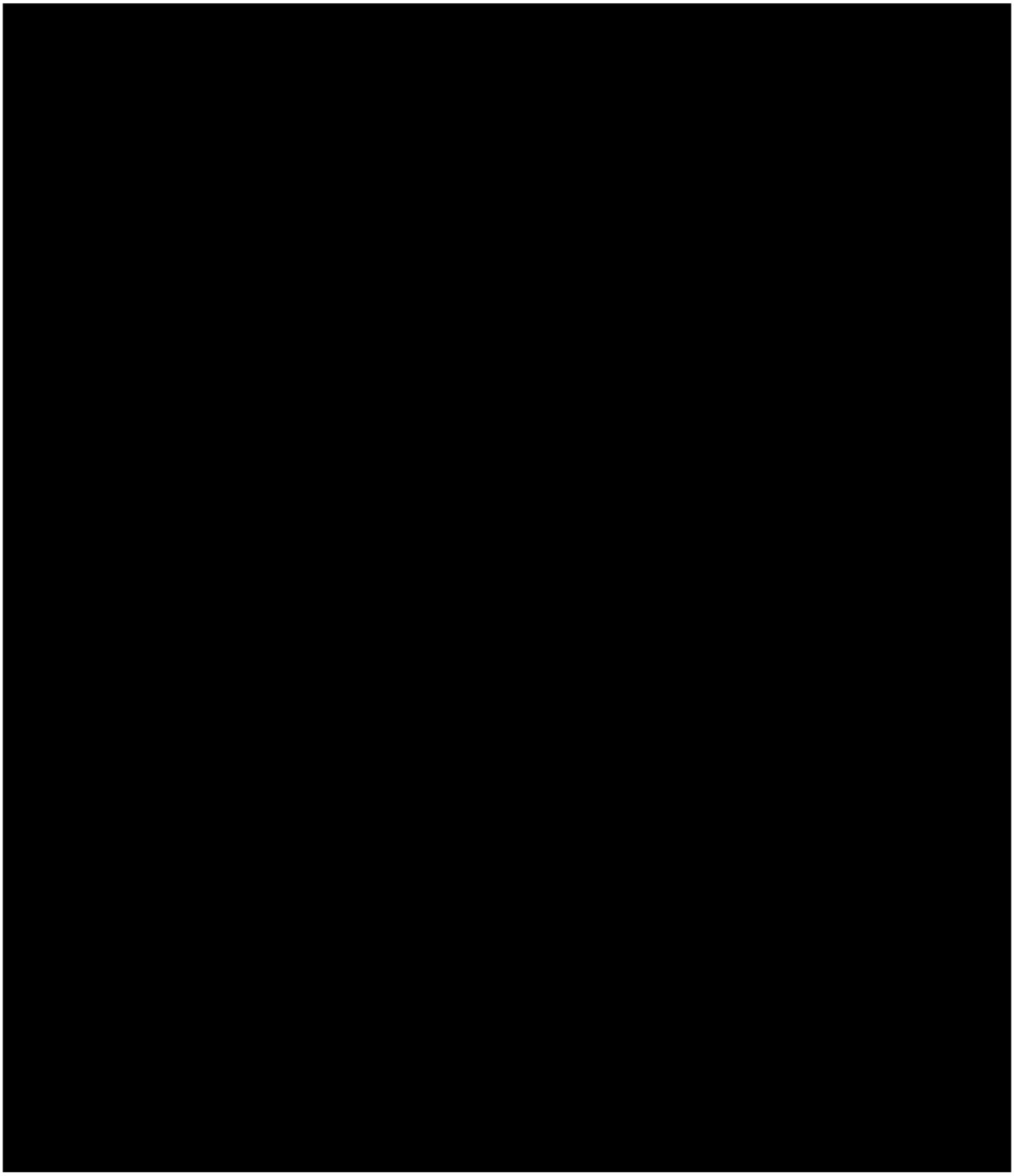
1. Preference for the proximity of topographic ridge features;
2. Preference for areas close to the active nest site/territory centre, so that preference degrades with distance from this feature;
3. Territory limits are designated by the use of Thiessen polygons, derived by Dirichlet Tessellation which assigns equidistant boundaries between neighbouring territory centres;
4. In the absence of a neighbouring territory centre within 12 km then a maximum ranging distance of 6 km from the territory centre is used; and
5. Several land covers are assumed to be avoided notably forestry and large water bodies (i.e. lochs or the sea).

The PAT is run in a spatial digital environment such as GIS, based on information on territory centres for the territory of interest and neighbouring territories; and topographic and broad land cover data (notably forestry and large water bodies). In considering potential loss of habitat due to displacement from a prospective wind farm it is assumed that such disturbance extends to a 500 m buffer from the proposed turbine array.

Information on breeding territory centres were solicited from the Highland Raptor Study Group (HRSG) and indicated [redacted] Best available information on nest site use was incorporated to determine territory centres for PAT model runs.

According to available data, GB and GBX [redacted] PAT predictions as regards the operational GB Wind Farm and the proposed GBX Wind Farm (with 500 m buffers) are illustrated in Fig. 5.

Aside from the PAT-predicted use within GB and GBX, other features should be noted: first, [redacted] and second that the boundaries were largely unconstrained at 6 km limits by widespread unsuitable habitat, except by fundamentally unsuitable habitat in the vicinity of GB and GBX in the northwestern limits, and by some commercial forestry plantations largely at the northeastern limits. The southeastern 'potential' was slightly pinched by the sea, also (Fig. 5).



The % habitat loss was first calculated for the 500m buffer of GBX which does not overlap with the original wind farm (GB) 500 m buffer. Using a PAT which assumed that the existing GB Wind Farm is an exclusion area (so no PAT predictions within the original wind farm) the predicted loss of ranging habitat to the extension was 0.19 %. If we assume that the existing GB is not an exclusion area then the predicted loss of ranging habitat to GBX was 0.17 %. As GBX [redacted] and largely in unsuitable habitat away from ridge features this result is unsurprising. As a comparison, the loss to the 500 m buffer around the GB turbines was 1.92 % which is again unsurprising as GB is also on the edge of the range and largely away from ridges.

Overall, therefore, according to PAT modelling the cumulative loss of [redacted] ranging habitat to GB plus GBX respectively was 1.92 + 0.17 = 2.09 %. This is negligible; individually and cumulatively.

It is also worth noting that even if GBX (and cumulative with GB) was predicted to cause a higher level of habitat loss, the [redacted] territory is little constrained by neighbours and so has considerable capacity for the territory's occupants to adapt to even higher loss; [redacted]

[redacted] could not be formally examined by a PAT model run. If a [redacted] become established then so far as an impact on the putative habitat of [redacted] this would be far more significant as a 'loss' to the occupants of [redacted] than any negligible consequence of displacement due to either GBX or in combination with GB.

[redacted] This is because the habitat encompassed by GB and (prospectively) GBX has minimal predicted attraction for golden eagles, of any age or territorial status. Empirically, according to an interpretation of the NES visual records, the presence of the operational GB wind farm [redacted]

To gain some further regional context on wind farm developments within golden eagle territories, a PAT model was run [redacted] which has an operational wind farm (+ operational extension) within its putative confines. This involves the [redacted] and the PAT predicted loss was estimated at 8.9 %. While HRSG monitoring of territories in eastern Sutherland is only periodic, the presence of [redacted] does not seem to have compromised the territory's status, despite having a substantially higher predicted % habitat loss than GBX (+ GB) under PAT predictions.

An ongoing research project involving Natural Research and Forest Enterprise Scotland (alluded to earlier: section 2) has resulted in nine territorial eagles being satellite tagged and provided several thousands of accurate locational and movement data informing a novel insight into the behaviour of territorial golden eagles in Scotland. These abundant and accurate data allow a preliminary examination of the PAT model's features, free from possible biases due to simpler and/or less refined technological methods associated with the data which underpinned the PAT model's derivation.

Returning to the five key features of the PAT model (see earlier: section 4), then the satellite tagging data from territorial birds are already revealing some features of the PAT model which appear to be supported, and some others which are apparently flawed:

1. Golden eagles prefer the proximity of ridges (supporting PAT);
2. Preference does not necessarily or simply degrade with distance from the territory centre (not supporting PAT);
3. Golden eagles are apparently highly territorial with respect to relationships with neighbouring territory holders, but locations where neighbours may interact can be limited and related to topographic features. Territory boundaries, however, are often poorly described by Thiessen polygons (not supporting PAT);

4. At least in SW Scotland, territory limits can extend further than 6 km from the territory centre (not supporting PAT); and
5. When it coincides with otherwise preferred habitat, closed canopy commercial forestry is largely avoided although some features, such as edges, wide rides and open clearings can be used as roost sites and (probably) diurnal perch-hunting sites. Lochs are not used but can be overflown at height to access other parts of a territory (largely supporting PAT).

With a wealth of new data becoming available on the behaviour and movements of Scottish golden eagles through a substantial satellite tracking programme, and as part of an ongoing process to create, update and refine habitat use models (including PAT) a novel model has been recently described and validated by independent datasets (GET: Fielding et al. in press).

5. GET predictions

The Golden Eagle Topography model (GET: Fielding et al. in press) was derived using several thousands of records from 92 satellite tagged golden eagles during dispersal in Scotland. Model development was based on expectations of four topographic variables being influential: slope, aspect, altitude, and distance from ridge. The telemetric dataset was divided into training and two testing components. The first test set was derived by a temporal split resulting in approximately equal sample size on records and some overlap in individuals' records with training data. The second test set involved no individuals within the training set. Aspect was unexpectedly dropped as neutral in apparent influence early in training model development. The model found that young golden eagles preferred, or used according to availability, space above slopes greater than 10^{o}, at an altitude of ≥ 300 m, and within 300 m of a ridge. The results from the test datasets were highly correlated with those from the training data, and performance as regards expected preferences was improved in both test datasets, indicating the model was robust.

Based on proximity to ridge, slope and altitude, GET provides for 10 classes of expected preference from 1 (least preferred) to 10 (most preferred). As a rough guide, indices (classes) of ≥ 6 indicate habitat that is predicted to be used according to availability or preferentially used more than landscape availability: classes ≥ 7 were all preferentially used.

Application of GET to the vicinity of GB and GBX showed that relatively little 'preferred' habitat (i.e. GET classes ≥ 6, or 6+) was encompassed by the operational GB and the proposed GBX, including 500 m buffers (Fig. 6).

Within GBX (+ buffer) there were 70.0 ha of 6+ classes and 42.0 ha of 7+ classes, within 304.5 ha encompassed by GBX (+ buffer).

Within GB (+ buffer) there were 119.5 ha of 6+ classes and 62.9 ha of 7+ classes, within 460.3 ha encompassed by GB (+ buffer).

[redacted]

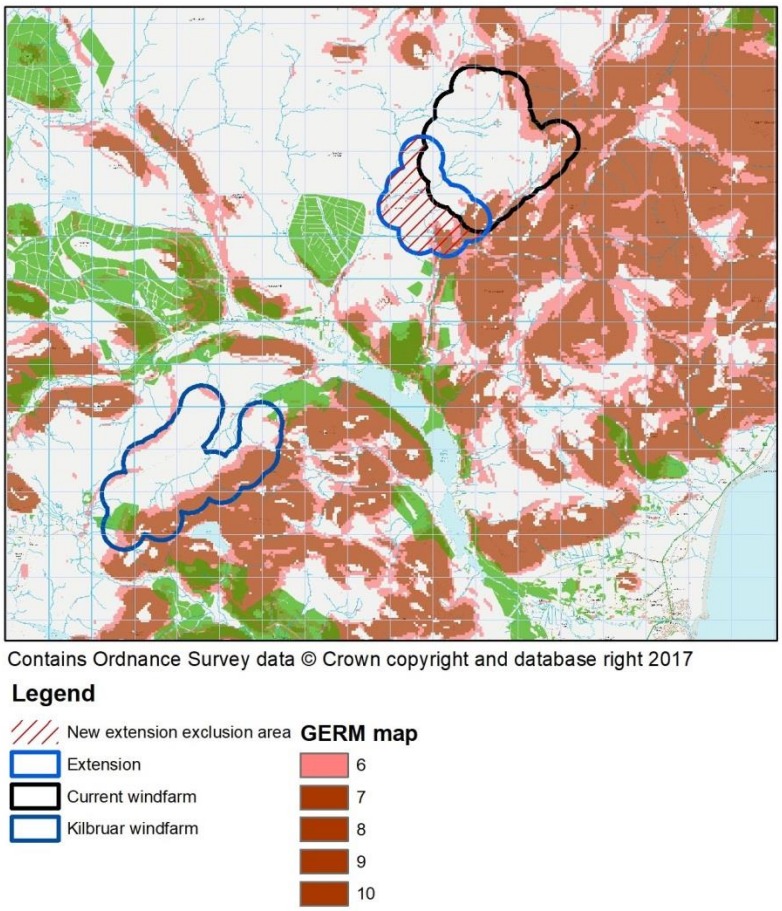


Fig. 6. Mapped distribution of predicted 'preferred' golden eagle habitat according to GET (i.e. classes ≥ 6) in the vicinity of GB, GBX [redacted] Grid square is 1 km and forestry is shown in green.

The prospective losses of 'preferred' habitat cannot be taken in isolation, however, and need to be placed in a wider context of habitat availability. To do so, the attribution of the landscape according to GET indices was applied within three concentric buffers (5, 10 and 15 km) centred on GBX (Fig. 7). These calculations for GBX (+ 500 m buffer) used the extent of habitats which were 'available' i.e. not within 500 m of an operational turbine or covered by forestry (Fig. 8).

GBX, excluding overlap with GB, is 304.5 ha. The 5 km buffer around GBX (excluding sea) is 6,316 ha so the extension is 4.8 % but its 6+ GET is 2.5 % and 7+ GET is 2.2 %.

The 10 km buffer around GBX is 107,900 ha and the extension is 0.28 % of this but its 6+ GET is 0.15 % and 7+ GET is 0.13 %.

The 15km buffer around GBX is 223,425 ha and the extension is 0.14% of this but its 6+ GET is 0.08% and 7+ GET is 0.07%.

In other words, GBX has a small local (within 5 km) effect but beyond that it is effectively zero. Even when it has some potential effect, e.g. within 5 km, the effect is less than expected based on area (4.8 % of the buffer but only 2.5 % of 6+ GET).

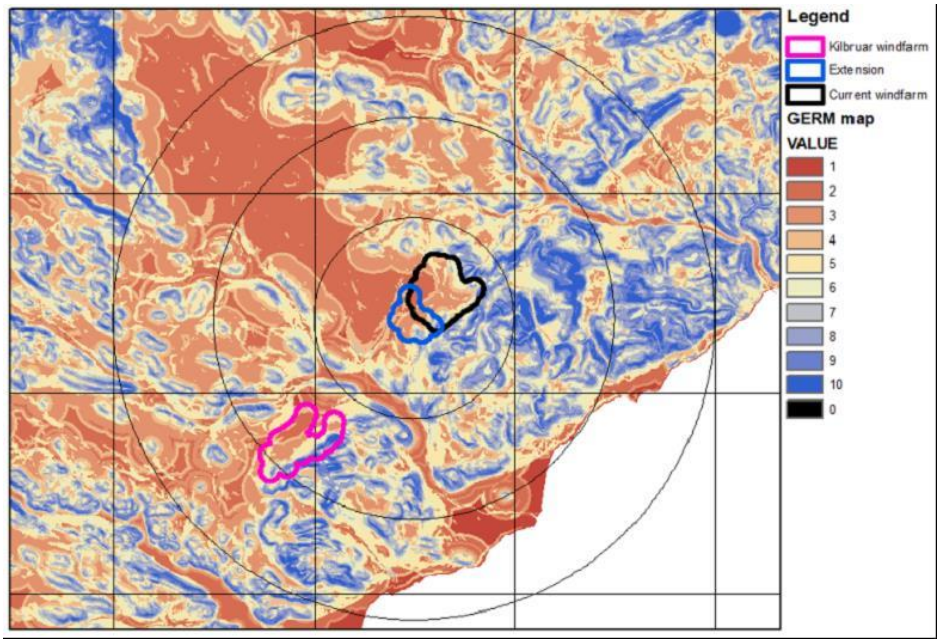


Fig. 7. GET predicted classes (1 – 10: least to most preferred) in the vicinity of GB, GBX and the Kilbruar Wind Farm (+ extension) (500 m buffers around turbine arrays). The concentric circles are 5, 10 and 15 km buffers centred on GBX. Grid square is 10 km. Contains Ordnance Survey data @ Crown copyright and database right 2017.

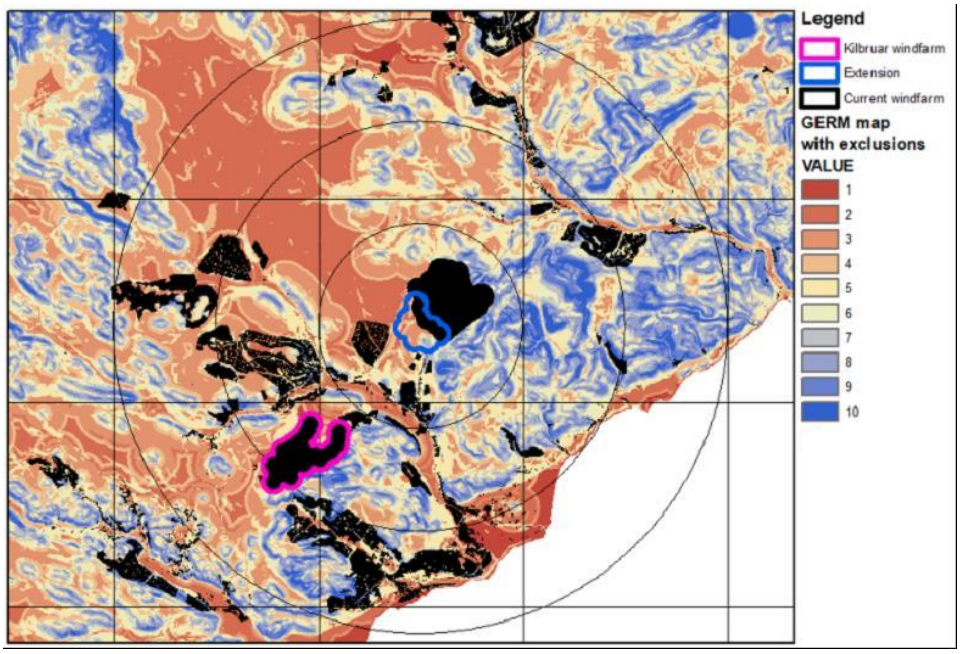


Fig. 8. GET predicted classes (1 – 10: least to most preferred) in the vicinity of GB, GBX and the Kilbruar Wind Farm (+ extension) (500 m buffers around turbine arrays). The concentric circles are 5, 10 and 15 km buffers centred on GBX. Black areas illustrate 'exclusion areas' according to assumed displacement from operational wind farms (+ 500 m buffer) and forestry. Grid square is 10 km. Contains Ordnance Survey data @ Crown copyright and database right 2017.

Overall, as apparent (Fig. 6 – 8) there is considerable suitable habitat available in the environs of GBX [redacted] and GBX constitutes an increasingly small contribution to suitable habitat with distance from the proposal, which would become even smaller on a regional (e.g. NHZ) basis.

Other results of the GET analyses are worth highlighting:

- Forestry appears to have led to a substantially greater predicted loss of suitable habitat within the 15 km buffer around GBX than operational wind farms, mostly to the southwest of GBX/GB (Fig. 8). Within this area an estimated 2,866.3 ha (11.1 %) of the 6+ GET classes were covered by trees, and 10.0 % of GET 7+ classes were covered by trees. These figures can be contrasted against putative losses within the same 15 km buffer for operational wind farms: GB, 0.5 % for 6+ and 0.04 % for 7+; and Kilbruar (+ extension), 0.7 % for 6+ and 0.06 % for 7+. Most of this loss was [redacted] and GB and GBX.
- Hence, by orders of magnitude, forestry has led to greater putative habitat loss than operational wind farms in the study area.
- Note also that GET does not predict suitable/preferred habitat to the west and northwest of GB and GBX and so there is no apparent prospect that the wind farms could act as a 'barrier' to eagle movements. GB and GBX are situated in locations which have negligible attractiveness for golden eagles.
- [redacted]
- There may also be scope for another new territory [redacted] Since both GBX (individually) and with GB (cumulatively) are of negligible attractiveness to eagles (see previous bullet point) then they would also not interfere with t[redacted]

Finally, GET was developed using data from dispersing golden eagles (i.e. following departure from the natal territory and before later settlement on an occupied territory). As noted earlier (section 2), however, the findings of GET also apparently apply on a preliminary basis to predicting habitat use of territorial birds. Notably (*cf* Fig 3 with Fig. 4) as GET does not make the mistaken PAT assumption that habitat use degrades with distance from the territory centre.

6. Conclusions

- Displacement (macro-avoidance) of golden eagles should be the potentially adverse effect of proposed wind farms in Scotland which is considered by way of potential impact in Environmental Impact Assessments.
- Reported NES observations around GB and the proposed GBX do not directly inform the potential use of GBX.
- Visual NES observations around GB illustrate that the habitat within the wind farm was not suitable and/or that eagles were disturbed by a few working turbines (confirming wider recent research).
- [redacted]
- Based on current known territories the individual (GBX) and cumulative (+ GB) loss of habitat through displacement under the PAT model was negligible.

- Under a more recent habitat use prediction model (GET) the putative loss of habitat was also negligible.
- [redacted]

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sse Renewables

rps

Key

- Site Boundary
- Turbine
- Vantage Point locations (2012)

VP 2km Viewsheds (2012)

- Viewshed VP4
- Viewshed VP5
- Viewshed VP7
- Viewshed VP9
- Viewshed VP10
- Viewshed VP11

Scale 1:35,000 @ A3

0 0.5 1 Km

N

Figure A9.1
2012 Vantage Points and Viewsheds overlapping the Proposed Development

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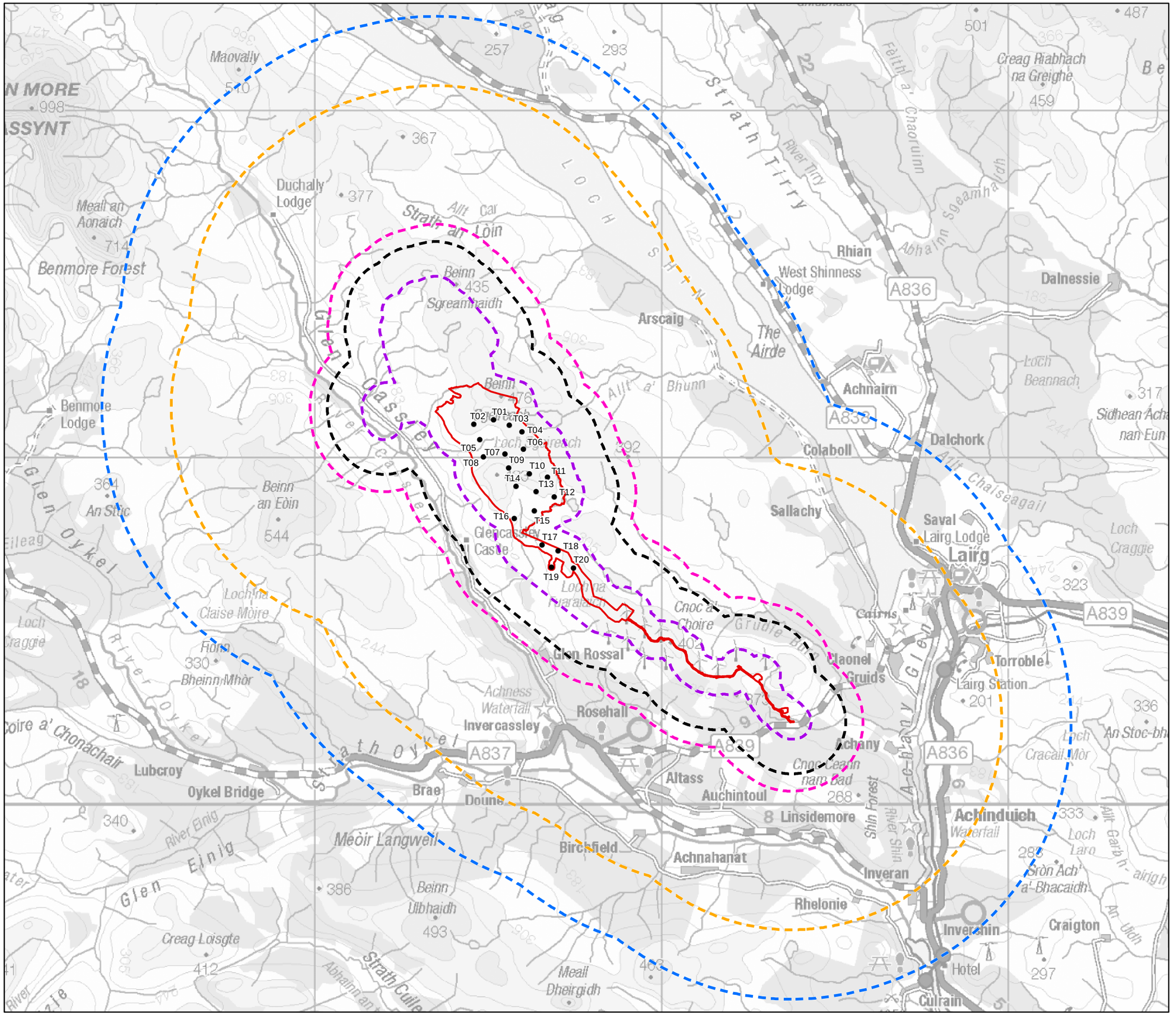

sse Renewables

rps

Key

- Site Boundary
- Turbine

Indicative Survey Areas (2012)

- Moorland Breeding Bird (500m)
- Black grouse (1.5 km)
- Raptor (2 km)
- Golden eagle (6 km)
- Breeding Diver (8 km)

Note - the indicative ornithological survey areas shown are based upon buffers on the 2012 Glencassley site boundary.

Scale 1:105,000@ A3

0 2 4 Km

N

Figure A9.2
2012 Indicative Ornithological Survey Areas with Proposed Development

Achany Extension Wind Farm
EIA Report

sse Renewables

rps

Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding diver survey area (1 km)
- Red-throated diver observation (2)

Scale 1:40,000 @ A3

0 0.5 1 Km

N

Figure A9.3
Red-throated Diver Records
2020 Breeding Season

Achany Extension Wind Farm
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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding diver survey area (1 km)
- Black-throated diver observation (2)

Scale 1:40,000 @ A3

0 0.5 1 Km

N

Figure A9.4
Black-throated Diver Records
2020 Breeding Season

Achany Extension Wind Farm
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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- Golden Eagle (26)
- Non-VP flights (2)

Scale 1:50,000 @ A3

0 0.5 1 Km

N

Figure A9.5
Golden Eagle Records
2018/19 Non-breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- Golden Eagle (24)
- Non-VP flights (3)

Scale 1:50,000 @ A3

Km 0 0.5 1

N

Figure A9.6
Golden Eagle Records
2019 Breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- Golden Eagle (6)

Scale 1:50,000 @ A3

Km

0 0.5 1

N

Figure A9.7
Golden Eagle Records
2019/20 Non-breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- Golden Eagle (10)
- Non-VP flights (6)

Scale 1:50,000 @ A3

Km 0 0.5 1

N

Figure A9.8
Golden Eagle Records
2020 Breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- Hen Harrier (5)

Scale 1:50,000 @ A3

0 0.5 1 Km

N

Figure A9.9
Hen Harrier Records
2020 Breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- Merlin (1)

Scale 1:50,000 @ A3

Km 0 0.5 1

N

Figure A9.11
Merlin Records
2019/20 Non-breeding Season

Achany Extension Wind Farm
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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)
- Non-VP flights (1)

Scale 1:50,000 @ A3

Km 0 0.5 1

N

Figure A9.13
Osprey Records
2019 Breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- Peregrine (2)

Scale 1:50,000 @ A3

0 0.5 1 Km

N

Figure A9.15
Peregrine Records
2020 Breeding Season

Achany Extension Wind Farm
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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- Red Kite (1)

Scale 1:50,000 @ A3

Km

0 0.5 1

N

Figure A9.16
Red Kite Records
2020 Breeding Season

Achany Extension Wind Farm
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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- White-tailed Eagle (7)

Scale 1:50,000 @ A3

Km 0 0.5 1

N

Figure A9.17
White-tailed Eagle Records
2018/19 Non-breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- White-tailed Eagle (1)

Scale 1:50,000 @ A3

Km

0 0.5 1

N

Figure A9.18
White-tailed Eagle Records
2019 Breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Breeding raptor survey area (2 km)

VP flightlines

- White-tailed Eagle (3)
- Non-VP flights (1)

Scale 1:50,000 @ A3

0 0.5 1 Km

N

Figure A9.19
White-tailed Eagle Records
2019/20 Non-breeding Season

Achany Extension Wind Farm
EIA Report

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sse Renewables

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Moorland breeding bird survey area (500 m)

Breeding status

- Territory (2)

Scale 1:37,000 @ A3

0 0.5 1 Km

N

Figure A9.20
Curlew Records
2020 Breeding Season

Achany Extension Wind Farm
EIA Report

sse Renewables

rps

Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Moorland breeding bird survey area (500 m)

VP flightlines

- Dunlin (8)

Breeding status

- Territory (12)

Scale 1:37,000 @ A3

0 0.5 1 Km

N

Figure A9.21
Dunlin Records
2019 Breeding Season

Achany Extension Wind Farm
EIA Report

sse Renewables

rps

Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Moorland breeding bird survey area (500 m)

VP flightlines

- Dunlin (19)

Breeding status

- Territory (8)

Scale 1:37,000 @ A3

0 0.5 1 Km

N

Figure A9.22
Dunlin Records
2020 Breeding Season

Achany Extension Wind Farm
EIA Report

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sse Renewables

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Moorland breeding bird survey area (500 m)

VP flightlines

- Golden Plover (4)
- Non-VP flights (1)

Scale 1:37,000 @ A3

0 0.5 1 Km

N

Figure A9.23
Golden Plover Records
2018/19 Non-breeding Season

Achany Extension Wind Farm
EIA Report

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sse Renewables

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Moorland breeding bird survey area (500 m)

VP flightlines

- Golden Plover (22)

Breeding status

- Territory (24)

Scale 1:37,000 @ A3

0 0.5 1 Km

N

Figure A9.24
Golden Plover Records
2019 Breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Moorland breeding bird survey area (500 m)

VP flightlines

- Golden Plover (6)

Scale 1:37,000 @ A3

0 0.5 1 Km

N

Figure A9.25
Golden Plover Records
2019/20 Non-breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- Moorland breeding bird survey area (500 m)

VP flightlines

- Golden Plover (17)

Breeding status

- Territory (20)

Scale 1:37,000 @ A3

0 0.5 1 Km

N

Figure A9.26
Golden Plover Records
2020 Breeding Season

Achany Extension Wind Farm
EIA Report

sse Renewables

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer

VP flightlines

- Greylag Goose (3)

Scale 1:50,000 @ A3

Km

0 0.5 1

N

Figure A9.29
Greylag Goose Records
2019 Breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer

VP flightlines

- Greylag Goose (4)

Scale 1:50,000 @ A3

Km 0 0.5 1

N

Figure A9.30
Greylag Goose Records
2019/20 Non-breeding Season

Achany Extension Wind Farm
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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer

VP flightlines

- Greylag Goose (1)

Scale 1:50,000 @ A3

Km 0 0.5 1

N

Figure A9.31
Greylag Goose Records
2020 Breeding Season

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer

VP flightlines

- Pink-footed Goose (6)
- Non-VP flights (2)

Scale 1:50,000 @ A3

Km

0 0.5 1

N

Figure A9.32
Pink-footed Goose Records
2018/19 Non-breeding Season

Achany Extension Wind Farm
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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer

VP flightlines

- Pink-footed Goose (1)

Scale 1:50,000 @ A3

Km 0 0.5 1

N

Figure A9.33
Pink-footed Goose Records
2019 Breeding Season

Achany Extension Wind Farm
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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer

VP flightlines

- Pink-footed Goose (6)

Scale 1:50,000 @ A3

0 0.5 1 Km

N

Figure A9.34
Pink-footed Goose Records
2019/20 Non-breeding Season

Achany Extension Wind Farm
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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer
- Non-VP flights (1)

Scale 1:50,000 @ A3

0 0.5 1 Km

N

Figure A9.35
Pink-footed Goose Records
2020 Breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer
- Adult female and 6 chicks observed
- Non-VP flights (2)

Scale 1:50,000 @ A3

Km 0 0.5 1

N

Figure A9.36
Teal Records
2020 Breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer

VP flightlines

- Whooper Swan (3)

Scale 1:50,000 @ A3

Km

0 0.5 1

N

Figure A9.37
Whooper Swan Records
2018/19 Non-breeding Season

Achany Extension Wind Farm
EIA Report

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Key

- Site Boundary
- Turbine
- Achany layout (Operational)
- Rosehall layout (Operational)
- Caithness and Sutherland Peatlands SAC and SPA
- 1 km buffer

VP flightlines

- Whooper Swan (1)

Scale 1:50,000 @ A3

0 0.5 1 Km

N

Figure A9.38
Whooper Swan Records
2019/20 Non-breeding Season

Achany Extension Wind Farm
EIA Report

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