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Technical Appendix 9.1

Kirkton Energy Park

Ornithological Survey Report 2019 - 2021

Kirkton Wind Farm Ltd.

wind2

November 2022

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1 Introduction

1.1 Terms of Reference

In September 2019, Atmos Consulting Ltd. was commissioned by Kirkton Wind Farm Ltd. to undertake ornithological surveys in relation to a proposed wind farm development, located approximately 2.1km south of the village of Melvich, Highland.

The proposed Kirkton Energy Park (hereafter referred to as the "site") has been subject to avian surveys from September 2019 through to August 2021, sufficient to provide an initial impact assessment on avian receptors at the site.

This Technical Appendix, provides details of the ornithology surveys carried out, reports on their findings and describes the results of the desk study carried out in support of the Ornithological Impact assessment described in Chapter 9: Ornithology.

1.2 Site Location and Description

The site is situated approximately 2.1km south of the village of Melvich, in the Scottish Highlands with an approximate grid reference of NC 87999 59788 (Appendix A, Figure 9.1.1 refers). The northern part of the site predominantly consists of rough grazing along with a commercial conifer plantation, cemetery and farm buildings. Moving south within the site, the terrain becomes more upland in character with areas of boggy wetland (including areas of habitat consisting of blanket bog and wet heath) becoming more apparent. The Halladale River is situated to the east of the site with associated tributaries running extensively throughout the site connecting to several lochs, lochans and bog pools to the west of the site.

The site is largely outwith and immediately adjacent to the Caithness and Sutherland Peatlands Special Protection Area (SPA) (Appendix A, Figure 9.1.2 refers). There is a small overlap in the north west of the site to incorporate the entirety of the forestry block there as part of the proposed Habitat Management Plan (**Technical Appendix 8.5: Draft Habitat Management Plan**). This is a large SPA, designated for a large and varied range of species; a full listing is provided in Section 4.1.1.

1.3 Objectives

The objectives of this Technical Appendix are to:

- summarise the avian desk study information obtained to date for the site;
- document the ornithological survey methodologies and avian species recorded during the period of survey:
  - Vantage Point (VP) surveys undertaken between September 2019 and February 2020, March 2020 to August 2020, September 2020 to February 2021 and March 2021 to August 2021 including flight data recorded for target species;
  - diver surveys undertaken between May and August in both 2020 and 2021;
  - moorland Breeding Bird surveys undertaken between April and July in both 2020 and 2021; and
  - breeding Raptor surveys undertaken between March and July in both 2020 and 2021.

2 Ornithological Legislation & Conservation Status

Legislation, non-statutory conservation designations, and NatureScot (NS) guidance pertaining to the ornithological interests discussed within this report are presented below.

2.1 Wildlife and Countryside Act 1981 (as amended) & Conservation (Natural Habitats & c.) Regulations 1994 (as amended in Scotland)

The Wildlife and Countryside Act 1981 (as amended) (WCA) is the principal mechanism for the legislative protection of wildlife in Great Britain. All wild birds and their active nests, eggs and young are protected from damage, destruction or capture under the WCA. Bird species listed on Schedule 1 gain additional protection particularly around their nests, with disturbance listed as an offence, with special penalties for breaches of the law related to those Schedule 1 species. The WCA also provides the mechanism by which the Directive on the Conservation of Wild Birds (Directive 2009/147/EC, the 'Birds Directive') is transposed into UK law, allowing for the designation of Special Protection Areas (SPAs).

The Birds Directive lays out special measures to conserve wild birds, their eggs, nests and habitats, and applies special protection to those species as listed under Annex I of the Directive. This is to apply special protection, in particular, to those species which are migratory and are considered to be of a shared heritage and conservation responsibility across all European Union member states.

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland), or 'Habitat Regulations', are the method by which the relevant European Directives are translated into Scottish law. Specifically, the Habitat Regulations transpose the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') and Natural Habitats and Wild Fauna and Flora (92/43/EEC, the 'Habitats Directive') into a Scottish context.

2.2 Nature Conservation (Scotland) Act 2004

The Scottish Biodiversity List (SBL) was developed to meet the requirements of Section 2(4) of the Nature Conservation (Scotland) 2004 Act (NCSA) for the conservation of biodiversity. This legislation required Scottish Ministers to publish lists of species of flora, fauna and habitats considered to be of principal importance for the purposes of biodiversity.

Taken together, the WCA (1981) and NCSA (2004) ensure that all wild birds, their nests and eggs are protected by making it an offence to:

- Intentionally or recklessly kill, injure or take any wild bird;
- Intentionally or recklessly take, damage or destroy the nest of any wild bird while it is in use or being built;
- Intentionally or recklessly take or destroy the egg of any wild bird; and

- Intentionally or recklessly disturb any wild bird listed on Schedule 1 while it is nest building or is at (or near) a nest with eggs or young, or disturb the dependent young of such a bird without a Schedule 1 licence provided by NatureScot.

2.3 Ramsar

Ramsar sites are designated under the Ramsar Convention on Wetlands (Ramsar 1971), which requires signatories to maintain the ecological character of their internationally important wetlands.

Within the Scottish context, most Ramsars are also SPAs or Natura sites, with the exception of specific sites where they are designated as wetland habitats only. Generally they have been treated as being the equivalent to Natura sites within the planning framework, although the situation has been complicated by recent statements on the Scottish Government website which state that Ramsar qualifying interests which coincide with the interests of Natura sites are given the same level of legal protection; where interests are not the same as Natura interests but instead match SSSI interests, they will receive protection under the SSSI regime. As such, although sites designated as Ramsar sites will be identified as such in the text, any consideration will address them as SPAs only.

2.4 Biodiversity Action Plans

The UK Biodiversity Action Plan (UK BAP) was the UK's response to the commitments of the Rio Convention on Biological Diversity. The plan outlines action for 26 species of birds of conservation importance/concern.

The Nature Conservation (Scotland) Act 2004 places a duty of care on public bodies to further the conservation of biodiversity in Scotland, the execution of which is implemented through Local Biodiversity Action Plans (LBAPs).

The 'UK Post-2010 Biodiversity Framework' succeeded the UK BAP and 'Conserving Biodiversity – the UK Approach'. The framework takes into account the 'Aichi targets' following a conference in Japan in 2010 and publication of the new EU Biodiversity Strategy (EUBS) in 2011, and complements existing UK biodiversity strategies and targets by identifying activities required to achieve them. This framework places more weight on national responses such as the Scottish Biodiversity Strategy, than on a UK wide response.

2.5 Birds of Conservation Concern 5 (BoCC)

The leading government (Joint Nature Conservation Committee (JNCC)) and non-government conservation organisations in the UK jointly reviewed the population status of the 247 bird species that are regularly found within the United Kingdom using data from national monitoring schemes. This was most recently reviewed in 2021 (Stanbury *et al.*, 2021) and was an update to the earlier 2015 BoCC report.

Based on seven quantitative criteria, each species has been placed on one of three lists:

- Red - species that are globally threatened, have had an historical population decline in the UK from 1800 -1995, a rapid (> or = 50%) decline in UK breeding population over the past 25 years, or a rapid (> or = 50%) contraction of UK breeding range over the past 25 years;

- Amber - species that have had a historical population decline from 1800-1995 but are recovering (population size has more than doubled over the past 25 years), a moderate (25-49%) decline in UK breeding population over the past 25 years, a moderate (25-49%) contraction of UK breeding range over the past 25 years, a moderate (25-49%) decline in UK non-breeding population over the past 25 years, or species with unfavourable conservation status in Europe also known as Species of European Conservation Concern (SPEC); and
- Green - species that have no identified threat to their population status.

2.6 Ornithological Guidance

NatureScot, formerly Scottish Natural Heritage[1] has produced several guidance documents in relation to the assessment of impacts of wind farm developments on bird populations. The following guidance informed the survey work and any subsequent assessments:

- Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action (2000);
- Monitoring the Impact of Onshore Wind Farms on Birds (2009a);
- Assessing the Cumulative Impacts of Onshore Wind Energy Developments (2012a);
- Natural Heritage Zones Bird Population Estimates (2015) (published by the Scottish Windfarm Bird Steering Group (SWBSG)) (Wilson, 2015);
- Assessing Connectivity with Special Protection Areas (SPAs) (2016a);
- Environmental Statements and Annexes of Environmentally Sensitive Bird information (2016b);
- Avoidance Rates for the Onshore SNH Bird Wind Farm Collision Risk Model (2017a);
- Recommended bird survey methods to inform impact assessment of onshore wind farms (2017b); and
- Assessing the Significance of Impacts from Onshore Wind Farms on Birds at Sites Outwith Designated Areas (2018a).

[1] References will therefore still refer to 'SNH' as this was the publisher of guidance etc at the time of publication.

3 Methodology

3.1 Desktop Study

3.1.1 Designated Sites

The desktop study consisted of a search for statutory and non-statutory designated sites with avian qualifying features within 10km of the proposed development, increased to 20km for Natura 2000 sites with qualifying interests for geese as a result of NatureScot guidance on connectivity (SNH, 2016a), as well as a data review for sources of information relating to bird populations on and within the vicinity of the proposed development.

3.1.2 Species Records

A search of publicly available records on the NBN Atlas (https://nbnatlas.org) for the last 10 years was completed to review historical records with respect to target species of birds that have been reported in the vicinity of the proposed development.

Only records which are licensed for commercial use have been consulted.

3.1.3 Target Species

Target avian species were identified as those that are either afforded specific legislative protection (i.e. of high conservation interest) or represent qualifying interests in designated sites in the wider area. Reference was then made to guidance for the identification of potentially vulnerable species (SNH,2017a; SNH, 2018a). The final list of target species was determined using these guidance documents along with the likelihood of each species being present at the site and in the environs (based upon available habitat, experience of working in this region and geographical location).

Target species are considered to be those:

- identified as potentially at risk from impacts of onshore wind farms (SNH, 2018a);
- species listed in Annex I of the Birds Directive (2009/147/EC); or
- non-passerines listed in Schedule 1 of the WCA

3.2 Survey Methodologies

Survey methodologies were in accordance with SNH (2017b) guidance as well as survey methodologies described in Gilbert *et al*. (1998) and Hardey *et al*. (2013).

All surveys were carried out by experienced ornithological surveyors who hold NatureScot Schedule 1 bird licences.

3.2.1 Vantage Point Surveys

Vantage point (VP) surveys were initiated in September 2019 and undertaken following the methods recommended by NatureScot guidance at the time of survey (SNH, 2017b).

Each VP survey was undertaken by a suitably experienced single observer in conditions of good visibility. Acceptable weather conditions included winds no stronger than Beaufort force six, and no persistent rain. The surveyor positioned themselves as inconspicuously as possible to minimise their effect on the birds' natural behaviour. The surveyor surveyed a 180° arc centred on a predetermined view bearing. While the VP was selected to ensure that the viewshed covered the required study area out to 2km, as per NatureScot guidance, observations from the VP have not been constrained to a 2km radius. The viewshed is based on visibility over bare ground at an imaginary layer 20m above the ground. Appendix A, Figure 9.1.3 shows the VP locations and their viewsheds.

Table 1 presents the details of all VP locations.

Table 1: Details of Vantage Point Locations

VP Number	Grid Reference		View Bearing	Notes
	Easting	Northing		
VP1	289295	959390	270°	Used for the duration of the survey period
VP2	288491	960012	315°	Used for the duration of the survey period
VP3	288331	958434	195°	Used for the duration of the survey period

Two years of diurnal VPs were completed in August 2021.

Surveys at each VP location lasted no longer than three hours duration. No simultaneous observations were undertaken. Other survey work and estate activity on the site was considered in order to minimise the potential for disturbance of baseline conditions and issues compromising data integrity. Diurnal VPs were completed to cover all daylight hours (between dawn and dusk) in any given survey day.

During each survey, the landscape was scanned continuously until a target species was detected. Once detected, the bird was observed until it landed or flew out of sight, with monitoring occurring so long as it remained within the viewshed field of view. The time of first detection was noted, and the exact time spent flying in a specified height band was recorded.

Flight activity was recorded within the following three height bands:

- A - < 20m;
- B - 20m – 150m; and,
- C - > 150m.

Band B is the band where collision risk can occur, being the height which the turbine blades will sweep once the proposed development is active. Birds at this height are therefore considered to be at collision risk height. Details of the date, timing, and surveyor for all VP surveys are provided in Appendix B.

3.2.2 Diver Survey

Diver surveys were undertaken to monitor the presence of breeding red-throated diver *Gavia stellata* and black-throated diver *Gavia arctica* on site following the methods recommended by Gilbert *et al* (1998). Two walk-over surveys were conducted on all suitable waterbodies for both red-throated and black-throated diver between late May

and late July 2020. The surveys observed the presence of divers and any evidence of nests or young.

Upon the observation of either red-throated and / or black-throated diver, diurnal vantage point (VP) surveys were undertaken using the same methodology as described in Section 3.2.1, in June - August 2020 and in May - August 2021. These additional VPs were used to help establish whether any routes used by divers are present within or close to the site. Appendix A, Figure 9.1.4 shows the diver VP locations and their viewsheds.

The position of the two diver VP locations is detailed in Table 2 below.

Table 2: Details of Diver VP Locations

VP Number	Grid Reference	
	Easting	Northing
VP4	285876	962589
VP5	286802	960723

3.2.3 Brown and Shepherd Breeding Bird Survey

An upland breeding bird survey was carried out using the Brown & Shepherd upland breeding bird survey method for moorland habitats (Brown & Shepherd, 1993), but using four visits as per NatureScot guidance (SNH, 2017b). This technique is used to census upland breeding waders such as golden plover *Pluvialis apricaria*, dunlin *Calidris alpina*, greenshank *Tringa nebularia* and other species of open upland moor, but can be used to record all moorland species and provides a reliable estimate for most other species so long as four visits are used.

These were completed between April and July in both 2020 and 2021, avoiding high winds and other unfavourable weather conditions. The method is based on a constant search effort, allowing 20 to 25 minutes per 500 x 500m quadrat of open land. A predetermined route through each quadrat was followed so that all areas of each quadrat were approached to within at least 100m, with the surveys taking place between 08:30 and 18:00, in accordance with the guidelines.

The behaviour and location of each individual bird was recorded on a 1:25,000 scale map, using standard BTO codes. Records from each survey were combined into a final visit map, so that duplicate records of the same birds could be removed.

Birds were assumed to be breeding or holding a territory (confirmed breeding) at a location if one or more of the following was recorded:

- Presence of a nest, eggs or young (including newly fledged); and / or
- A bird was observed carrying food or breeding material.

In the absence of either of these indicative behaviours, birds were classified as probable breeding if one or more of the following was recorded:

- Courtship, displaying or singing in the same location on more than one visit;
- Agitated behaviour including alarm calls or distraction display; and / or
- Territorial disputes.

In the absence of any of the above indicative behaviours, birds were classified as possible breeding if one or more of the following was recorded:

- Singing or displaying on one visit;

- A pair in suitable habitat; and / or
- Birds reacting antagonistically on one visit.

Other records were considered to be of non-breeding birds. The surveyor also recorded all passerines observed during the survey.

3.2.4 Breeding Raptor Survey

Surveys for breeding moorland raptors require visits between March and July. The first visit in March to early April is carried out to detect occupancy by the various species. A second visit is used to identify active nests in April and early May. The third visit is carried out in June to check for the presence of young birds, and the final visit in July to August is used to recorded fledged young (Hardey *et al.*, 2013). Surveys were carried out during daylight hours.

Target species during the breeding raptor surveys included hen harrier *Circus cyaneus*, merlin *Falco columbarius*, peregrine *Falco peregrinnus* and short-eared owl *Asio flammeus*. These were identified based on the suitable habitats present on the site.

The identity and activity of all raptors were recorded on 1:25,000 scale maps, using standard BTO codes for all species and behaviour. Any wader activity was also recorded during the raptor surveys to add additional information to their presence on site.

3.3 Survey Limitations

The outbreak of COVID-19 and subsequent lockdown and travel restrictions caused some disruption to the surveying schedule in the early part of the breeding season 2020. This had most impact on the moorland breeding bird survey, which only commenced in late April. This does mean that early breeding activity which resulted in territory abandonment may have been missed and so there may be an underestimate in the activity observed on site. To help offset this, waders were also recorded during the raptor surveys (which commenced earlier than the breeding bird surveys) to try and reduce and manage the effect of this.

4 Results

4.1 Desktop Study

4.1.1 Designated Sites

Statutory Designations

There are several designated sites with avian qualifying features in the vicinity (< 10km) of the proposed development (Appendix A, Figure 9.1.2 refers).

Special Protection Areas (SPA)

Caithness and Sutherland Peatlands SPA lies immediately adjacent to the western boundary of the proposed development, with a small overlap in the north west of the proposed development site to incorporate the entirety of the coniferous plantation there as part of the proposed Habitat Management Plan (**Technical Appendix 8.5: Draft Habitat Management Plan** refers). The Caithness and Sutherland Peatlands SPA forms the largest and most intact area of blanket bog in the UK. These peatlands, and the surrounding moorland and open water, are of international importance for the conservation of a diverse range of breeding birds. Species for which the SPA is designated for are shown in Table 3.

Table 3: Caithness and Sutherland Peatlands SPA qualifying features (SNH 2017c)

Species	Scientific Name	Criteria for inclusion	Population Estimate (2001)	Most Recent Population Estimate (2007/09)	Current conservation status
Black-throated Diver	*Gavia arctica*	Article 4.1	26 pairs (16.3% of GB population)	17 pairs	Unfavourable declining
Golden Eagle	*Aquila chrysaetos*	Article 4.1	5 pairs (1.3% of GB population)	5 pairs	Favourable maintained
Golden Plover	*Pluvialis apricaria*	Article 4.1	1064 pairs (4.7% of GB population)	1922 pairs	Favourable maintained
Hen Harrier	*Circus cyaneus*	Article 4.1	14 pairs (2.8% of GB population)	18 pairs	Favourable maintained
Merlin	*Falco columbarius*	Article 4.1	54 pairs (4.2% of GB population)	54 pairs	Favourable maintained
Red-throated Diver	*Gavia stellata*	Article 4.1	89 pairs (9.5% of GB population)	46 pairs	Favourable maintained
Short-eared Owl	*Asio flammeus*	Article 4.1	30 pairs (3% of GB population)	30 pairs	-
Wood Sandpiper	*Tringa glareola*	Article 4.1	5 pairs (50% of GB population)	6 pairs	Favourable maintained
Common Scoter	*Melanitta nigra*	Article 4.2	27 pairs (<0.1% of Western Siberian/ Western & Northern Europe/ North-western Africa	26 pairs	Unfavourable declining

Species	Scientific Name	Criteria for inclusion	Population Estimate (2001)	Most Recent Population Estimate (2007/09)	Current conservation status
			population)		
Dunlin	*Calidris alpina schinzii*	Article 4.2	1860 pairs (16.9% of the Baltic/UK/Ireland population)	1366 pairs	Favourable maintained
Greenshank	*Tringa nebularia*	Article 4.2	54 pairs (0.4% of the Europe/Western Africa population)	653 pairs	Favourable maintained
Wigeon	*Anas penelope*	Article 4.2	43 pairs (<0.1% of Western Siberian/North-western/North-eastern Europe population)	43 pairs	-

The **North Caithness Cliffs SPA** lies approximately 3km north of the proposed development at its closest point. The SPA covers a stretch of northern coastline extending 2km out to sea and supports in excess of 20,000 individual seabirds. Species for which the SPA is designated for are shown in Table 4.

Table 4: North Caithness Cliffs SPA qualifying features (SNH 2018b)

Species	Scientific Name	Criteria for inclusion	Population Estimate	Current conservation status
Peregrine	*Falco peregrinus*	Article 4.1	6 pairs (0.5% of GB population) (figure from SPA citation 2018)	Unfavourable declining
Common Guillemot	*Uria aalge*	Article 4.2	38,300 individuals (1% of the North Atlantic biogeographic population and 4% of GB population) (1985 – 1987)	Favourable maintained
Fulmar	*Fulmarus glacialis*	Article 4.2	14,700 pairs (3% of GB population) (1985 – 1987)	Favourable maintained
Black-legged Kittiwake	*Rissa tridactyla*	Article 4.2	13,100 pairs (3% of GB population) (1985 – 1987)	Unfavourable declining
Razorbill	*Alca torda*	Article 4.2	4,000 individuals (3% of GB population) (1985 – 1987)	Favourable recovered
Puffin	*Fratercula arctica*	Article 4.2	2,080 pairs (0.4% of GB population and greater than 2,000 individuals) (1985 –	Favourable maintained

Species	Scientific Name	Criteria for inclusion	Population Estimate	Current conservation status
			1987)	
Seabird assemblage	No additional species beyond those listed above	Article 4.2	110,000 individuals (1985 – 1987)	Favourable maintained

Caithness Lochs SPA consists of a suite of six lochs and a mire (Broubster Leans) located approximately 15km to the east of the proposed development at its closest point. The lochs cover a range of types from oligotrophic to eutrophic, and support a wide diversity of aquatic and wetland vegetation. The SPA is designated for non-breeding populations of three waterfowl species (Table 5 refers).

Table 5: Caithness Lochs SPA qualifying features (SNH 1999)

Species	Scientific Name	Criteria for inclusion	Population Estimate	Current conservation status
Greenland white-fronted goose	*Anser albifrons flavirostris*	Article 4.1	Winter peak mean of 440 (3% of GB population, 1% of Greenlandic population) (1993 / 1994 – 1997 / 1998)	Favourable declining
Greylag goose	*Anser anser*	Article 4.2	Winter peak mean of 7,190 (7% of GB and Icelandic populations) (1993 / 1994 – 1997 / 1998)	Favourable maintained
Whooper swan	*Cygnus cygnus*	Article 4.1	Winter peak mean of 240 (4% of GB population, 1% of Icelandic population) (1993 / 1994 – 1997 / 1998)	Favourable maintained

Ramsar

Caithness and Sutherland Peatlands Ramsar forms one of the largest and most intact areas of blanket bog in the world, including an exceptionally wide range of vegetation and surface pattern types. In terms of birds, it is designated for its qualifying populations of dunlin and greylag goose, as well as a diverse breeding bird assemblage, including a number of nationally important populations. The RAMSAR covers a similar footprint as the Caithness and Sutherland Peatlands SPA, lying immediately adjacent to the western boundary of the proposed development, with a small overlap in the north west of the proposed development site to incorporate the entirety of the coniferous plantation there as part of the proposed Habitat Management Plan (**Technical Appendix 8.5: Draft Habitat Management Plan** refers). (JNCC, 2008).

Sites of Special Scientific Interest (SSSI)

West Halladale SSSI lies immediately adjacent to the western boundary of the proposed development, with a small overlap in the north west of the proposed development site to incorporate the entirety of the coniferous plantation there as part of the proposed

Habitat Management Plan (**Technical Appendix 8.5: Draft Habitat Management Plan** refers). The SSSI includes extensive areas of blanket bog and supports nationally scarce populations of *Sphagnum pulchrum* and dwarf birch *Betula nana*. The extent and diversity of habitat, including lochs, lochans, peaty pools as well as rivers and burns provide ideal conditions for a range of waders and wildfowl. The site is designated for breeding black-throated diver and common scoter *Melanitta nigra*, as well as its breeding bird assemblage. This includes dunlin, golden plover, greenshank, greylag goose, hen harrier, merlin, golden eagle and peregrine (SNH, 2009b).

East Halladale SSSI is situated approximately 1.50km to the east of the proposed development at its closest point. The SSSI is nationally important for blanket bog vegetation, its breeding populations of dunlin and golden plover and the assemblage of upland breeding birds.

Breeding golden plover and dunlin are widely distributed across the site. Their breeding density is well above the average for these species on the peatlands of Caithness and Sutherland; their populations are nationally important. The breeding bird assemblage lists red-throated diver, black-throated diver, greylag goose, common scoter, golden eagle, peregrine and merlin (SNH, 2010a).

Red Point Coast SSSI lies approximately 4.55km to the north of the proposed development at its closest point. The site has been designated for nationally important geology, coastal vegetation and breeding guillemot *Uria aalge*.

The cliffs at Red Point Coast SSSI have large numbers of breeding seabirds, notably guillemot. The breeding guillemot population on Red Point Coast SSSI forms more than 1% of the British population (SNH, 2009c).

Lochan Buidhe Mires SSSI is situated approximately 6.37km to the west of the proposed development at its closest point and is designated for its blanket bog habitats and its breeding bird assemblage. Species listed on the breeding bird assemblage are dunlin, greenshank, curlew, golden plover, red-throated diver, black-throated diver, greylag goose, merlin, peregrine and golden eagle (SNH, 2010b).

National Nature Reserve (NNR)

Forsinard Flows NNR is part of a vast expanse of blanket bog, sheltered straths and mountains known as the Flow Country. The Flow Country contains one of the largest expanses of blanket bog in the UK and is a vital resource for carbon storage. A variety of waders and wildfowl are present within the designated site including dunlin, golden plover, greenshank, red-throated and black-throated diver and common scoter. Hen harrier are also known to hunt within the area. The NNR lies approximately 6.95km south south east of the proposed development at its closest point (RSPB, undated).

4.1.2 Species Records

A search of the NBN Atlas for the last 10 years within a 5km radius of the proposed development showed records for one species that is listed either on Annex I of the EC Birds Directive (2009/147/EC), Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), or are species determined by NatureScot to be particularly at risk from onshore wind farms (SNH, 2018a) (undertaken under licence CC0, OGL, CC-BY) (Table 6).

Table 6: Recorded Bird Species (data from NBN Atlas)

Species	Annex I	Schedule 1	At risk from windfarms
Curlew [1] *Numenius arquata*			X
Dunlin [1, 2] *Calidris alpina*	X		X
Herring gull [1] *Larus argentatus*			X
Lapwing [1] *Vanellus vanellus*			X
Redwing [1] *Turdus iliacus*		X	
Whooper swan [1] *Cygnus cygnus*	X	X	X

[1] Data sourced from Birds (BTO/JNCC/RSPB Partnership)

[2] Only *schinzii* race listed as an Annex I species

4.2 Vantage Point Surveys

Tables 7 – 10 summarise the VP survey effort across all VP locations from September 2019 to August 2021, inclusive. The specific details of each VP survey visit (date, time, duration, and surveyor) can be found in Appendix B, Tables 32 – 35. A summary of the weather conditions during all VP surveys is presented in Appendix C, Tables 36 – 39.

Table 7: Vantage Point Survey Effort (September 2019 – February 2020)

VP Number	September 2019	October 2019	November 2019	December 2019	January 2020	February 2020	Total Hours
1	6	6	6	6	6	3	33
2	6	6	6	6	6	6	36
3	6	6	6	6	6	6	36

Table 8: Vantage Point Survey Effort (March – August 2020)

VP Number	March 2020	April 2020	May 2020	June 2020	July 2020	August 2020	Total Hours
1	9	3	9	12	12	12	57
2	6	6	6	12	12	12	54
3	6	3	9	12	12	12	54

Table 9: Vantage Point Survey Effort (September 2020 – February 2021)

VP Number	September 2020	October 2020	November 2020	December 2020	January 2021	February 2021	Total Hours
1	3	9	6	6	6	6	36
2	6	6	6	6	6	6	36
3	3	9	6	6	6	6	36

Table 10: Vantage Point Survey Effort (March – August 2021)

VP Number	March 2021	April 2021	May 2021	June 2021	July 2021	August 2021	Total Hours
1	12	12	12	12	12	12	72
2	12	12	12	12	12	12	72
3	12	12	12	12	12	12	72

4.2.1 Non-Breeding Season (September 2019 – February 2020)

A total of seven target species were recorded during the VP watches that took place between September 2019 and February 2020.

A summary of numbers of target species flights and flight times are presented in Table 11, with species organised alphabetically. Appendix D, Table 40 details individual flight data for all target species. A complete species list with details on the conservation status of all species is included in Appendix E.

Point registrations (i.e. birds that were heard but not seen or birds on the ground) are not included in the flight summary in Table 11. A summary of all point registrations is included in Appendix F, Table 45.

The flight lines for these registrations are presented in Appendix A, Figures 9.1.5a – 9.1.5c, and include all ground registrations and heard-only registrations.

Table 11: Summary Flight Data for Target Species (September 2019 – February 2020)

Species	Minimum No. of Birds	Maximum No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds
Fieldfare	3	34	2	2,950	1,915
Golden eagle	1	1	4	960	485
Greylag goose	6	23	3	2,755	2,635
Hen harrier	1	1	1	70	0
Red-breasted merganser	1	1	1	25	0
Shelduck	1	1	1	25	25
Teal	1	14	2	47	0

The species that was most commonly observed was golden eagle, with four flights and a total number of 485 seconds within the risk height recorded. All observations were

from two separate VP surveys in autumn 2019. This raptor is a qualifying species of the Caithness and Sutherland Peatlands SPA.

The species with the highest number of seconds within the risk height was greylag goose, appearing within the risk height for 2,635 seconds. Three flights were observed for this species, making it the second most commonly observed. While the local breeding population of greylag goose is a qualifying species of the nearby Caithness and Sutherland Peatlands Ramsar, this winter flight activity is likely to be due to the occurrence of migratory geese which do not form part of the Ramsar population.

The species with the second highest number of seconds within the risk height was fieldfare with 1,915 seconds recorded. Though a target species, fieldfare is not a qualifying feature for any of the nearby designated areas.

4.2.2 Breeding Season (March – August 2020)

A total of 14 target species were recorded during the VP watches that took place between March and August 2020.

Table 12 presents a summary of all flight line data recorded during the VP surveys, with species organised alphabetically. Table 13 presents a summary of all flight line data recorded during the VP surveys, with total flight time per species, regardless of height, displayed monthly, with species organised alphabetically.

Appendix D, Table 41 details individual flight data for all target species. A complete species list with conservation status details of all species is included in Appendix E.

Point registrations (i.e. birds that were heard but not seen, or birds on the ground) are not included in the flight summary in Tables 12 and 13. A summary of all point registrations is included in Appendix F, Table 46.

The flight lines for these registrations are presented in Appendix A, Figures 9.1.6a – 9.1.6d and include all point registrations.

Table 12: Summary Flight Data for Target Species (March – August 2020)

Species	Minimum No. of Birds	Maximum No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds
Barnacle goose	4	4	1	200	40
Curlew	1	2	31	983	507
Dunlin	1	23	4	255	230
Golden plover	1	11	24	515	165
Greenshank	1	1	2	62	35
Greylag goose	2	110	13	40,726	40,246
Hen harrier	1	1	11	1,256	43
Lapwing	1	5	5	121	80
Merlin	1	1	4	30	0
Oystercatcher	1	4	4	265	0
Peregrine	1	1	1	45	0
Snipe	1	2	4	45	0
Whimbrel	7	7	1	210	0
Whooper swan	12	12	1	240	240

Table 13: Seasonal Activity Patterns for Target Species from March to August 2020 (total flight (not bird) seconds at all heights)

Species	March	April	May	June	July	August
Barnacle goose	50	0	0	0	0	0
Curlew	0	0	277	12	152	337
Dunlin	10	0	15	0	0	5
Golden plover	0	25	232	0	0	23
Greenshank	0	0	0	62	0	0
Greylag goose	465	55	80	30	0	333
Hen harrier	305	0	0	713	233	5
Lapwing	0	0	30	11	0	16
Merlin	0	5	25	0	0	0
Oystercatcher	0	0	45	55	0	0
Peregrine	0	0	45	0	0	0
Snipe	0	0	10	9	0	16
Whimbrel	0	30	0	0	0	0
Whooper swan	20	0	0	0	0	0

The most commonly observed species across the breeding season was curlew, with 31 flights recorded throughout the site. Curlew also spent the second greatest amount of time within the risk height, with 507 seconds recorded. Though this species is not a qualifying feature of nearby SPA or Ramsar sites, it is listed as part of the breeding bird assemblage that is a feature of the Lochan Buidhe Mires SSSI.

Greylag goose was the species that had the highest number of seconds within the risk height, with 40,246 seconds recorded. This is mostly accounted for by migratory flocks passing through the site in March and larger flocks present in August which could be early migration or locally breeding birds forming post-breeding flocks. Observations of greylag goose during the main part of the breeding season from April to July was mostly of pairs. These are more likely to be individuals from the nearby breeding population of the Caithness and Sutherlands Peatlands Ramsar site.

Golden plover was the second most commonly observed species and were observed from all three VP positions for a total of 24 individual flights.

Golden plover, dunlin and greenshank were recorded throughout the site, appearing within the risk window for 165, 230 and 35 seconds, respectively. All three species are a qualifying feature of the Caithness and Sutherland Peatlands SPA, and dunlin is also a qualifying feature of the Caithness and Sutherland Peatlands Ramsar site.

Hen harrier was observed from all three VP positions for a total of 11 individual flights. Most observations involved the bird hunting low over the ground, below the risk height. Similarly, four individual merlin flights were recorded, but the birds were always seen low to the ground. Both these raptors are qualifying features of the Caithness and Sutherland Peatlands SPA.

A single flight of a male peregrine was recorded in April just south of Creag Chailein; the bird was seen to fly above the risk height. This raptor is a qualifying species of the North Caithness Cliffs SPA.

4.2.3 Non-Breeding Season (September 2020 – February 2021)

A total of six target species were recorded during the VP watches that took place between September 2020 and February 2021.

A summary of numbers of target species flights and flight times are presented in Table 14, with species organised alphabetically. Appendix D, Table 42 details individual flight data for all target species. A complete species list with details on the conservation status of all species is included in Appendix E.

Point registrations (i.e. birds that were heard but not seen, or birds on the ground) are not included in the flight summary in Table 14. A summary of all point registrations is included in Appendix F, Table 47.

The flight lines for these registrations are presented in Appendix A, Figures 9.1.7a – 9.1.7c and include all ground registrations and heard-only registrations.

Table 14: Summary Flight Data for Target Species (September 2020 – February 2021)

Species	Minimum No. of Birds	Maximum No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds
Greylag goose	2	17	3	1,931	587
Hen harrier	1	1	4	867	0
Merlin	1	1	1	12	0
Peregrine	1	1	1	75	0
Pink-footed goose	26	26	1	1,196	0
Snipe	3	3	1	21	0

Hen harrier was the most commonly observed species, with four flights recorded from all three VPs. All observations were of birds hunting low to the ground, below the risk height. One flight of a merlin was recorded, also below the risk height. These raptors are both qualifying features of the Caithness and Sutherland Peatlands SPA.

Greylag goose was the species that had the highest number of seconds within the risk height, appearing at this height for 587 seconds. It was also the second most commonly observed species with three flights recorded. As for 2020, this winter flight activity is likely to be due to the occurrence of migratory geese which do not form part of the nearby breeding Caithness and Sutherlands Peatlands Ramsar population.

A single flight of a peregrine was recorded, though the individual didn't spend any time within the risk height. This raptor is a qualifying species of the North Caithness Cliffs SPA.

4.2.4 Breeding Season (March – August 2021)

A total of 12 target species were recorded during the VP watches that took place between March and August 2021.

Table 15 presents a summary of all flight line data recorded during the VP surveys, with species organised alphabetically. Table 16 presents a summary of all flight line data recorded during the VP surveys, with total flight time per species, regardless of height, displayed monthly, with species organised in alphabetically.

Appendix D, Table 43 details individual flight data for all target species. A complete species list with conservation status details of all species is included in Appendix E.

Point registrations (i.e. birds that were heard but not seen, or birds on the ground) are not included in the flight summary in Tables 15 and 16. A summary of all point registrations is included in Appendix F, Table 48.

The flight lines for these registrations are presented in Appendix A, Figures 9.1.8a – 9.1.8d and include all point registrations.

Table 15: Summary Flight Data for Target Species (March – August 2021)

Species	Minimum No. of Birds	Maximum No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds
Curlew	1	2	39	909	475
Dunlin	1	1	1	4	0
Golden plover	1	3	43	666	97
Greylag goose	1	16	28	4,341	1,349
Hen harrier	1	1	2	53	33
Lapwing	1	6	11	597	593
Merlin	1	1	3	113	0
Peregrine	1	1	1	25	25
Pink-footed goose	18	150	9	30,760	1,428
Snipe	1	2	13	112	34
Whimbrel	9	9	1	342	342
Whooper swan	8	8	1	216	216

Table 16: Seasonal Activity Patterns for Target Species from March to August 2021 (total flight (not bird) seconds at all heights)

Species	March	April	May	June	July	August
Curlew	12	106	267	233	151	0
Dunlin	0	0	0	4	0	0
Golden plover	0	41	95	159	191	0
Greylag goose	109	92	160	118	95	207
Hen harrier	53	0	0	0	0	0
Lapwing	0	0	16	161	62	0
Merlin	0	0	0	0	0	113
Peregrine	0	25	0	0	0	0
Pink-footed goose	0	473	0	0	0	0
Snipe	0	7	7	38	33	0
Whimbrel	0	38	0	0	0	0
Whooper swan	27	0	0	0	0	0

The species that spent the most time within the risk window were pink-footed goose and greylag goose, appearing at this height for 1,428 and 1,349 seconds, respectively. All records of pink-footed goose were of migratory flocks seen in April. Greylag goose observations, however, were evenly spread across the breeding season and were often of pairs. These birds are likely to be from the nearby breeding population of the Caithness and Sutherlands Peatlands Ramsar site.

Golden plover was the most commonly observed species, recorded from all three VP positions for a total of 43 individual flights, and appearing within the risk window for 97 seconds. This species is a qualifying feature of the Caithness and Sutherland Peatlands SPA.

The second most commonly observed species was curlew, with 39 flights recorded. Though this species is not a qualifying feature of the nearby SPA or Ramsar sites, it is listed as part of the breeding bird assemblage that is a feature of the Lochan Buidhe Mires SSSI.

There was one observation of a dunlin in June, in which a single bird flew below the risk height. Dunlin is a qualifying feature of the Caithness and Sutherland Peatlands SPA and Ramsar sites.

Hen harrier and merlin were observed at the start and end of the breeding season, respectively. There were two observations of a female hen harrier in March flying in the risk window; both observations were in the vicinity of VP1. There were three observations of a female merlin in August in the vicinity of the VP3 and VP2 locations, but the bird was always seen flying low to the ground, below the risk window. These raptors are both qualifying features of the Caithness and Sutherland Peatlands SPA.

A single flight of a female peregrine was recorded in April, in which it spent 25 seconds within the risk window near Creag Chailein in the north of the site. This raptor is a qualifying species of the North Caithness Cliffs SPA.

4.3 Diver Survey Results

4.3.1 2020

Table 17 summarises the diver VP survey effort across the diver VP locations from June 2020 to August 2020 inclusive. The specific details of each VP survey visit (date, time, duration, and surveyor) can be found in Appendix B, Tables 33. A summary of the weather conditions during all VP surveys is presented in Appendix C, Table 37.

Table 17: Diver Vantage Point Survey Effort 2020

VP	June	July	August	Total Hours per Year
4	6	18	12	36
5	6	6	12	24

A summary of numbers of target species flights, flight times and ground registrations are presented in Table 18. Appendix D, Table 41 details individual flight data for all target species. A complete species list with details on the conservation status of all species is included in Appendix E. A summary of all point registrations is included in Appendix F, Table 45.

The location of VPs 4 and 5, together with the flight lines from these surveys are presented in Appendix A, Figure 9.1.9.

Table 18: Summary Flight Data for Diver Species Recorded during VP Surveys

Species	Minimum No. of Birds	Maximum No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds	Number of Ground Registrations
Black-throated diver	2	4	4	310	310	1

Species	Minimum No. of Birds	Maximum No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds	Number of Ground Registrations
Red-throated diver	1	3	11	1,710	1,710	0

Red-throated divers were most frequently recorded moving within the vicinity of Loch Baligill and Loch na h-Eaglaise Mòr to the west of the site.

During the June surveys, birds were recorded most often in pairs or as a group of three flying both within and below the risk height.

The July surveys mostly recorded single birds traversing north to south and south to north within the risk height.

The August surveys recorded three red-throated divers including a pair and two single birds all flying within the risk height.

Black-throated divers were observed on four occasions during the surveys. Birds were recorded in pairs and groups of three or four in the vicinity of Loch Baligill and Achridigill Loch. All records recorded birds flying within the risk height. No evidence of breeding was recorded.

For both species of diver, no diver flights have been recorded within the site, either during the diver-specific surveys or more general VP surveys.

4.3.2 2021

Table 19 summarises the diver VP survey effort across the diver VP locations from May 2021 to August 2021 inclusive. The specific details of each VP survey visit (date, time, duration, and surveyor) can be found in Appendix B, Table 35. A summary of the weather conditions during all VP surveys is presented in Appendix C, Table 39.

Table 19: Diver Vantage Point Survey Effort 2021

VP	May	June	July	August	Total Hours per Year
4	3	6	6	12	27
5	3	6	6	12	27

A summary of numbers of target species flights, flight times and ground registrations are presented in Table 20. Appendix D, Table 43 details individual flight data for all target species. A complete species list with the conservation status details of all species is included in Appendix E. A summary of all point registrations is included in Appendix F, Table 48.

The location of VPs 4 and 5, together with the flight lines from these surveys are presented in Appendix A, Figure 9.1.10.

Table 20: Summary Flight Data for Diver Species Recorded during VP Surveys

Species	Minimum No. of Birds	Maximum No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds	Number of Ground Registrations
Black-throated diver	1	2	0	0	0	8
Red-throated diver	1	2	6	968	968	0

Both black-throated and red-throated divers were frequently recorded in the west and north west of the site throughout the breeding season.

Red-throated divers were observed making flights on six occasions during the diver VPs throughout the breeding season. Birds were recorded flying either singly or in pairs at risk height in a north north east or south west direction.

All observations of black-throated diver were of birds on the ground.

For both species of diver, no diver flights have been recorded within the site, either during the diver-specific surveys or more general VP surveys.

4.4 Moorland Breeding Bird Survey Results

4.4.1 2020

Four Brown and Shepherd visits were carried out as detailed in Table 21, which meets NatureScot guidance (2017b) requirements of four survey visits at least seven days apart between early April and the end of July. The study area for this survey included the site boundary plus a 500m buffer (Appendix A, Figure 9.1.11 refers).

Table 21: Moorland Breeding Bird Survey Effort 2020

Visit Number	Date	Observer	Start time	Stop time	Duration
1	30/04/2020	PH	10:00	16:00	06:00
	01/05/2020	PH	08:00	14:00	06:00
2	01/06/2020	PH	08:00	14:00	06:00
	02/06/2020	PH	08:00	14:00	06:00
3	25/06/2020	PH	08:00	14:00	06:00
	26/06/2020	PH	08:00	14:00	06:00
4	28/07/2020	SL	10:10	16:15	06:05
	29/07/2020	SL	11:00	16:00	05:00

During the breeding bird survey, a total of 47 species were recorded (Appendix A, Figure 9.1.11 refers). Table 22 presents, alphabetically, each of the species in terms of their breeding status, conservation value, and whether they are considered to be at risk from wind farms (SNH, 2018a). It also presents the species' breeding status at the site.

Table 22: Breeding Bird Survey Recorded Species

BTO Code	Common Name	Scientific Name	EU Birds Directive: Annex I	Schedule 1 Wildlife & Countryside Act 1981	Scottish Priority Species	Birds of Conservation Concern (BoCC)	At risk from windfarms (SNH 2006)	Breeding Status and number of territories (possible, probable, confirmed or non-breeding)
B.	Blackbird	*Turdus merula*				Green	No	Probable (1) Non-breeding (1)
BC	Blackcap	*Sylvia atricapilla*				Green	No	Non-breeding (1)
CH	Chaffinch	*Fringilla coelebs*				Green	No	Probable (4) Possible (5) Non-breeding (4)
CT	Coal tit	*Periparus ater*				Green	No	Non-breeding (4)
CM	Common gull	*Larus canus*				Amber	No	Non-breeding (1)

BTO Code	Common Name	Scientific Name	EU Birds Directive: Annex I	Schedule 1 Wildlife & Countryside Act 1981	Scottish Priority Species	Birds of Conservation Concern (BoCC)	At risk from windfarms (SNH 2006)	Breeding Status and number of territories (possible, probable, confirmed or non-breeding)
CS	Common sandpiper	*Actitis hypoleucos*				Amber	No	Non-breeding (1)
CK	Cuckoo	*Cuculus canorus*			X	Red	No	Non-breeding (1)
CU	Curlew	*Numenius arquata*			X	Red	Yes	Possible (1) Non-breeding (2)
DN	Dunlin	*Calidris alpina*				Red	Yes	Probable (1) Non-breeding (1)
D.	Dunnock	*Prunella modularis*				Amber	No	Non-breeding (1)
GC	Goldcrest	*Regulus regulus*				Green	No	Probable (1) Possible (2) Non-breeding (2)
GP	Golden plover	*Pluvialis apricaria*	X		X	Green	Yes	Probable (1) Non-breeding (1)
GO	Goldfinch	*Carduelis carduelis*				Green	No	Probable (1)
GT	Great tit	*Parus major*				Green	No	Non-breeding (2)
GR	Greenfinch	*Carduelis chloris*				Red	No	Non-breeding (1)
GK	Greenshank	*Tringa nebularia*				Amber	Yes	Non-breeding (1)
GJ	Greylag goose	*Anser anser*				Amber	Yes	Possible (1)
L.	Lapwing	*Vanellus vanellus*			X	Red	Yes	Possible (1) Non-breeding (1)
LR	Lesser redpoll	*Acanthis cabaret*			X	Red	No	Possible (1) Non-breeding (2)
LI	Linnet	*Linaria cannabina*			X	Red	No	Probable (1) Non-breeding (2)
MA	Mallard	*Anas platyrhynchos*				Amber	No	Possible (1)
MP	Meadow pipit	*Anthus pratensis*				Amber	No	Probable (7)
M.	Mistle thrush	*Turdus viscivorus*				Red	No	Non-breeding (2)
OC	Oystercatcher	*Haematopus ostralegus*				Amber	No	Probable (1)
PH	Pheasant	*Phasianus colchicus*				Green	No	Possible (1)
PW	Pied wagtail	*Motacilla alba*				Green	No	Confirmed (1) Probable (1) Possible (2) Non-breeding (3)
RN	Raven	*Corvus corax*				Green	No	Non-breeding (1)
RL	Red legged partridge	*Alectoris rufa*				Green	No	Non-breeding (2)

BTO Code	Common Name	Scientific Name	EU Birds Directive: Annex I	Schedule 1 Wildlife & Countryside Act 1981	Scottish Priority Species	Birds of Conservation Concern (BoCC)	At risk from windfarms (SNH 2006)	Breeding Status and number of territories (possible, probable, confirmed or non-breeding)
RH	Red-throated diver	*Gavia stellata*	X	X		Green	Yes	Confirmed (1) Possible (1)
RE	Redwing	*Turdus iliacus*		X		Amber	No	Non-breeding (1)
RB	Reed bunting	*Emberiza schoeniclus*			X	Amber	No	Probable (1) Non-breeding (2)
R.	Robin	*Erithacus rubecula*				Green	No	Possible (2) Non-breeding (1)
SM	Sand martin	*Riparia riparia*				Amber	No	Confirmed (1)
SW	Sedge warbler	*Acrocephalus schoenobaenus*				Amber	No	Probable (1) Non-breeding (2)
SK	Siskin	*Spinus spinus*				Green	No	Possible (1) Non-breeding (2)
S.	Skylark	*Alauda arvensis*			X	Red	No	Probable (13) Possible (5)
SN	Snipe	*Gallinago gallinago*				Amber	No	Probable (1)
ST	Song thrush	*Turdus philomelos*			X	Amber	No	Probable (1) Non-breeding (3)
SH	Sparrowhawk	*Accipiter nisus*				Amber	No	Non-breeding (1)
SC	Stonechat	*Saxicola rubicola*				Green	No	Confirmed (2) Non-breeding (2)
SL	Swallow	*Hirundo rustica*				Green	No	Non-breeding (2)
T.	Teal	*Anas crecca*				Amber	No	Non-breeding (1)
W.	Wheatear	*Oenanthe oenanthe*				Amber	No	Probable (1) Possible (1) Non-breeding (5)
WC	Whinchat	*Saxicola rubetra*				Red	No	Non-breeding (1)
WW	Willow warbler	*Phylloscopus trochilus*				Amber	No	Probable (7) Non-breeding (1)
WP	Woodpigeon	*Columba palumbus*				Amber	No	Non-breeding (1)
WR	Wren	*Troglodytes troglodytes*				Amber	No	Probable (4) Possible (6) Non-breeding (4)
Y.	Yellowhammer	*Emberiza citrinella*			X	Red	No	Possible (1)

4.4.2 2021

Four Brown and Shepherd visits were carried out as detailed in Table 23, which meets NatureScot guidance (2017b) requirements of four survey visits at least seven days

apart between early April and the end of July. The study area for this survey included the site boundary plus a 500m buffer (Appendix A, Figure 9.1.12 refers).

Table 23: Moorland Breeding Bird Survey Effort 2021

Visit Number	Date	Observer	Start time	Stop time	Duration
1	14/04/2021	PH	08:30	14:30	06:00
	30/04/2021	PH	08:30	14:30	06:00
2	15/05/2021	PH	08:30	14:30	06:00
	22/05/2021	PH	08:00	14:00	06:00
	28/05/2021	PH	08:30	14:30	06:00
3	05/06/2021	PH	08:30	14:30	06:00
	11/06/2021	PH	08:30	14:30	06:00
	28/06/2021	PH	08:30	14:30	06:00
4	02/07/2021	PH	08:30	14:30	06:00
	24/07/2021	PH	08:30	14:30	06:00
	07/07/2021	PH	08:30	14:30	06:00

During the breeding bird survey, a total of nine species were recorded (Appendix A, Figure 9.1.12 refers). (This is less than were recorded in the 2020 season, as small passerines were not recorded and activity was focussed on the target species.) Table 24 presents, alphabetically, each of the species in terms of their breeding status, conservation value, and whether they are considered to be at risk from wind farms (SNH, 2018a). It also presents the species' breeding status at the site.

Table 24: Breeding Bird Survey Recorded Species

BTO Code	Common Name	Latin Name	EU Birds Directive: Annex 1	Schedule 1 Wildlife & Countryside Act 1981	Scottish Priority Species	Birds of Conservation Concern (BoCC)	At risk from windfarms (SNH 2006)	Breeding Status and number of territories (possible, probable, confirmed or non-breeding)
BZ	Buzzard	*Buteo buteo*				Green	No	Non-breeding (1)
CU	Curlew	*Numenius arquata*			X	Red	Yes	Probable (1) Possible (1) Non-breeding (4)
DN	Dunlin	*Calidris alpina*				Red	Yes	Probable (1) Possible (1)
GP	Golden plover	*Pluvialis apricaria*	X		X	Green	Yes	Probable (2) Possible (2) Non-breeding (1)
GJ	Greylag goose	*Anser anser*				Amber	Yes	Non-breeding (2)
L.	Lapwing	*Vanellus vanellus*			X	Red	Yes	Non-breeding (5)
OC	Oystercatcher	*Haematopus ostralegus*				Amber	No	Probable (1) Unknown (2)
RH	Red-throated diver	*Gavia stellata*	X	X		Green	Yes	Possible (1)

BTO Code	Common Name	Latin Name	EU Birds Directive: Annex 1	Schedule 1 Wildlife & Countryside Act 1981	Scottish Priority Species	Birds of Conservation Concern (BoCC)	At risk from windfarms (SNH 2006)	Breeding Status and number of territories (possible, probable, confirmed or non-breeding)
SN	Snipe	*Gallinago gallinago*				Amber	No	Probable (1) Possible (1) Non-breeding (1)

4.5 Breeding Raptor Survey Results

4.5.1 2020

A total of 17 breeding raptor survey days were carried out over four months at the site as detailed in Table 25. The survey included a 2km buffer encompassing the proposed development site.

Table 25: Breeding Raptor Survey Effort 2020

Visit Number	Date	Observer	Start time	Stop time	Duration
1	23/04/2020	PH	14:00	17:00	03:00
	24/04/2020	PH	14:00	17:00	03:00
	26/04/2020	PH	14:00	20:00	06:00
	02/05/2020	PH	10:00	16:00	06:00
	06/05/2020	PH	09:00	15:00	06:00
2	18/05/2020	PH	10:00	16:00	06:00
	20/05/2020	PH	09:30	15:30	06:00
	21/05/2020	PH	12:00	18:00	06:00
	30/05/2020	PH	07:00	13:00	06:00
3	09/06/2020	PH	10:00	16:00	06:00
	11/06/2020	PH	10:00	16:00	06:00
	12/06/2020	PH	08:00	14:00	06:00
	14/06/2020	PH	08:00	14:00	06:00
4	11/07/2020	PH	08:00	14:00	06:00
	12/07/2020	PH	10:00	16:00	06:00
	18/07/2020	PH	08:00	14:00	06:00
	19/07/2020	PH	10:00	16:00	06:00

Three Annex 1 / Schedule 1 species were recorded on site as shown in Table 26. Observations of all raptors recorded during these surveys are presented in Appendix A, Figure 9.1.13.

Table 26: Breeding Status of Annex 1/Schedule 1 Raptors Observed During Raptor Surveys 2020

Schedule 1 species	Breeding status	No. of registrations
Merlin	Non-breeding	3
Osprey	Non-breeding	2

Schedule 1 species	Breeding status	No. of registrations
Peregrine	Non-breeding	1

Merlin was recorded on most surveys. A single male was seen on two occasions east of the A897, within the survey buffer. A single male merlin was also recorded west of the site boundary, flying south.

Two observations of osprey were recorded within the survey buffer: one to the east and a second to the west of the site boundary. During the July diver VP surveys, osprey was also recorded flying west to the north of Loch na h-Eaglaise Mòr.

There is no evidence of either merlin or osprey breeding on or in the buffer areas close to the site. Given the merlin activity recorded in the outermost part of the eastern buffer it is possible there was a territory to the east of the survey area.

Hen harrier was recorded during VP and diver VP surveys (Appendix A, Figures 9.1.6a and 9.1.9 respectively), appearing most regularly hunting to the west of the site. Despite both male and female hen harriers being recorded during these surveys, no evidence of breeding has been observed within the site or survey buffer. Hen harrier can range over long distances from breeding locations and also may depart territories early if their nests fail early season.

Buzzard and sparrowhawk were also frequently observed on the site.

4.5.2 2021

A total of 14 breeding raptor survey days were carried out over four months at the site as detailed in Table 27. The survey included a 2km buffer encompassing the proposed development site.

Table 27: Breeding Raptor Survey Effort 2021

Visit Number	Date	Observer	Start time	Stop time	Duration
1	02/04/2021	PH	09:00	15:00	06:00
	07/04/2021	PH	09:00	15:00	06:00
	17/04/2021	PH	09:30	15:30	06:00
	23/04/2021	PH	08:30	14:30	06:00
2	02/05/2021	PH	09:00	15:00	06:00
	07/05/2021	PH	08:30	14:30	06:00
	16/05/2021	PH	09:00	15:00	06:00
	30/05/2021	PH	09:00	15:00	06:00
3	04/06/2021	PH	09:00	15:00	06:00
	09/06/2021	PH	09:00	15:00	06:00
	25/06/2021	PH	09:00	15:00	06:00
4	10/07/2021	PH	09:00	15:00	06:00
	18/07/2021	PH	09:00	15:00	06:00
	30/07/2021	PH	09:00	15:00	06:00

One Annex 1 / Schedule 1 species was recorded on site as shown in Table 28. Observations of all raptors recorded during these surveys are presented in Appendix A, Figure 9.1.14.

Table 28: Breeding Status of Annex 1/Schedule 1 Raptors Observed During Raptor Surveys 2021

Schedule 1 species	Breeding status	No. of registrations
Hen Harrier	Non-breeding	2

There were two observations of a male hen harrier flying to the east of the Halladale River in the vicinity of the Smigel Burn. These observations were in the May and June surveys. There were also two observations of a female hen harrier during March VP surveys flying in the vicinity of VP1, not far north west of where the male hen harrier was recorded (Appendix A, Figure 9.1.8a). However, no evidence of hen harrier breeding has been observed within the site or survey buffer.

Buzzards were also frequently observed on the site.

5 Collision Risk Modelling

Collision Risk Modelling (CRM) was carried out for nine species for which levels of flight activity recorded over the site during the 24 months of VP surveys (September 2019 – August 2021) were deemed reasonable for such an assessment.

As listed below, greylag goose had the highest number of seconds at risk height, followed by pink-footed goose, curlew, lapwing, golden eagle, whooper swan, golden plover, dunlin and hen harrier.

In this instance, CRM has been undertaken for the following species:

- Greylag goose (44,817 at risk flight seconds);
- Pink-footed goose (1,428 at risk flight seconds);
- Curlew (982 at risk flight seconds);
- Lapwing (673 at risk flight seconds);
- Golden eagle (485 at risk flight seconds);
- Whooper swan (456 at risk flight seconds);
- Golden plover (262 at risk flight seconds);
- Dunlin (230 at risk flight seconds); and
- Hen harrier (76 at risk flight seconds).

Flights included in the calculations were all those recorded within the viewsheds of the VP locations during survey times (i.e. not including incidental records) and recorded at collision risk height.

A worked example of the model is presented in Appendix G.

A model (Forsythe *et al.* 1995) was used to calculate the daytime length as a function of latitude (58°30'39"N for the centre of the proposed development site) and date (2020). The VP data was analysed for seasonal presence of a species on site (Appendix E). Table 29 presents the turbine parameters used for this model.

Table 29: Turbine Parameters

Parameter	Dimensions	Unit
Number of turbines	11	
Blades per turbine	3	
Hub height	83.4	metres
Rotor radius	66.5	metres
Maximum chord	3.7	metres
Pitch	15	degrees
Rotation period	4	seconds
Proportion operational	0.85	

5.1 Random Collision Risk Model

The general methodology used to predict collision risk for birds using the wind farm airspace is provided by NatureScot (SNH, 2009a).

In summary, the following steps were followed for random bird movements (as assumed for all species) in this assessment:

- Digitise all flight lines and record relevant characteristics (including species, number of birds, start time of flight and time within each height band) in database;
- Review the flight line data, which in this instance indicated that a random collision analysis should be conducted for each species;
- Identify all flights for each species that are at any point within the 'at risk' height band and sum the total 'at risk' flight duration for each VP, multiplying any flight at risk time by the number of birds observed, where more than one bird is recorded per flight line;
- Calculate an 'occupancy rate' for each vantage point, defined as the observed 'at risk' activity levels divided by total observation time and area observed, giving the occupancy per unit time and unit area for each VP;
- Average the occupancy rate across the VPs using an un-weighted mean approach;
- Apply the average occupancy rate to the wind development site, based on the site area, risk volume and total turbine rotor volume, applying a factor to estimate the total time that the birds could theoretically be active during the year, based on an algorithm for calculating day length (Forsythe *et al.* 1995); thus determining the total predicted time spent by the individual species within air space that could be swept by turbine blades;
- Run the collision model with relevant turbine and ornithological parameters to calculate the theoretical probability of transits resulting in a collision assuming no avoiding action;
- Multiply the number of transits by the collision rate, avoidance factor and operating parameters of the proposed wind farm to estimate the theoretical number of collisions per year; and
- Avoidance rates used were in accordance with SNH guidance (SNH, 2017a).

The predicted mortality through collision is dependent on a number of variables, including flight activity within the turbine envelope, the species' physiology, nocturnal flight behaviour and flight velocity, weather conditions, the predicted avoidance rate, the number, rotational speed and dimensions of the turbines, and the proportion of the time that the turbines are operational throughout the year.

The following assumptions were made for the various species:

- A daylight calculator was used to produce figures for the total daylight period at the proposed development site;
- Biometric data (bird length and wingspan) for the various species were obtained from the BTO webpage; and
- An assessment was made on the months active at the site for each species, with some species resident and others seasonal visitors. All species were considered active during the day only.

Table 30 presents a summary of the model used for each species, biometric parameters, avoidance rates and the seasons during which the species was present on site.

Table 30: Random CRM Biometric Parameters

Species	Bird length (m)	Wingspan (m)	Bird speed (m/s)	Avoidance rate	Months active	Daylight hours	Nocturnal hours	Total hours	Assumed activity period	Flapping / gliding
Curlew	0.55	0.9	16.3	0.980	March - August	2888.65	0.00	2888.65	Daylight hours only	F
Dunlin	0.18	0.40	15.3	0.980	March - August	2888.65	0.00	2888.65	Daylight hours only	F
Golden eagle	0.82	2.12	11.9	0.990	All year	4517.57	0.00	4517.57	Daylight hours only	G
Golden plover	0.28	0.72	13.7	0.980	March - September	3273.19	465.98	3739.17	Daylight hours plus 25% nocturnal hours	F
Greylag goose	0.82	1.64	17.1	0.998	All year	4517.57	0.00	4517.57	Daylight hours only	F
Hen harrier	0.48	1.10	9.1	0.990	All year	4517.57	0.00	4517.57	Daylight hours only	G
Lapwing	0.30	0.84	12.8	0.980	March - September	3273.19	0.00	3273.19	Daylight hours only	F
Pink-footed goose	0.68	1.52	17.1	0.998	September - March	1996.29	0.00	1996.29	Daylight hours only	F
Whooper swan	1.52	2.30	17.3	0.995	September - March	1996.29	0.00	1996.29	Daylight hours only	F

Table 31 presents the results of the random model for Year 1 (September 2019 - August 2020), Year 2 (September 2020 - August 2021) and the mean of both years. A worked example for the model is included in Appendix G.

Table 31: Random CRM Results

	Year	Annual collision risk	Years per collision	Collision over 30 years
Greylag goose	Year 1 (September 2019 – August 2020)	0.393	2.548	11.79
	Year 2 (September 2020 – August 2021)	0.013	73.621	0.39
	Mean (Year 1 + Year 2 / 2)	0.203	4.926	6.09
Pink-footed	Year 1 (September 2019	n/a	n/a	n/a

	Year	Annual collision risk	Years per collision	Collision over 30 years
goose	– August 2020)			
	Year 2 (September 2020 – August 2021)	0.057	17.494	1.71
	Mean (Year 1 + Year 2 / 2)	0.029	34.483	0.855
Curlew	Year 1 (September 2019 – August 2020)	0.037	26.271	1.11
	Year 2 (September 2020 – August 2021)	0.025	40.179	0.75
	Mean (Year 1 + Year 2 / 2)	0.031	32.258	0.93
Lapwing	Year 1 (September 2019 – August 2020)	0.004	262.584	0.12
	Year 2 (September 2020 – August 2021)	0.026	39.015	0.78
	Mean (Year 1 + Year 2 / 2)	0.015	66.666	0.45
Golden eagle	Year 1 (September 2019 – August 2020)	0.016	60.678	0.48
	Year 2 (September 2020 – August 2021)	n/a	n/a	n/a
	Mean (Year 1 + Year 2 / 2)	0.008	125.000	0.24
Whooper swan	Year 1 (September 2019 – August 2020)	0.006	160.759	0.18
	Year 2 (September 2020 – August 2021)	0.005	204.696	0.15
	Mean (Year 1 + Year 2 / 2)	0.006	166.666	0.165
Golden plover	Year 1 (September 2019 – August 2020)	0.012	83.222	0.36
	Year 2 (September 2020 – August 2021)	0.005	217.865	0.15
	Mean (Year 1 + Year 2 / 2)	0.008	120.438	0.255
Dunlin	Year 1 (September 2019 – August 2020)	0.011	89.270	0.33
	Year 2	n/a	n/a	n/a

	Year	Annual collision risk	Years per collision	Collision over 30 years
	(September 2020 – August 2021)			
	Mean (Year 1 + Year 2 / 2)	0.006	181.818	0.165
Hen harrier	Year 1 (September 2019 – August 2020)	0.001	939.850	0.03
	Year 2 (September 2020 – August 2021)	0.001	1,472.754	0.03
	Mean (Year 1 + Year 2 / 2)	0.001	1,147.447	0.03

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Appendices

Appendix A. Figures

Figure 9.1.1 - Site Location Plan

Figure 9.1.2 - Designated Sites

Figure 9.1.3 - Vantage Point Locations and Viewsheds

Figure 9.1.4 - Diver Vantage Point Locations and Viewsheds

Figure 9.1.5a - Vantage Point Records September 2019 – February 2020 Raptors

Figure 9.1.5b - Vantage Point Records September 2019 – February 2020 Geese

Figure 9.1.5c - Vantage Point Records September 2019 – February 2020 Other Species

Figure 9.1.6a - Vantage Point Records March – August 2020 Raptors

Figure 9.1.6b - Vantage Point Records March – August 2020 Geese, Swans and other Species

Figure 9.1.6c - Vantage Point Records March – August 2020 Waders

Figure 9.1.6d - Vantage Point Records March – August 2020 Waders Continued

Figure 9.1.7a - Vantage Point Records September 2020 – February 2021 Raptors

Figure 9.1.7b - Vantage Point Records September 2020 – February 2021 Geese and Swans

Figure 9.1.7c - Vantage Point Records September 2020 – February 2021 Other Species

Figure 9.1.8a - Vantage Point Records March – August 2021 Raptors

Figure 9.1.8b - Vantage Point Records March – August 2021 Geese and Swans

Figure 9.1.8c - Vantage Point Records March – August 2021 Waders

Figure 9.1.8d - Vantage Point Records March – August 2021 Waders Continued

Figure 9.1.9 - Diver Vantage Point Records 2020

Figure 9.1.10 - Diver Vantage Point Records 2021

Figure 9.1.11 - Breeding Bird Survey Results 2020

Figure 9.1.12 - Breeding Bird Survey Results 2021

Figure 9.1.13 - Breeding Raptor Survey Results 2020

Figure 9.1.14 - Breeding Raptor Survey Results 2021

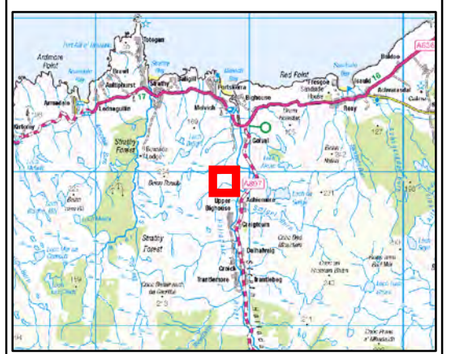
Kirkton Energy Park

Kirkton Wind Farm Ltd

Figure 9.1.1
Site Location Plan

Key

Site boundary



atmos CONSULTING

0 0.5 1 2
Kilometres

N

Scale @ A3:
1:50,000

November 2022 40421/OR/010d

Drawn by: JT Checked by: TH Approved by: JW

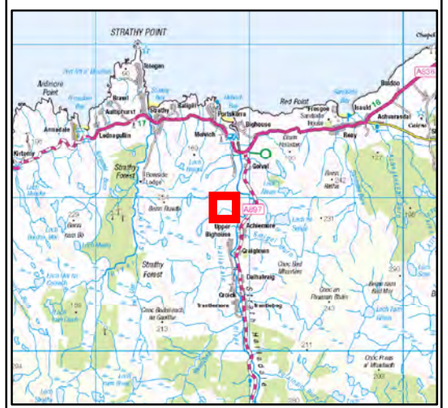
Kirkton Energy Park

Kirkton Wind Farm Ltd

Figure 9.1.2
Designated Sites

Key

- Site boundary
- 5km buffers to 20km
- Special Area of Conservation
- Ancient Woodland Inventory
- Special Protection Area
- National Nature Reserve
- Site of Special Scientific Interest
- RSPB Reserve
- RAMSAR wetland
- RSPB Important Bird Areas



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Kilometres

N

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November 2022 40421/OR/011e

Drawn by: JT Checked by: TH Approved by: JW

Kirkton Energy Park

Kirkton Wind Farm Ltd

Figure 9.1.3
Vantage Point Locations and Viewsheds

Key

- Site boundary
- Proposed turbine
- Special Protection Area

Viewshed

- VP 1
- VP 2
- VP 3
- Forestry

Generated using Ordnance Survey's Terrain 50 dataset that does not take into account the screening effects of buildings.

Observer height 1.5m above ground.
Viewshed height modelled 20m above ground.

Forestry has been used to screen visibility at a height of 10m using the Ordnance Survey OpenMapLocal Woodland dataset.

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0 0.25 0.5 1
Kilometres

N

Scale @ A3:
1:25,000

November 2022 TL01n 40421/OR/012f
Drawn by: AF Checked by: TH Approved by: JW

Kirkton Energy Park

Kirkton Wind Farm Ltd

Figure 9.1.4
Diver Vantage Point Locations and Viewsheds

Key

- Site boundary
- Proposed turbine
- Special Protection Area
- VP 4
- VP 5
- Forestry

Generated using Ordnance Survey's Terrain 50 dataset that does not take into account the screening effects of buildings.

Observer height 1.5m above ground.
Viewshed height modelled 20m above ground.

Forestry has been used to screen visibility at a height of 10m using the Ordnance Survey OpenMapLocal Woodland dataset.

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0 0.25 0.5 1
Kilometres

N

Scale @ A3:
1:25,000

November 2022 TL01n 40421/OR/012f
Drawn by: AF Checked by: TH Approved by: JW

Kirkton Energy Park

Kirkton Wind Farm Ltd

Figure 9.1.5a
Vantage Point Activity
(Sep 2019 - Feb 2020) - Raptors

Key

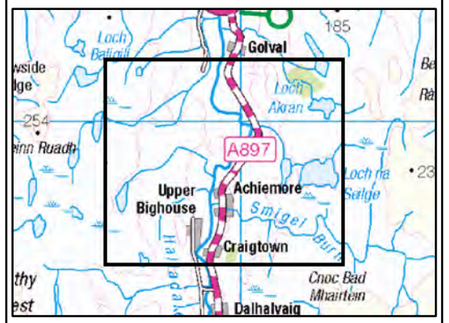
- Site boundary
- Proposed turbine
- Vantage Point

Species

- Golden eagle
- Hen harrier

Height Band

- Below 20m height
- 20 - 150m height
- Above 150m height
- On ground
- Heard only



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0 0.25 0.5 1
Kilometres

N

Scale @ A3:
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November 2022 TL01n 40421/OR/013e
Drawn by: JT Checked by: TH Approved by: JW