7 ORNITHOLOGY

7.1 INTRODUCTION

This chapter has been prepared by Fehily Timoney and Company (FT) to examine the potential effects that the proposed project (described in **Chapter 2**) may have on the avifauna of the study area. This assessment considers the potential effects with regard to each phase of the development: construction phase, operational phase, and decommissioning phase. Appropriate mitigation measures are described to avoid, or/reduce potential negative effect(s). The mitigation measures detailed within this chapter should be read in conjunction with mitigation measures contained in **Chapter 6: Biodiversity** and those contained in the CEMP (**Volume IV, Appendix 2.1**).

A detailed description of the project assessed in this EIAR is provided in **Chapter 2** and is comprised of the following main elements:

- The wind farm site (referred to in this EIAR as 'the Site');
- The grid connection route (referred to in this EIAR as the 'GCR');
- The turbine delivery route (referred to in this EIAR as the 'TDR' or 'Haul Route');

This Chapter of the EIAR is supported by Figures in **Volume III** and the following Appendix documents provided in **Volume IV**:

- **Appendix 7.1:** Bird Survey Reports
- **Appendix 7.2:** Collision Risk Model Report
- **Appendix 7.3:** Survey Details, Dates and Weather Conditions
- **Appendix 7.4:** Figures
- **Appendix 7.5:** Survey Results

Common acronyms used throughout this EIAR can be found in **Appendix 1.2**.

The main wind farm site includes the wind turbines, internal access tracks, hard standings, the permanent meteorological mast, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm.

The grid connection includes the buried grid connection cable route which is envisaged to run approximately 16.8km from the on-site substation at Dyrick Hill to the 110 kV ESB substation at Dungarvan in Co. Waterford, of which, 368m is within the site of the Development, and 16,432m is located along the public road corridor.

The turbine delivery route includes all aspects of the route from the port of Waterford to the site entrance including proposed temporary accommodation works to facilitate the delivery of wind turbine components.

Bird surveys of the study area following SNH (2017) guidance were carried out during the winters of 2020-2021 and 2021-2022, as well as the summers of 2020, 2021, and 2022. Three VP locations were selected to cover the site (VP1 – VP3). In February 2022, VP2 had to be moved slightly to VP2b as a result of a minor restriction in terms of access. In July 2022, tall bracken growth had impeded the view from VP2b, resulting in an additional short move to VP2d. The viewshed remained the same at both VP locations given the minor shift in locations locally.

VP surveys were carried out at the site monthly from April 2020 to September 2022 inclusive. The summer season was defined as running from April to September inclusive (six months) for 2020 2021, and 2022, and the winter season from October to March inclusive (six months) for 2020/21 and 2021/22. Therefore, over the entire survey period, three summer surveys and two winter surveys were completed. In addition, a round of autumn migration surveys were conducted in September and October of 2021. Watches were 2 * 3 hours = 6 hours per VP per month. Thus, the following survey effort was completed for the following seasons:

- Summer 2020: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds. Note that, as a result of the project commencing in May of 2020, the first round of summer VP surveys were omitted. As a result, 2 hours less were conducted at VP1, with 1 hour and 35 minutes less at VP2, and 4 hours and 35 minutes less at VP3. Thus, the total for the season was 99 hours and 50 minutes, or 359,400 seconds.
- Summer 2021: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds. Note that an extra ten minutes was conducted at each of the three VPs. Thus, the total was 108 hours and 30 minutes, or 390,600 seconds.
- Summer 2022: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds.
- Winter 2020/2021: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds. Note that an additional 25 minutes was conducted at each of the three VPs, thus the total for the season was 109 hours and 25 minutes, or 393,300 seconds.
- Winter 2021/2022: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds. Note that an additional 25 minutes was conducted at each VP. Thus, the total for the season was 109 hours and 25 minutes, or 393,300 seconds.
- Autumn Migration 2021: 3VPs * 6 hours / VP * 1 month = 18 hours or 64800.

The total survey effort over the 2.5-year survey period (3 x summer seasons, and 2 x winter seasons) was 535 hours and 10 minutes or 1,926,600 seconds. Thus, whilst VP surveys fell slight short of the required total (VP1 by 1 hour, VP2 by 15 minutes, and VP3 by 3 hours and 35 minutes), the supplementary round of autumn migration surveys more than covered this shortfall, with VP1 exceeding requirements by 5 hours, VP2 by 5 hours and 45 minutes, and VP3 by 3 hours and 35 minutes, meaning the combined survey effort required for all seasons exceeds that required by SNH guidance (SNH, 2017).

Bird surveys and contributions towards this chapter were completed by Ben O' Dwyer (FT Ecologist, BSc Wildlife Biology), Catherine Elder (FT GIS Technician, BSc Earth Science, MSc Environmental Engineering), Chandra Walters (FT Ecologist, BSc Ecology, MSc Horticulture), David Daly (FT Ecologist, BSc Ecology, MSc Species Identification and Survey Skills, Gary Locke (FT GIS Technician, BA Liberal Arts, HDip Applied Computing Technology, MSc Geographical Information Systems and Remote Sensing, Joseph Adamson (FT Subcontractor, BSc, MSc) Jon Kearney (FT Principal Ecologist; BSc. Applied Ecology MSc. Ecological Management and Biological Conservation), Kate Mahony (FT Ecologist), Noel Linehan (FT Subcontractor), Paul Rowe (FT Subcontractor), Rebecca Furlong (FT GIS Technician; BSc Earth and Ocean Sciences, Cert. Geographic Information Systems, MEngSc Civil and Environmental Engineering) and Seán Ronayne (FT Ecologist; BSc. Zoology; MSc. Marine Biology; MSc. Ecological Assessment).

Background information and biographies of surveyors listed above are detailed in **Table 7-1**:

Table 7-1: Surveyor Biographies

Surveyor	Biography
Ben O'Dwyer	Ben O'Dwyer is an ecologist with Fehily Timoney and Company with over 5 years' experience. He holds a fist class honours Bachelor of Science (BSc) in Wildlife Biology from Institute of Technology Tralee. A large portion of Ben's work is focused on the survey and assessment of proposed renewable energy development sites, and he has carried out comprehensive ecological work for a number of sites, from plant and animal surveys and habitat mapping to Ecological Appraisals, AA Screening Reports, Natura Impact Statements, and Ecological Enhancement plans.
Catherine Elder	Catherine holds a degree in Earth Science, an MSc in Environmental Engineering and has over 8 years' experience in local government, private and research sectors. Catherine is a problem solver, an excellent communicator and has been a creative facilitator for a range of projects. She has saved operational costs by automating GIS processes, purchasing GPS surveying equipment and using open-source OSi RINEX data and she has delivered new investment strategy options to improve nationwide gas network planning. Catherine has directed accurate conversion of several large water network databases for the southern region and has managed 70+ Phase I and II site remediations throughout Ireland and UK.
Chandra Walter	Chandra holds a BSc in Ecology and an MSc in Organic Horticulture, both degrees were awarded with Honours by University College Cork. Chandra is a dedicated ecologist, with excellent report writing and data management skill. She is skilled with

Surveyor	Biography
	QGIS and SPSS statistics. Chandra has good plant and insect identification skills, particularly for pollinators and freshwater macro-invertebrates. She is also experienced in both terrestrial and freshwater ecology.
David Daly	David Daly is a Project Ecologist working as part of the Energy and Planning Team at Fehily Timoney and Company. A large portion of his work is focused on the survey and assessment of proposed wind and solar energy development sites, and he has carried out comprehensive ecological work on a number of sites, from flora and fauna surveys and habitat mapping to Ecological Appraisals, Avian Monitoring Reports, AA Screening/ NIS Reports, and Habitat and Species Enhancement Plans. Since joining FT, David has carried out numerous habitat surveys, including surveys of woodland, grassland, and peatland habitats, and also qualitative assessments and mapping of the same. He has also carried out numerous mammal surveys including bat, badger, otter, and general mammal surveys. Bird surveys completed by David since joining FT include winter vantage point surveys, Irish Wetland Bird Surveys, hen harrier roost watches and breeding transects.
Gary Locke	Gary has a Master of Science (MSc) in Geographical Information Systems and Remote Sensing from University College Cork (2015), a Higher Diploma (HDip) in Applied Computing Technology from University College Cork (2014) and a Bachelor of Arts (BA) in Liberal Arts from University of Limerick (2013). He has completed an online course at the University of Michigan, which covers fundamental programming concepts including data structures, networked application program interfaces, and databases, using the Python programming language.
Joseph Adamson	Joseph holds a BSc (Thames Valley University) and MSc (UCD) and is a member of the Chartered Institute of Ecology and Environmental Management. Joseph has over 30 years' experience as an ornithologist and has worked in the USA and Ireland. He is an experienced field ornithologist who contributed to ecological impact assessments, habitat restoration and creation projects, hydrological assessments, and peat stability assessments. Species specific surveys include Hen Harrier, Barn Owl, Nightjar, Red Grouse, Merlin, Golden Plover, Greenland White-fronted Geese, Red Kite, Buzzard, and upland and general bird surveys. Joseph has also acted as Environmental Officer for a large number of wind farm projects during construction.
Jon Kearney	Jon Kearney is the Principal Ecologist with FT with over 17 years' experience in both the UK and Ireland. He has extensive experience in Project Management and is a specialist in Ornithological surveys and assessments. His skills include an in-depth knowledge of field survey techniques and methodology, ornithological surveys, mitigation design, water quality assessment, Appropriate Assessment and Ecological Impact Assessment. Jon has extensive experience of ornithological, mammal, reptile and amphibian surveying, habitat surveying, botanical surveying and invertebrate sampling techniques and identification. Jon has completed ecological assessments, biodiversity chapters and Natura Impact Statements for a wide variety of projects in Ireland including over 50 Wind farm sites. Jon has carried out ornithological surveys for the following sites Annagh, Lettercraffroe, Dromada, Leanamore, Carrickeeny, Athea, Knockranny, Gortyrahilly, Drehid, Moanvane, Croaghaun, Inchamore and Toberatoreen. Jon has provided expert witness testimony at three an Bord Pleanála oral hearings. He provided ecological advice to clients and Senior Council on the O'Grainne V An Bord Pleanála High Court Case and the North Kildare Wind Farm v An Bord Pleanála High Court Case. He has considerable experience of EIS and ecological constraints work, which often includes extensive reference to, and interpretation of, Article 6 of 'The Habitats Directive', and to other EU, UK and Irish conservation legislation.
Kate Mahony	Kate holds a degree and a PhD in Zoology from University College Cork and an MSc in Marine Biology. Kate is experienced in both terrestrial and marine ecology, with particular expertise in intertidal and estuarine ecology. Since starting at FT, Kate has gained experience

Surveyor	Biography
	in a variety of ecological skills, including Appropriate Assessment Screening reports, EcIA reports, Invasive Species Management Plans, Habitat Management Plans and detailed Ornithology report. She has conducted habitat surveys, bat surveys, bird VP surveys and mammal surveys in a range of habitats including peatland, woodland, grassland, and rivers.
Noel Linehan	Noel Linehan has been actively birdwatching for 36 years. He is a bird field identification expert, including based on vocalisations. He has had many rare bird sightings validated by the Irish Rare Birds Committee, including several species new to Ireland. In a voluntary capacity he is a recorder on the Birdwatch Ireland Countryside Bird Survey, leads field outings and gives presentations. He started the Cork Swift Project in 2022 and is currently working in partnership with Cork City Council, Birdwatch Ireland Cork Branch and Swift Conservation Ireland towards securing future nest sites for Swifts throughout County Cork. After a very successful 24-year career in Process Instrument Engineering (BSc (Hons)) he changed career to a full time Project Field Ornithologist in 2021 and has quickly become well known for those traits which made his engineering career successful: attention to detail, thorough, reliable, honest, fair, professional, and well liked. He has worked and is currently working on a variety of projects, for multiple clients, and is experienced in a range of bird survey methodologies, survey design and reporting. Noel completed the British Trust for Ornithology course "Bird Survey Techniques for Environmental and Ecological Professionals" in November 2022.
Paul Rowe	Paul has been actively immersed in the birding world for over 30 years, birdwatching both from home and abroad. Over that time he has acquired an in-depth knowledge of Ireland's avifauna, from field identification, vocalisations, habitat preferences, behavioural habits, as well as abundance and distribution throughout Ireland. For many years he has submitted counts and records for I-WeBS (Irish Wetland Bird Survey), as well as of scarce and rare birds, mainly in the Munster region. Paul completed a four-year project in the Ireland Bird Atlas 2007-2011 in which he was designated a 10km square grid in Co. Cork, monitoring and recording the breeding and wintering birds in the grid over the four-year period. He is an ornithological surveyor with a wide experience in field surveying techniques including vantage point surveys, breeding bird transects, hinterland surveys, as well as winter waterbird surveys. Paul has been involved with many proposed and existing wind farm projects over the years throughout Munster and the Midlands. He has seen over 2000 of the world's bird species.
Rebecca Furlong	Rebecca is responsible for the co-ordination of all environmental department geographic information systems (GIS) projects. She is experienced in many aspects of environmental risk/impact assessment modelling in GIS including database design, database management, data conversion/projection, raster spatial analysis / Heat Mapping, ArcGIS Story maps and management of ArcGIS online, data modelling and data processing utilising all main GIS software packages (including ArcGIS, QGIS, MapInfo). Rebecca has experience with various GIS and surveying software packages including Collector, Survey 123. Refer to CV for further details.
Seán Ronayne	Seán is a survey ecologist with Fehily Timoney & Company with extensive bird surveying experience. Seán holds a degree (BSc Zoology), and two masters from UCC (MSc Marine Biology + Ecological Assessment). Seán has worked in various ornithological roles both in Ireland and abroad for 10 years and has been birdwatching for more than 20 years. Two of Seán's dissertations were of an ornithological nature, and he has also published several papers in peer-reviewed journals, most recently on: "An observation of vocal mimicry by Dupont's Lark Chersophilus duponti in Catalonia.", published in Revista Catalana d'Ornitologia. Seán is also a very keen sound-recordist and recorded over 200 species of birds in Catalunya, in 2020. Seán is also working to sound record and catalogue all the resident and regularly occurring bird species of Ireland, of which he has recorded 174 species, to date.

7.2 METHODOLOGY

7.2.1 Relevant Guidance

The methodology for this appraisal has been devised in consideration of the following relevant guidance published by the Environmental Protection Agency (EPA) '*Guidelines on the information to be contained in Environmental Impact Assessment Reports*' (EPA, 2022) and '*Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*' (DoHPLG, 2018) and the Chartered Institute of Ecology and Environmental Management (CIEEM) '*Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (Version 1.1)*' (CIEEM, 2018 and revisions).

Additional guidance available from the EU such as '*Guidance document on wind energy developments and EU nature legislation*' (2020) and '*Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment*' (2013) has also been considered. The Heritage Council publication '*Best Practice Guidance for Habitat Survey and Mapping*' (Smith *et al*., 2011) is also referenced.

Relevant guidance from Scottish Natural Heritage (SNH) in relation to birds such as SNH *Recommended bird survey methods to inform impact assessment of onshore windfarms (2017)*. 'Survey Methods for use in assessing the impacts of onshore wind farms on bird communities (2005 & 2010)' and *'Assessing the cumulative impact of onshore wind energy developments (2012)'* have also been utilised.

Documentation available from Waterford County Council (WCC) such as the '*Waterford County Development Plan: 2011-2017* and *Waterford County Development Plan 2022-2028* has been reviewed and utilised where relevant.

7.2.2 Legislative Context

All birds are protected under the Wildlife (Amendment) Act, 2000 (as amended).

The conservation of birds and their habitats in Ireland has been expanded by EU law, most notably by the EU Birds Directive and EU Habitats Directive, which provide bird protection legislation.

Species listed in Annex I and migratory species are subject to special conservation measures to protect their habitat, through the establishment of Special Protection Areas (SPAs), under

Directive 2009/147/EC on the Conservation of Wild Birds (the Wild Birds Directive). The Habitats Directive (Directive 92/43/EC on the Conservation of Natural Habitats and of Wild Fauna and Flora) and Birds Directive were transposed into Irish law inter alia by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011), as amended and the Planning and Development Act 2000 as amended.

7.2.3 Consultation

For a full list of consultations and responses, please see **Appendix 1.3: Scoping Opinion** in **Volume IV**.

7.2.4 Desktop Study

A desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the site's natural environment. Records available on the NPWS and the National Biodiversity Data Centre websites were reviewed, in addition to records of rare/sensitive species within the 10km grid squares overlapped by a 2km buffer surrounding the study area obtained by request from NPWS (received 7th October 2022).

Other data sources include Ireland's Wetlands and their Waterbirds: Status and Distribution (Crowe 2005), and the Breeding and Winter Birds of Britain and Ireland Bird Atlas 2007-11 (Downie, et al., 2014).

Other sources included:

- OSI Aerial photography and 1:50000 mapping;
- NPWS website (mapviewer) grid square S10 flora and fauna records, accessed 16th January 2023;
- National Biodiversity Data Centre (NBDC) website and data obtained on 16th January 2023;
- Teagasc Soil area maps;
- Geological Survey Ireland (GSI) area maps, and;
- EPA website datasets (soil, surface water quality, ground water quality, designated sites).

7.2.5 Field Study

The details, dates and weather conditions are provided in **Appendix 7.3**.

Target Species

The following criteria has been utilised to select target species for the current study. Scottish Natural Heritage (SNH) guidance (SNH, 2017) on the assessment of the effects of wind farms on ornithological interests suggests that there are four important species lists from which target species can be drawn, as follows:

- Species listed on Annex 1 of the Birds Directive (EC, 2009)
- Red-listed birds of Conservation Concern
- Schedule 1 of the Wildlife and Countryside Act 1981 (not applicable in Ireland) and;
- Regularly occurring migratory species.

In addition to the above, consideration was given to species identified locally as being of conservation concern, regionally or those particularly susceptible to impact from wind farm development. Note that not all species on the above lists would be categorised as target species, e.g. most passerine species and general lowland farmland birds are not considered to be particularly susceptible to impacts from wind farms (SNH, 2017).

In the Irish context, it has been suggested that target species should be taken from species of conservation concern in Ireland (BOCCI) (Gilbert et al., 2021), those likely to occur within the vicinity of the proposed wind farm, and those most at risk from particular impacts such as disturbance and displacement (Nairn, R. and Partridge, K., 2013).

'Birds of Conservation Concern in Ireland' (BoCCI) are classified into three separate lists: red, amber, and green. Red-listed species are of high conservation concern, Amber-listed species are of medium conservation concern and Green-listed species are considered to be of no conservation concern (Gilbert et al., 2021).

To date four BoCCI lists have been published with the current list by Gilbert et al., (2021) superseding the three former lists by Colhoun and Cummins (2013), Lynas et al., (2007), and Newton et al., (1999). The conservation status of bird species found in this study was assessed using the most recent (2021) BoCCI List (Gilbert et al., 2021).

Additionally, a review of the bird species listed on Annex I of the EU Birds Directive (2009/147/EC) was undertaken in assessing the conservation status of birds. Annex I species are afforded additional protection through the designation of Special Protection Areas (SPAs) throughout EU countries in addition to existing National legislation.

Overview of methods of surveys

Initial walkovers of the site were carried out to enable the identification of suitable survey locations.

Field surveys were undertaken to gather detailed information on bird distribution and flight activity in order to predict the potential effects of a wind farm development on birds.

The field surveys comprised two main elements; vantage point (VP) watches and targeted distribution and abundance surveys which comprised:

- VP watches undertaken over 2.5 years at three VPs (winter 20/21, winter 21/22, summer 2020, summer 2021, and summer 2022).
- Transect surveys (winter 20/21, winter 21/22, summer 2020, summer 2021, and summer 2022);
- Hinterland surveys (winter 20/21, winter 21/22, summer 2020, summer 2021, and summer 2022).
- Breeding wader transects (summer 2020, summer 2021, and summer 2022).

7.2.5.1 Vantage Point (VP) Watches / Flight Activity Surveys

Selection of VP Locations

Vantage point (VP) surveys were carried out with regard to 'Recommended bird survey methods to inform impact assessment of onshore wind farms' (SNH, 2017).

VP surveys were carried out by suitably qualified personnel over:

- Two winter seasons:
  - a six-month period spanning October 2020 to March 2021(inclusive), and
  - a six-month period spanning October 2021 to March 2022(inclusive).
- Three summer seasons:
  - a six-month period spanning April to September 2020 (inclusive), and
  - a six-month period spanning April to September 2021 (inclusive), and
  - a six-month period spanning April to September 2022 (inclusive).

The overall aim of these surveys was to quantify the level of flight activity and distribution over the flight activity survey area and to determine bird usage of the site. The flight activity survey area was taken to be that area encompassing 500m circular buffers drawn around the location of each proposed turbine, as required by SNH (2017) guidance. Vantage points are ideally

located on elevated areas, or other areas, which provide clear views over the survey area. Achieving maximum visibility over as much of the site as possible is important for these surveys.

According to SNH (2017) vantage points should be located so as to allow full coverage of the flight activity survey area such that no point is greater than 2km from a VP. To minimise observer effect on bird behaviour, VPs should ideally be located outside the survey area but should be located as close as possible.

SNH (2017) stipulates that where VPs are located within the survey area, they should not be used simultaneously with other VPs which overlook them to minimise potential observer effect on birds. This was adhered to during the total survey period.

With regards to the proposed wind farm site, VP locations were selected to provide maximum site coverage. Factors which limited selection of VP locations included the forested nature of the site and the undulating typography of the landscape.

The locating of the VPs within the survey area achieved visual coverage of the site in line with SNH (2017) guidance. Each VP overlaps with at least one other VP. Overlap in VP surveys conducted over the course of the survey period was minimised to reduce the risk of surveyor presence affecting bird behaviour. Surveyor presence did not affect bird behaviour during any of the VP surveys which were carried out. This was reflected in the flight paths recorded for the various target and secondary species with birds regularly recorded flying in relatively close proximity to surveyors. If observer presence influenced bird behaviour, we would expect to see alterations in flight path to avoid the surveyor. This was not the case and no obvious alterations in flight paths were observed.

Three VP locations were selected to cover the site (VP1 – VP3). In February 2022, VP2 had to be moved slightly to VP2b as a result of a change in access restrictions. In July 2022, tall bracken growth had impeded the view from VP2b, resulting in an additional short move to VP2d. The viewshed remained the same at both VP locations given the minor shift in locations locally.

VP surveys were carried out at the site monthly from April 2020 to September 2022 inclusive. The summer season was defined as running from April to September inclusive (six months) for 2020 2021, and 2022, and the winter season from October to March inclusive (six months) for 2020/21 and 2021/22. Therefore, over the entire survey period, three summer surveys and

two winter surveys were completed. In addition, a round of autumn migration surveys was conducted in September and October of 2021. Watches were 2 * 3 hours = 6 hours per VP per month. Thus, the following survey effort was completed for the following seasons:

- Summer 2020: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds. Note that, as a result of the project commencing in May of 2020, the first round of summer VP surveys were omitted. As a result, 2 hours less were conducted at VP1, with 1 hour and 35 minutes less at VP2, and 4 hours and 35 minutes less at VP3. Thus, the total for the season was 99 hours and 50 minutes, or 359,400 seconds.
- Summer 2021: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds. Note that an extra ten minutes was conducted at each of the three VPs. Thus, the total was 108 hours and 30 minutes, or 390,600 seconds.
- Summer 2022: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds.
- Winter 2020/2021: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds. Note that an additional 25 minutes was conducted at each of the three VPs, thus the total for the season was 109 hours and 25 minutes, or 393,300 seconds.
- Winter 2021/2022: 3 VPs * 6 hours / VP / month * 6 months = 108 hours or 388,800 seconds. Note that an additional 25 minutes was conducted at each VP. Thus, the total for the season was 109 hours and 25 minutes, or 393,300 seconds.
- Autumn Migration 2021: 3VPs * 6 hours / VP * 1 month = 18 hours or 64800.

The total survey effort over the 2.5-year survey period (3 x summer seasons, and 2 x winter seasons) was 535 hours and 10 minutes or 1,926,600 seconds. Thus, whilst VP surveys fell slightly short of the required total (VP1 by 1 hour, VP2 by 15 minutes, and VP3 by 3 hours and 35 minutes), the supplementary round of autumn migration surveys more than covered this shortfall, with VP1 exceeding requirements by 5 hours, VP2 by 5 hours and 45 minutes, and VP3 by 3 hours and 35 minutes, meaning the combined survey effort required for all seasons exceeds that required by SNH guidance (SNH, 2017).

The Irish Transverse Mercator (ITM) grid co-ordinate locations of each VP are provided in Table 7-2, below. Figures showing the location of each VP and the viewsheds from each VP in order to show the extent of site coverage are provided in **Volume III**. Full details on individual VP surveys including survey dates, times and weather conditions can be found in **Appendix 7.3.**

Table 7-2: Vantage Point Locations

VP No.	ITM Grid Co-ordinates
1	614671 605630
2, 2b, 2d	617257 605131, 617072 605532, 617061 605654
3	615898, 605892

Viewshed Analysis of VP Locations

Viewshed analysis was undertaken for each VP location to determine visual coverage of the survey area (taken to encompass the site and the flight activity survey area). Viewsheds were set to observer height of 2m showing a view of everything over 25m height. Viewsheds encompassed a 2km radius with 360^0 view. Each viewshed was then cropped to an 180^0 arc showing the relevant direction of view.

Viewshed analysis determined that, based on the VP locations selected, visual coverage of approximately 95.45% of the survey area was achieved, thereby ensuring near complete coverage of the flight activity survey area by VP surveys in line with SNH (2017) guidance. Figures showing the viewsheds from each VP in order to show the extent of site coverage are provided in **Volume III**.

Flight Data Recording

During VP surveys the flight behaviour of target species was recorded. Based on the precautionary principle flight behaviour of secondary species was also recorded; however, recording of secondary species was subsidiary to recording of target species (SNH, 2017). At the time of each species observation the following information was recorded:

- The time that the bird was detected;
- The flight duration (seconds) within various flight height categories:
- 0-10m (s), 10-20m (s), 20-30m (s), 30-50m (s), 50-100m (s), 100-185m (s), > 185m (s);
- Sex and age of the bird(s) (adult/juvenile), where possible to determine;
- Type of activity/behaviour such as hunting, flying, displaying etc;
- Estimation of actual flight height;
- Habitat(s) where the bird was observed;
- Weather conditions at time of sighting including wind speed and direction.

Once an initial sighting was made, each target or secondary species was observed until lost from view. Flight paths were recorded as observed, including where birds travelled or were observed outside of the flight activity survey area; such that all flight activity within the broader landscape was encompassed.

Details on flight behaviour for each individual target/secondary species observed, including a unique map identifier code which corresponds to a mapped flight path, are provided in tabulated format in Appendix 7.4. All flight paths are provided in **Volume III.** Flight paths are mapped as both lines and polygons in figures. Polygons were provided when flight paths were complex in nature (i.e. larger flock with several individuals moving separately and provides a conservation area of activity). Note that each polygon depicts one separate observation. Summaries and monthly peak counts of all non-target species of conservation concern recorded during VP surveys are provided in **Appendix 7.4**.

7.2.5.2 Distribution and Abundance Surveys

Distribution and abundance surveys were carried out to record numbers and distributions of breeding, wintering and migrant birds using the site that might be affected either directly or indirectly by the proposed development (e.g., collision risk, habitat loss, displacement effects).

Transect Surveys

A transect survey is a survey along a defined route within the survey area. The overall aim of the transect surveys was to assess general bird distribution throughout the site and gather data on bird usage of the site.

For general breeding bird surveys, the method utilised was based on the existing British Trust for Ornithology (BTO) Breeding Bird Survey (BBS or CBS) [1]. The study area for this survey comprised a total of two no. c. 1km transects which were selected and centred on different habitats present within the subject site. Birds were counted over two visits, each timed to coincide with the early part of the breeding season (April to mid-May) and later part of the season (mid-May to late June), with visits at least four weeks apart (transect order and direction were reversed between surveys to avoid confounding transect order and direction with time of day). Surveyors recorded all birds seen or heard as they walked methodically along the transect routes. Birds were recorded in four distance categories, measured at right angles to the transect line (within 25m, between 25m - 100m and over 100m from the transect line) and those seen in flight only. Recording birds in distance bands gives a measure of bird detectability and allows relative population densities to be estimated if required (BTO, 2018). For the general wintering bird survey, the method utilised was the same as for the breeding bird transects, except it was undertaken in the winter season.

[1] British Trust for Ornithology. http://www.bto.org/volunteer-surveys/bbs/research-conservation/methodology. www.bto.org. [Online]

Transect surveys were completed for two winter seasons; between October 2020 and March 2021, and October 2021 to March 2022, as well as three summer seasons; between May and August 2020, May and July 2021, and April and June 2022. All bird species seen or heard, typically within 100m of the transect route, were recorded, although the typography of the landscape often allowed for detection of birds at greater distances.

The transect route was selected to provide representative coverage of all habitats, both open and closed, occurring within the site e.g., clear-fell forestry, young/mature forestry, scrub etc.

A map showing the transect survey routes within the proposed wind farm site is included in the Figures in **Volume III**. Details on each transect survey carried out including the survey date, time and weather conditions can be found in **Appendix 7.3**. Tabulated results for all species recorded during monthly transect surveys are provided in Table 7-17.

7.2.5.3 Hinterland Surveys

The methodology used for wetland sites during hinterland surveys followed I-WeBS (Irish Wetland Bird Survey) methodology (Lewis et al, 2019), whereby each location was surveyed for the duration necessary to identify and obtain a count for all target species present. The same approach was adapted for non-wetland sites. Timing and details of hinterland surveys are detailed in **Appendix 7.3**.

The surveys were carried out in suitable habitats including woodlands and wetlands in the area surrounding the proposed wind farm site. This comprised of 12 hinterland vantage points within 10km from the Site. These hinterland vantage points (HVP) were chosen as they had suitable habitat for the following target species: raptors, waders, waterfowl, swans, geese, barn owl, wildfowl and other waterbirds. Additionally, checks were made in the general area surrounding the Site. Surveys were carried out between May 2020 and September 2022. The HVPs detailed in Table 2.2 and **Appendix 7.4**, Figure 3 were checked regularly across this period.

The centre point of HVP9 is in close proximity to HVP10, but HVP9 extended further up and down the R671 from the centre point on the map.

A hinterland survey for raptors was conducted in accordance with Hardey et al. (2013) to assess hen harrier and other raptor activity over the winter and breeding periods in the greater surroundings of the Site.

An area between VP3 and north of VP1 was searched on the following dates: 21/10/2020, 21/01/2021, 17/02/2021, 23/03/2021. Additionally, a watch was conducted on 27/12/2021 at Aughavanlomaun (HVP1). Hinterland surveys survey were also completed monthly during the summer 2022 breeding season (20th April 2022 to the 25th of September 2022). Timing and details of hinterland surveys are detailed in **Appendix 7.3**. A map showing the areas encompassed by the hinterland surveys is included in the Figures in **Appendix 7.4**.

7.2.5.4 Other Breeding Season Surveys

Breeding Wader Walkover Surveys

Breeding wader walkover surveys were undertaken in the Summers of 2020 (April, May, June, and July), 2021 (April, May, and June), and 2022 (April, May, and June) to detect the presence of breeding waders within 2km of the study area. Any sightings of target species exhibiting potential breeding behaviour were investigated to determine breeding status within the study area.

A map showing the areas encompassed by the walkover survey is included in the Figures in **Volume III**.

7.2.6 Avifauna Receptor Evaluation

Avifauna resources are to be initially evaluated as to whether or not they constitute key receptors for the assessment following NRA guidance. For the purposes of impact assessment, a receptor 'importance value' or sensitivity, following published guidance as in Percival (2007), SNH (2017) and literature review of published information on birds and wind farms (Pearce-Higgins J. L., 2009; Pearce-Higgins J. S., 2012; Drewitt A. L., 2006; Drewitt and Langston, 2008 and Masden, 2009) is to be calculated. Where provided receptor values from Percival (2007) are below those recommended in guidance within the Irish context (NRA, 2009a); then the evaluation has been increased in line with the recommended Irish evaluation as a precautionary principle. **Table 7-3** illustrates the combined receptor evaluation criteria used to assign sensitivity levels to key receptors:

Table 7-3: Avian Resource Evaluation Criteria

Sensitivity of key receptor	Percival 2007 criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
Very High.	Species is cited interest of SPA. Species present in Internationally important numbers.	International Importance.	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive	Species is cited Special Conservation Interest of SPA. Species present in Internationally important numbers. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive
High	Other non-cited species which contribute to integrity of SPA. Ecologically sensitive species (<300 breeding pairs in UK) and less common birds of prey. Species listed on Annex 1 of the EU Birds Directive. Regularly occurring relevant migratory species which are rare or vulnerable	National Importance	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list	Other non-cited / not a Special Conservation Interest species which contribute to integrity of SPA. Ecologically sensitive species (<300 breeding pairs nationally) and less common birds of prey. Species listed on Annex 1 of the EU Birds Directive. Regularly occurring relevant migratory species which are rare or vulnerable Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list (in this case BOCCI Red list).
Medium	Species present in regionally important numbers (>1% of regional population). Species occurring within SPA's but not crucial to the integrity of the site. Species listed as priority species in the UK BAP subject to special	County Importance	Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; County important populations of species. Sites containing habitats and species that are rare or are undergoing a	Species present in regionally important numbers (>1% of regional population). Species occurring within SPA's but not crucial to the integrity of the site. Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred

Sensitivity of key receptor	Percival 2007 criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
	conservation measures		decline in quality or extent at a national level.	to in Article 4(2) of the Birds Directive; County important populations of species. Species that are rare or are undergoing a decline in quality or extent at a national level.
Low	Species covered above which are present very infrequently or in very low numbers. Any other species of conservation interest not covered above, e.g. species listed on the red or amber lists of the BoCC.	Local Importance (High Value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list.	Locally important populations of priority species identified in the Local BAP, if this has been prepared. Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Amber listed species.
Negligible	Species that remain common and widespread	Local Importance (Low Value)	n/a	Species that remain common and widespread. Green Listed Species.

7.2.7 Assessing Effect Significance

Once the value of the identified ecological receptors (features and resources) was determined, the next step was to assess the potential effect of the project on the identified key ecological receptors.

Table 7-4 to Table 7-9 outline the EPA (2022) evaluation criteria utilised in this appraisal of the Environmental Factor, Ornithology. These criteria are included in the Guidelines on the Information to be contained in Environmental Impact Assessment Reports:

Table 7-4: Probability of Effects (EPA, 2022)

Likely Effects	Unlikely Effects
The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.

Table 7-5: Quality of Effects (EPA, 2022)

Quality of Effect	Description
Positive Effect	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or removing nuisances or improving amenities)
Neutral Effect	No effects or effects that are imperceptible, within the normal bounds of variation or within the margin of forecasting error.
Negative/Adverse Effect	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

Table 7-6: Significance of Effects (EPA, 2022)

Significance of Effect	Description
Imperceptible	An effect capable of measurement but without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant	An effect which, by its character, magnitude, duration, or intensity alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration, or intensity significantly alters most of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics

Table 7-7: Duration of Effects (EPA, 2022)

Duration of Effect	Description
Momentary Effects	Effects lasting from seconds to minutes
Brief Effects	Effects lasting less than a day
Temporary Effects	Effects lasting less than a year
Short-term Effects	Effects lasting one to seven years
Medium-term Effects	Effects lasting seven to fifteen years
Long-term Effects	Effects lasting fifteen to sixty years
Permanent Effects	Effects lasting over sixty years

Table 7-8: Types of Effects (EPA, 2022)

Type of Effect	Description
Effect/Impact	A change resulting from the implementation of a project.
Likely Effects	The effects that are specifically predicted to take place – based on an understanding of the interaction of the proposed project and the receiving environment.
Indirect Effects (a.k.a. secondary effects)	Effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.

Type of Effect	Description
Cumulative Effects	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
'Do Nothing' Effects	The environment as it would be in the future should the subject project not be carried out.
'Worst Case' Effects	The effects arising from a project in the case where mitigation measures substantially fail.
Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
Irreversible Effects	When the character, distinctiveness, diversity, or reproductive capacity of an environment is permanently lost.
Reversible Effects	Effects that can be undone, for example through remediation or restoration.
Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents (e.g. combination of SOx and NOx to produce smog).

Table 7-9: Definition of Terms – Source, Pathway, Receptor (EPA, 2022)

Term	Description
Source	The activity or place from which an effect originates
Pathway	The route by which an effect is conveyed between a source and a receptor.
Receptor	Any element in the environment which is subject to effects.
Effect/Impact	A change resulting from the implementation of a project

7.2.8 Assessing Effect Type and Magnitude

Assessment of effects considers construction, operational and decommissioning effects with reference to the potential for direct, indirect, and cumulative effects. The assessment also takes account of any residual effects that may persist following the implementation of any mitigation or best practice design. The characterisation of effects reflects the ecological structure and function upon which the key ecological receptors depend. Detailed assessment of effects considers the magnitude of effects affecting populations.

This EIAR uses the EPA classification of effects in order to describe the quality, significance, duration, and type of effect. Effects on avifauna are to be assessed following published guidance by Percival (2003). Once key avian receptors have been selected and assigned an evaluation of importance or sensitivity, the significance of potential effects are rated as a product of both the magnitude of the predicted effect and the sensitivity if the key receptor affected. The magnitude of effect is based on probability of the likely effect occurring.

The criteria outlined in **Table 7-10** below has been developed by Percival (2003) to determine the magnitude of potential effects on a species. Methodology for assessing sites outside of European Sites (i.e. SPAs) state 'the test of significance of an impact will be whether the wind

farm impact is causing a significant change to the population its range or distribution' (Percival, 2003). It is important to consider availability of alternative habitat elsewhere during this assessment (Percival, 2003).

Table 7-10: Determination of Magnitude Effects (Percival, 2003)

Magnitude	Description
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. *Guide: < 20% of population / habitat remains*
High	Major loss or major alteration to key elements/ features of the baseline (pre-development) conditions such that post development character/ composition/ attributes will be fundamentally changed. *Guide: 20-80% of population/ habitat lost*
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed. *Guide: 5-20% of population/ habitat lost*
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. *Guide: 1-5% of population/ habitat lost*
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. *Guide: < 1% population/ habitat lost*

The significance of potential effects is assessed by cross tabulating the magnitude of effects and bird sensitivity to predict significance of each potential effect. Population status, distribution, and trends of potentially affected species such as migratory winter birds should be taken into consideration when undertaking the assessment. Significant ratings are interpreted as follows, **very low** and **low** should not normally be of concern however normal design care should be undertaken to minimise effects, **medium** represents a potentially significant effect that requires careful individual assessment, while **very high** and **high** represents a highly significant effect on bird populations. A significance matrix table, combining magnitude and sensitivity to assess overall significance is presented below in **Table 7-11.**

Table 7-11: Significance matrix: combining magnitude and sensitivity to assess significance (Percival, 2003)

Significance		Sensitivity			
		Very High	High	Medium	Low
Magnitude	Very High	Very High	Very High	High	Medium

Significance		Sensitivity			
		Very High	High	Medium	Low
	High	Very High	Very High	Medium	Low
	Medium	Very High	High	Low	Very Low
	Low	Medium	Low	Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low

7.3 DESCRIPTION OF THE EXISTING ENVIRONMENT

The ecology of the existing environment is described within this section.

7.3.1 Site Description

The Site, as shown in **Figure 2.1**, is located within an area of farmland, forestry, and upland heath, and is located within the townlands of Ballynaguilkee Upper, Broemountain, Corradoon, Dyrick, Lickoran, Lickoranmountain, Lisleagh, Lisleaghmountain, Lyrattin and Scartmountain. The Site is located 43km west of Waterford City, 55km northeast of Cork City, and 12.9km northwest of Dungarvan.

The proposed grid connection passes through the townlands of Broemountain, Lyrattin, Farnane Lower, Farnane Upper, Castlequarter, Mountaincastle South, Carrigaun (Mansfield), Langanoran, Sleadycastle, Knockaunnaglokee, Garryduff, Colligan More, Garryclone, Colliganwood, Ballymacmague North, Ballymacmague South and Killadangan.

Temporary works will be required to accommodate the delivery of the turbine components. These temporary works are included as part of this application and are assessed as part of this EIAR and are located in the townlands of Ballynaguilkee Lower, Kilcooney, and Lisleagh Gorteens, Kilmurry, Rathpatrick, Ballyduff East, Joulterspark and Burgery.

The redline boundary extends to 358.6ha, and comprises a mixture of farmland, forestry, and upland heath. Much of the lands are in private, third-party ownership, while a portion of the site is shared land (commonage).

For further information, please refer to **Chapter 6: Biodiversity**.

7.3.2 Desktop Study

7.3.2.1 Sites of International Importance

Note only Special Protection Areas (relating to birds) are addressed in this chapter. Special Areas of Conservation (relating to habitats, plants, mammals, and all other non-avian taxa of note) are covered in the **Chapter 6: Biodiversity**. The same logic applies to sites of national importance.

Special Protection Areas (SPAs)

Special Protection Areas (SPAs) are designated under the EU Birds Directive (2009/147/EC) ('The Birds Directive'). There are five SPAs within 25km of the study area. See Table 7-12 for more information.

An Appropriate Assessment (AA) Screening Report and Natura Impact Statement (NIS) have been completed in order to ascertain if the proposed development either alone or in combination with other plans or projects, will adversely affect the integrity of a European Site (SACs and SPAs); and accompanies this planning application. **Table 7-12** below details the European sites protected for bird species (SPAs) within 25km of the proposed wind farm.

Table 7-12: Summary of Special Protection Areas (SPAs) within 25km of the project

Designated Site	Site code	Qualifying Interest	Distance to site (km)
Blackwater Callows SPA	004094	• Whooper Swan (*Cygnus cygnus*) [A038] • Wigeon (*Anas penelope*) [A050] • Teal (*Anas crecca*) [A052] • Black-tailed Godwit (*Limosa limosa*) [A156] • Wetland and Waterbirds [A999]	11.35 (SW)
Dungarvan Harbour SPA	004032	• Great Crested Grebe (*Podiceps cristatus*) [A005] • Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] • Shelduck (*Tadorna tadorna*) [A048] • Red-breasted Merganser (*Mergus serrator*) [A069] • Oystercatcher (*Haematopus ostralegus*) [A130] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Lapwing (*Vanellus vanellus*) [A142] • Knot (*Calidris canutus*) [A143] • Dunlin (*Calidris alpina*) [A149] • Black-tailed Godwit (*Limosa limosa*) [A156] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Turnstone (*Arenaria interpres*) [A169] • Wetland and Waterbirds [A999]	11.81 (SE)
Mid-Waterford Coast SPA	004193	• Cormorant (*Phalacrocorax carbo*) [A017] • Peregrine (*Falco peregrinus*) [A103] • Herring Gull (*Larus argentatus*) [A184] • Chough (*Pyrrhocorax pyrrhocorax*) [A346]	18.98 (ESE)

Designated Site	Site code	Qualifying Interest	Distance to site (km)
Blackwater Estuary SPA	004028	• Wigeon (*Anas penelope*) [A050] • Golden Plover (*Pluvialis apricaria*) [A140] • Lapwing (*Vanellus vanellus*) [A142] • Dunlin (*Calidris alpina*) [A149] • Black-tailed Godwit (*Limosa limosa*) [A156] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Wetland and Waterbirds [A999]	19.72 (SSW)
Helvick Head to Ballyquin SPA	004192	• Cormorant (*Phalacrocorax carbo*) [A017] • Peregrine (*Falco peregrinus*) [A103] • Herring Gull (*Larus argentatus*) [A184] • Kittiwake (*Rissa tridactyla*) [A188] • Chough (*Pyrrhocorax pyrrhocorax*) [A346]	20.44 (SE)

7.3.2.2 Sites of National Importance

Sites of National Importance in Ireland are termed Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA).

While the Wildlife (Amendment) Act 2000 has been passed into law, pNHAs will not have legal protection until the consultative process with landowners has been completed; this process is currently ongoing. For the purposes of this assessment however pNHAs have be treated as fully designated sites. There are no NHAs and five pNHAs present within 10km of the proposed wind farm.

Table 7-13 show the location of the designated sites in relation to the proposed turbine locations. The closest designated site to the wind farm is Glenboy Wood pNHA (site code 000952 – 3.03km northwest). The closest national site after Glenboy Wood pNHA is the Blackwater River & Estuary pNHA (site code 000072 – 6.41km southwest). See **Table 7-13** for more information.

Table 7-13: Summary of National Sites within 10km of the project

Designated Site	Site code	Features of Interest (Birds)	Distance to site (km)
Glenboy Wood	000952	N/A - information not available.	3.03 (NW)
Blackwater River And Estuary	000072	No birds of note discussed in the NPWS synopsis. However, birds are covered under the Blackwater Estuary SPA (004028) and the Blackwater Callows SPA (004094).	6.41 (SW)
Nier Valley Woodlands	000668	Old oak woodlands with - Long-eared owl (*Asio otus*), Woodcock (*Scolopax rusticola*), Badger (*Meles meles*) and Natterer's Bat (*Myotis nattereri*).	7.66 (NE)
Comeragh Mountains	001952	Peregrine (*Falco peregrinus*), a species listed on Annex I of the E.U. Birds Directive, breeds within the site, as does Raven (*Corvus corax*).	8.40 (E)

Designated Site	Site code	Features of Interest (Birds)	Distance to site (km)
		Hen Harrier (*Circus cyaneus*), also listed on this Annex, is found on the site.	
Lismore Woods	000667	The site supports a typical woodland bird community, with Raven (*Corvus corax)*, Sparrowhawk (*Accipiter nisus*), Hooded Crow (*Corvus cornix*), and Long-eared Owl (*Asio otus*) representing the larger species. Jay (*Garrulus glandarius*) and Woodcock (*Scolopax rusticola*) are seen sometimes and may nest. Summer breeders include many Blackcap (*Sylvia atricapilla*) and Chiffchaff (*Phylloscopus collybita*).	8.48 (WSW)

7.3.2.3 Other Designated Sites

Nature Reserves

There are no nature reserves within 10km of the proposed development.

Ramsar Sites

There are no Ramsar sites within 10km of the proposed development. The closest Ramsar site is Dungarvan Harbour, 16km to the southeast of the site.

7.3.2.4 Avifauna

A desktop study was undertaken to locate any records of rare or protected avian species that have previously been recorded in the site and the surrounding area. Examination of NPWS and NBDC records indicates that there is a combined total of 39 species, regardless of conservation status or date, recorded in the 10km grid square (S10) which overlaps the study area and are listed in Table 7-14, below. Of these 39 species, eight (black-headed gull, common gull, cormorant, curlew, golden plover, herring gull, lapwing, and wheatear) are considered to be historical records, as they have not been documented in the grid square in the last fifteen years. A total of 11 that are on the current Birds of Conservation Concern in Ireland (BoCCI) red list (Gilbert *et al*., 2021) and 16 are on the BoCCI amber list (Gilbert *et al*., 2021). Two of the species (hen harrier and merlin) are further listed on Annex I of the EU Birds Directive (EC, 2009). Four are species which are not rare (Red or Amber listed) or protected under Annex I (Habitats Directive) but have been included as they are indicator/keystone species and/or may be sensitive to wind farm development; namely buzzard, grey heron, little grebe, and moorhen.

Pheasant is the only invasive species (not included in Table 7-14 due to the fact that it is an invasive) recorded in the 10km grid square.

Table 7-14: Rare and protected species of avifauna recorded historically within the 10km square (S10) in which the subject site is located[2]

Species	*Latin*	Year of last record	BoCCI status	Annex I status
Black-headed Gull	*Chroicocephalus ridibundus*	29/02/1984	Amber	No
Buzzard	*Buteo buteo*	11/05/2021	Green	No
Common Gull	*Larus canus*	29/02/1984	Amber	No
Coot	*Fulica atra*	05/03/2016	Amber	No
Cormorant	*Phalacrocorax carbo*	29/02/1984	Amber	No
Curlew	*Numenius arquata*	31/07/1991	Red	No
Goldcrest	*Regulus regulus*	17/03/2021	Amber	No
Golden Plover	*Pluvialis apricaria*	29/02/1984	Red	Yes
Greenfinch	*Carduelis chloris*	31/12/2011	Amber	No
Grey Heron	*Ardea cinerea*	31/12/2011	Green	No
Grey Wagtail	*Motacilla cinerea*	31/12/2011	Red	No
Hen Harrier	***Circus cyaneus***	**15/07/2021**	Amber	Yes
Herring Gull	*Larus argentatus*	29/02/1984	Amber	No
House Martin	*Delichon urbicum*	31/12/2011	Amber	No
House Sparrow	*Passer domesticus*	31/12/2011	Amber	No
Kestrel	*Falco tinnunculus*	06/02/2021	Red	No
Lapwing	*Vanellus vanellus*	29/02/1984	Red	No
Linnet	*Carduelis cannabina*	31/12/2011	Amber	No
Little Grebe	*Tachybaptus ruficollis*	05/03/2016	Green	No
Mallard	*Anas platyrhynchos*	05/03/2016	Amber	No
Meadow Pipit	*Anthus pratensis*	19/10/2015	Red	No
Merlin	***Falco columbarius***	**31/12/2011**	Amber	Yes
Moorhen	*Gallinula chloropus*	05/03/2016	Green	No
Mute Swan	*Cygnus olor*	05/03/2016	Amber	No
Pochard	*Aythya ferina*	05/03/2016	Red	No
Red Grouse	*Lagopus lagopus scotica*	12/09/2021	Red	No

[2] Colours correspond to BoCCI conservation status, and Annex I species are shown in bold. Species rows which have not been colourised refer to historical records greater than 15 years of age.

Species	*Latin*	Year of last record	BoCCI status	Annex I status
Redwing	*Turdus iliacus*	31/12/2011	Red	No
Sand Martin	*Riparia riparia*	31/12/2011	Amber	No
Skylark	*Alauda arvensis*	31/12/2011	Amber	No
Snipe	*Gallinago gallinago*	31/12/2011	Red	No
Spotted Flycatcher	*Muscicapa striata*	31/12/2011	Amber	No
Starling	*Sturnus vulgaris*	31/12/2011	Amber	No
Stock Dove	*Columba oenas*	31/12/2011	Red	No
Swallow	*Hirundo rustica*	31/12/2011	Amber	No
Swift	*Apus apus*	31/12/2011	Red	No
Wheatear	*Oenanthe oenanthe*	31/07/1991	Amber	No
Willow Warbler	*Phylloscopus trochilus*	31/12/2011	Amber	No
Woodcock	*Scolopax rusticola*	31/12/2011	Red	No
Yellowhammer	*Emberiza citrinella*	31/12/2011	Red	No

7.3.3 Field Surveys

Species of conservation concern that are known to be potentially vulnerable to wind farm developments will be discussed in more detail in this section. Species have been selected for detailed discussion on the basis of conservation status, vulnerability to wind farm developments and if species sightings have been confirmed on or near the proposed wind farm site, which will indicate potential links between species recorded at the proposed site and the surrounding environment.

7.3.3.1 Target Species Observations (Flight Activity Surveys)

As per SNH guidance (2017) the Site, for the purposes of flight activity surveys (vantage point surveys) is defined not by the planning boundary for the Site but by a 500m radius circle (buffer) around the proposed wind turbine locations. The proposed turbine locations form the centre point of each of these 500m radius buffers. This study area is called the '**flight activity survey area'** and is unique to this survey type. Any target species passing within this 500m buffer from proposed turbine locations (flight activity survey area) is considered within the main wind farm site under the SNH (2017) guidance.

Target species recorded are shown below in **Table 7-15**.

During the winter 2020/2021 season, five target species were recorded. Of these, two species were red-listed (golden plover, and kestrel), one species was amber-listed (lesser black-backed gull), and two were green-listed (buzzard, and sparrowhawk). Golden plover is also listed under Annex I of the EU Birds Directive.

During the winter 2021/2022 season, 16 target species were recorded. Of these, five species were red-listed (golden plover, kestrel, lapwing, snipe, and stock dove), six species were amber-listed (black-headed gull, hen harrier, lesser black-backed gull, mallard, merlin, and teal) and five were green-listed (buzzard, green sandpiper, grey heron, peregrine, and sparrowhawk). Golden plover, hen harrier, merlin, and peregrine are also listed under Annex I of the EU Birds Directive.

During the summer 2020 season, five target species were recorded. Of these, two species were red-listed (kestrel, and stock dove), one species was amber-listed (lesser black-backed gull), and one was green-listed (buzzard). Hen harrier is also listed under Annex I of the EU Birds Directive.

During the summer 2021 season, 11 target species were recorded. Of these, four species were red-listed (kestrel, snipe, stock dove, and swift), three species were amber-listed (black-headed gull, herring gull, and lesser black-backed gull), and four were green-listed (buzzard, osprey, peregrine, and sparrowhawk). Peregrine is also listed under Annex I of the EU Birds Directive.

During the summer 2022 season, 16 target species were recorded. Of these, six species were red-listed (golden plover, kestrel, red kite, snipe, stock dove, and swift), five species were amber-listed (cormorant, hen harrier, herring gull, lesser black-backed gull, and mallard), and four were green-listed (buzzard, great black-backed gull, grey heron, and sparrowhawk). Golden plover, peregrine, and red kite are also listed under Annex I of the EU Birds Directive.

Table 7-15: Target species and species of conservation concern recorded on Dyrick Hill vantage point surveys between May 2020 and September 2022, inclusive.

Species	BoCCI	Annex I	Summer 2020	Summer 2021	Summer 2022	Winter 20/21	Winter 21/22
Black-headed Gull	Amber	No		✓			✓
Buzzard	Green	No	✓	✓	✓	✓	✓
Cormorant	Amber	No			✓		
Golden Plover	**Red**	**Yes**			✓	✓	✓

Species	BoCCI	Annex I	Summer 2020	Summer 2021	Summer 2022	Winter 20/21	Winter 21/22
Great Black-backed Gull	Green	No			✓		
Green Sandpiper	Green	No					✓
Grey Heron	Green	No			✓		✓
Hen Harrier	**Amber**	**Yes**	✓		✓		✓
Herring Gull	Amber	No		✓	✓		
Kestrel	Red	No	✓	✓	✓	✓	✓
Lapwing	Red	No					✓
Lesser Black-backed Gull	Amber	No	✓	✓	✓	✓	✓
Mallard	Amber	No			✓		✓
Merlin	**Amber**	**Yes**					✓
Osprey	Green	No		✓			
Peregrine	**Green**	**Yes**		✓	✓		✓
Red Kite	**Red**	**Yes**			✓		
Snipe	Red	No		✓	✓		✓
Sparrowhawk	Green	No		✓	✓	✓	✓
Stock Dove	Red	No	✓	✓	✓		✓
Swift	Red	No		✓	✓		
Teal	Amber	No					✓

7.3.3.2 Hinterland Surveys

Hinterland surveys to establish occupancy and quantity of target species that could potentially cross the site whilst moving to and from roosting and feeding grounds within a 10km radius of the site were carried out monthly across two and a half years of surveys, between October 2020 and September 2022, inclusive. These surveys were for wintering (IWeBS-style survey) and breeding target species.

Target species recorded are shown below in **Table 7-16**.

During the summer 2020 season, one target species was recorded: red-listed grey wagtail.

During the summer season 2021, ten target species were recorded. Of these, four species were red-listed (grey wagtail, kestrel, meadow pipit, and swift), five species were amber-listed (goldcrest, house martin, spotted flycatcher, swallow, and willow warbler) with the remainder green-listed (buzzard).

During the summer season 2022, 16 target species were recorded. Of these, five species were red-listed (grey wagtail, kestrel, meadow pipit, snipe, and swift), eight species were amber-listed (goldcrest, hen harrier, house martin, mallard, merlin, skylark, swallow, and willow warbler) with the remainder green-listed (buzzard, peregrine, and sparrowhawk). Hen harrier, merlin, and peregrine are also listed under Annex I of the EU Birds Directive.

During the winter 2020/2021 season, red-listed redwing was recorded.

During the winter 2021/2022 season, 16 target species were recorded. Of these, six species were red-listed (golden plover, grey wagtail, kestrel, meadow pipit, redwing, and snipe), seven species were amber-listed (goldcrest, hen harrier, lesser black-backed gull, mallard, skylark, starling, and swallow), with the remainder green-listed (buzzard, grey heron, and sparrowhawk). Golden plover and hen harrier are also listed under Annex I of the EU Birds Directive.

Table 7-16: Target species and species of conservation concern recorded on Dyrick Hill hinterland surveys between July 2020 and September 2022, inclusive.

Common Name	BoCCI*	Annex I**	Summer 20	Summer 21	Summer 22	Winter 20/21	Winter 21/22
Buzzard	Green	No		✓	✓		✓
Goldcrest	Amber	No		✓	✓		✓
Golden Plover	**Red**	**Yes**					✓
Grey Heron	Green	No					✓
Grey Wagtail	Red	No	✓	✓	✓		✓
Hen Harrier	**Amber**	**Yes**			✓		✓
House Martin	Amber	No		✓	✓		
Kestrel	Red	No		✓	✓		✓
Lesser Black-backed Gull	Amber	No					✓
Mallard	Amber	No			✓		✓
Meadow Pipit	Red	No		✓	✓		✓
Merlin	**Amber**	**Yes**			✓		
Peregrine	**Green**	**Yes**			✓		
Redwing	Red	No				✓	✓
Skylark	Amber	No			✓		✓
Snipe	Red	No			✓		✓
Sparrowhawk	Green	No			✓		✓
Spotted Flycatcher	Amber	No		✓			
Starling	Amber	No					✓
Swallow	Amber	No		✓	✓		✓
Swift	Red	No		✓	✓		

Common Name	BoCCI*	Annex I**	Summer 20	Summer 21	Summer 22	Winter 20/21	Winter 21/22
Willow Warbler	Amber	No		✓	✓		

* Species of conservation concern in Ireland (BOCCI) (Gilbert *et al*., 2021)
** Species listed on Annex 1 of the Birds Directive (EC, 2009)

7.3.3.3 Winter and Breeding Walkover Surveys

Transect surveys for all species were recorded during monthly surveys of the proposed wind farm site over three summers and two winters. This survey captured the baseline of avian species using the site as well as their abundance and includes seasonal visitors of the winter (i.e., golden plover) and summer months (i.e., cuckoo, and swallow). Over the entire survey period, a total of 50 bird species were recorded. Of the 50 species, one is Annex I listed (golden plover), six are red-listed (golden plover, kestrel, meadow pipit, redwing, snipe, and stock dove) and 12 are amber-listed (goldcrest, house martin, house sparrow, lesser black-backed gull, linnet, mallard, skylark, spotted flycatcher, starling, swallow, wheatear, and willow warbler). The remaining 32 species are green-listed. The recorded information is provided in **Table 7-17**:

Table 7-17: Target species and species of conservation concern recorded on Dyrick Hill transect surveys (wintering and breeding) between April 2020 and September 2022, inclusive.

Species	BoCCI	Annex I	Summer 2020		Summer 2021		Summer 2022		Winter 20/21		Winter 21/22	
			Total	Mean	Total	Mean	Total	Total	Mean	Total	Mean	Total
Blackbird	Green	No	9	2.25	12	2.5	13	2.17	10	1.67	25	2.78
Blackcap	Green	No	5	1.25			10	1.67				
Blue Tit	Green	No	2	0.5	6	1					3	0.33
Bullfinch	Green	No			2	0.33	2	0.33				
Buzzard	Green	No			1	0.17	4	0.67			6	0.67
Chaffinch	Green	No	16	4	18	3.67	37	6.17	28	4.67	36	4

Species	BoCCI	Annex I	Summer 2020		Summer 2021		Summer 2022		Winter 20/21		Winter 21/22	
			Total	Mean	Total	Mean	Total	Total	Mean	Total	Mean	Total
Chiffchaff	Green	No			2	0.33					1	0.11
Coal Tit	Green	No			1	0.17	1	0.17			9	1
Crossbill	Green	No			2	0.33					1	0.11
Dunnock	Green	No			2	0.5	6	1			11	1.22
Fieldfare	Green	No									44	4.89
Goldcrest	Amber	No	2	0.5	9	1.5	12	2			12	1.33
Golden Plover	**Red**	**Yes**									**163**	**18.11**
Goldfinch	Green	No			7	1.17	4	0.67	3	0.5	12	1.33
Great Tit	Green	No			1	0.17	4	0.67			9	1
Hooded Crow	Green	No	2	0.5	6	1	14	2.33	10	1.67	21	2.33
House Martin	Amber	No	1	0.25	4	0.67	2	0.33				
House Sparrow	Amber	No					2	0.33			2	0.22
Jackdaw	Green	No			6	1	4	0.67			29	3.22
Kestrel	Red	No									2	0.22
Lesser Black-backed Gull	Amber	No			1	0.17						
Lesser Redpoll	Green	No			11	1.83	2	0.33	3	0.5		
Linnet	Amber	No			8	1.33	12	2			4	0.44
Magpie	Green	No			5	0.83					17	1.89
Mallard	Amber	No					1	0.17				
Meadow Pipit	Red	No	14	3.5	32	5.33	60	10	6	1	73	8.11
Mistle Thrush	Green	No					8	1.33	2	0.33	9	1
Pheasant	Green	No	1	0.25			13	2.17			7	0.78
Pied Wagtail	Green	No			1	0.17	1	0.17			7	0.78
Raven	Green	No	2	0.5	2	0.33	1	0.17	2	0.33	14	1.56

Species	BoCCI	Annex I	Summer 2020		Summer 2021		Summer 2022		Winter 20/21		Winter 21/22	
			Total	Mean	Total	Mean	Total	Total	Mean	Total	Mean	Total
Redwing	Red	No							6	1	9	1
Reed Bunting	Green	No			1	0.17	1	0.17	5	0.83	3	0.33
Robin	Green	No	14	3.5	12	2	6	1	13	2.17	28	3.11
Rook	Green	No	19	4.75	7	1.17	9	1.5	15	2.5	32	3.56
Siskin	Green	No	2	0.5	3	0.5			8	1.33	2	0.22
Skylark	Amber	No			4	0.67	17	2.83			13	1.44
Snipe	Red	No									1	0.11
Song Thrush	Green	No	3	0.75	4	0.67	13	2.17	5	0.83	22	2.44
Sparrowhawk	Green	No									1	0.11
Spotted Flycatcher	Amber	No			1	0.17	2	0.33				
Starling	Amber	No	37	9.25	23	3.83	3	0.5	13	2.17	357	39.67
Stock Dove	Red	No					4	0.67				
Stonechat	Green	No	7	1.75	4	0.67	8	1.33	2	0.33	10	1.11
Swallow	Amber	No	5	1.25	13	2.17	10	1.67				
Treecreeper	Green	No					1	0.17			1	0.11
Wheatear	Amber	No					1	0.17				
Whitethroat	Green	No			2	0.33						
Willow Warbler	Amber	No	6	1.5	8	1.33	15	2.5				
Woodpigeon	Green	No	12	3	11	1.83	61	10.17	14	2.33	45	5
Wren	Green	No	8	2	20	3.33	35	5.83	10	1.67	53	5.89

7.3.3.4 Breeding Wader Surveys

Transect surveys to assess the presence of breeding wader populations were completed during the summers of 2020, 2021, and 2022. A number of methods were combined from published literature including Bibby et al, (2000), Gilbert et al, (1998), Brown & Shepherd (1993) and SNH (2017) to estimate numbers of target species breeding within the study area. A total of four transects were used to sample habitat deemed suitable for breeding waders on site. No breeding waders were found on site over the combined survey periods.

Outside of the breeding wader surveys, snipe (red-listed) was observed during winter 2020/2021 and summer 2021, however no breeding behaviour was observed.

During hinterland surveys, evidence of snipe breeding was recorded on the 20th of March 2022. On this occasion three snipe were heard both drumming and calling at Knocknanask South, approximately 2km west of the proposed wind farm site in an area of coniferous plantation of various ages and moor with areas of heather.

Furthermore, snipe drumming and calling was heard from Knocksculloge in April and May 2022.

7.3.3.5 Non-target Species Recorded During VP Surveys

Non-target species were also recorded during 2019/2020, 2020/2021, and 2021/2022 vantage point survey periods, as a summary of additional species, noted during each survey. In total, 53 non-target species were recorded during the entire two and a half years of surveys.

Of these 53 species, three are red-listed (grey wagtail, meadow pipit, and redwing), and 11 are amber-listed (goldcrest, greenfinch, house martin, house sparrow, linnet, sand martin, skylark, spotted flycatcher, starling, swallow, and willow warbler). The remaining 39 species are green-listed. See **Table 7-18** for further details:

Table 7-18: Non-target species recorded during VP surveys over five seasons at Dyrick Hill.

Species	BoCCI	Annex I	Summer 2020	Summer 2021	Summer 2022	Winter 20/21	Winter 21/22
Blackbird	Green	No	✓	✓	✓	✓	✓
Blackcap	Green	No	✓	✓	✓		
Blue Tit	Green	No	✓	✓	✓	✓	✓
Bullfinch	Green	No	✓	✓	✓	✓	✓

Species	BoCCI	Annex I	Summer 2020	Summer 2021	Summer 2022	Winter 20/21	Winter 21/22
Chaffinch	Green	No	✓	✓	✓	✓	✓
Chiffchaff	Green	No	✓	✓	✓		
Coal Tit	Green	No	✓	✓	✓	✓	✓
Common Crossbill	Green	No	✓	✓	✓	✓	✓
Cuckoo	Green	No		✓	✓		
Dunnock	Green	No	✓	✓	✓	✓	✓
Feral Pigeon	Green	No		✓	✓		✓
Fieldfare	Green	No				✓	✓
Goldcrest	Amber	No	✓	✓	✓	✓	✓
Goldfinch	Green	No	✓	✓	✓	✓	✓
Grasshopper Warbler	Green	No		✓	✓		
Great Spotted Woodpecker	Green	No			✓		
Great Tit	Green	No	✓	✓	✓	✓	✓
Greenfinch	Amber	No		✓		✓	✓
Grey Wagtail	Red	No		✓			✓
Hooded Crow	Green	No	✓	✓	✓	✓	✓
House Martin	Amber	No	✓	✓	✓		✓
House Sparrow	Amber	No	✓	✓	✓	✓	✓
Jackdaw	Green	No	✓	✓	✓	✓	✓
Jay	Green	No	✓	✓	✓	✓	✓
Lesser Redpoll	Green	No	✓	✓	✓	✓	✓
Linnet	Amber	No	✓	✓	✓	✓	✓
Long-tailed Tit	Green	No		✓	✓	✓	
Magpie	Green	No	✓	✓	✓	✓	✓
Meadow Pipit	Red	No	✓	✓	✓	✓	✓
Mistle Thrush	Green	No	✓	✓	✓	✓	✓
Pheasant	Green	No	✓	✓	✓	✓	✓
Pied Wagtail	Green	No	✓	✓	✓	✓	✓
Raven	Green	No	✓	✓	✓	✓	✓
Redwing	Red	No				✓	✓
Reed Bunting	Green	No	✓	✓	✓	✓	✓
Reed Warbler	Green	No			✓		
Robin	Green	No	✓	✓	✓	✓	✓
Rook	Green	No	✓	✓	✓	✓	✓
Sand Martin	Amber	No		✓	✓		

Species	BoCCI	Annex I	Summer 2020	Summer 2021	Summer 2022	Winter 20/21	Winter 21/22
Sedge Warbler	Green	No			✓		
Siskin	Green	No	✓	✓	✓	✓	✓
Skylark	Amber	No	✓	✓	✓	✓	✓
Song Thrush	Green	No	✓	✓	✓	✓	✓
Spotted Flycatcher	Amber	No		✓	✓		
Starling	Amber	No	✓	✓	✓	✓	✓
Stonechat	Green	No	✓	✓	✓	✓	✓
Swallow	Amber	No	✓	✓	✓		✓
Tree Pipit	Green	No		✓			
Treecreeper	Green	No		✓	✓		✓
Whitethroat	Green	No	✓	✓	✓		
Willow Warbler	Amber	No	✓	✓	✓		
Woodpigeon	Green	No	✓	✓	✓	✓	✓
Wren	Green	No	✓	✓	✓	✓	✓

7.3.3.6 Target species recorded during VP, transects and other species-specific surveys

The following target species were recorded during vantage point (VP) surveys, transects and other species-specific survey. The records of these species during hinterland surveys have also been included to provide context in relation to connectivity to important habitats in the surrounding area outside of the proposed wind farm site. The study area for VP surveys is called the 'flight activity survey area' and is unique to this survey type. Any target species passing within this 500m buffer from proposed turbine locations (flight activity survey area) is considered within the proposed wind farm site under the SNH (2017) guidance. Many of the observations of target species were outside of the flight activity survey area. However, the details of these observations were noted during the survey. The 'rotor sweep zone' is the height at which the proposed turbine blades would be rotating. It extends for the minimum tip of the blade from the ground to the maximum tip height of the blade in rotation. With a proposed hub height of 104m and a blade radius of 81m, the lower tip height is 23 and the upper tip height is 185m. Theoretically birds flying within this height range (23m to 185m) would be at risk of collision without the consideration of avoidance.

Table 7-19: Observation time recorded during vantage point surveys within the flight activity survey area (500m turbine buffer) and the rotor sweep zone – 2019 to 2022.

Species	Total Observation time during VPs (Seconds)	Total observation time in the flight activity survey area (Seconds)	Percentage of all VP observation time in the flight activity survey area (%)	Total observation time in the rotor sweep zone (Seconds)	Percentage of all VP observation time in the rotor sweep zone (%)
Black-headed Gull	246	0	0	0	0
Buzzard	62,206	49,249	2.56	28,792	1.49
Cormorant	0	0	0.00	0	0.00
Golden Plover	71,152	69,803	3.62	12,778	0.66
Great Black-backed Gull	9,495	44	0.00	0	0.00
Green Sandpiper	0	0	0.00	0	0.00
Grey Heron	37	2	0.00	0	0.00
Hen Harrier	1,249	1226	0.06	632	0.03
Herring Gull	25,082	24,936	1.29	628	0.03
Kestrel	44,900	29,826	1.55	18,548	0.96
Lapwing	19	19	0.00	19	0.00
Lesser Black-backed Gull	54,747	36,573	1.90	1,960	0.10
Mallard	389	136	0.01	73	0.00
Merlin	116	82	0.00	82	0.00
Osprey	480	480	0.02	480	0.02
Peregrine	1,203	829	0.04	439	0.02
Red Kite	335	335	0.02	200	0.01
Snipe	471	401	0.02	134	0.01
Sparrowhawk	2,102	1,683	0.09	881	0.05
Stock Dove	16,594	3,727	0.19	522	0.03
Swift	272	181	0.01	163	0.01
Teal	12	0	0.00	0	0.00

7.3.3.6.1 Black-headed Gull

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

A single record with no flight details occurred from VP2 on the 4th September 2021.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

A single flightline was recorded from VP3 on 7th November 2021, when two birds were noted flying for a total of 246 seconds in the 185m+ height band. This flightline occurred outside the flight activity survey area.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recorded during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recorded during hinterland surveys.

7.3.3.6.2 Buzzard

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

A total of 112 flightlines were recorded from all VPs combined during the three summer survey seasons. A total of 32,847 seconds of flight time was recorded. In all 76 records occurred within the flight activity survey area, amounting to a total of 25,270 seconds, of which 18,776 occurred in the rotor sweep zone.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded on 102 occasions from all VPs. A total of 29,359 seconds of activity time was logged. In all, 78 records occurred within the flight activity survey area, amounting to 23,979 seconds, of which 10,016 occurred in the rotor sweep zone.

Summer Walkover Surveys (2020, 2021, and 2022)

Recorded on three dates during summer walkovers: 31st July 2021 - one bird from transect 1; 27th April 2022 -two birds from transect 2; and two birds from transect 2 on the 19th June 2022. The aforementioned record was noted as a likely pair on territory.

Winter Walkover Surveys (2020/21, and 2021/22)

Recorded on two dates during winter walkovers: 17th November 2021 - one bird from transect one, and two birds from transect 2; 4th February 2022 - one bird from transect 3; and one bird each from transects 2 and 3 on the 23rd March 2022.

Hinterland Surveys (2020, 2021, and 2022)

Recorded on 12 occasions over combined hinterland seasons (including both summer and winter), with a maximum count of four birds seen from Glenshellane Woods on the 7th November 2021. Birds were also recorded from Broemountain, Aughavanlomaun, Knocksculloge, Knocknanask, and from the R671.

7.3.3.6.3 Cormorant

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Not recorded within the flight activity survey area, however; a single bird was noted passing outside and east of the VP3 viewsheds (flightline not drawn as the bird was beyond 2km) at approximately 100m, heading in a north-westerly direction on the 31st July.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Not recording during winter season vantage point surveys.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recording during hinterland surveys.

7.3.3.6.4 Golden Plover

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on 19 occasions with the majority of records (15) coming from VP1, with the remainder (4) from VP3. All summer records refer to birds either on the cusp of migrating north in spring (records only occur between the 9th and 24th April) or having just arrived back after the breeding season (records only occur between and 16th and 29th September). Numbers of birds involved varied from four birds recorded from VP3 on the 29th September 2022, with a peak of 125 birds from VP1 on the 9th April 2022, and an overall average of 53.21 birds (stdev +/- 49.02). A total of 42,594 (all 19 records) seconds of activity was recorded. A total of 14 records occurred within the flight activity survey area, amounting to a total of 41,447 seconds. Of these 41,447 seconds, 6,120 occurred in the rotor sweep zone.

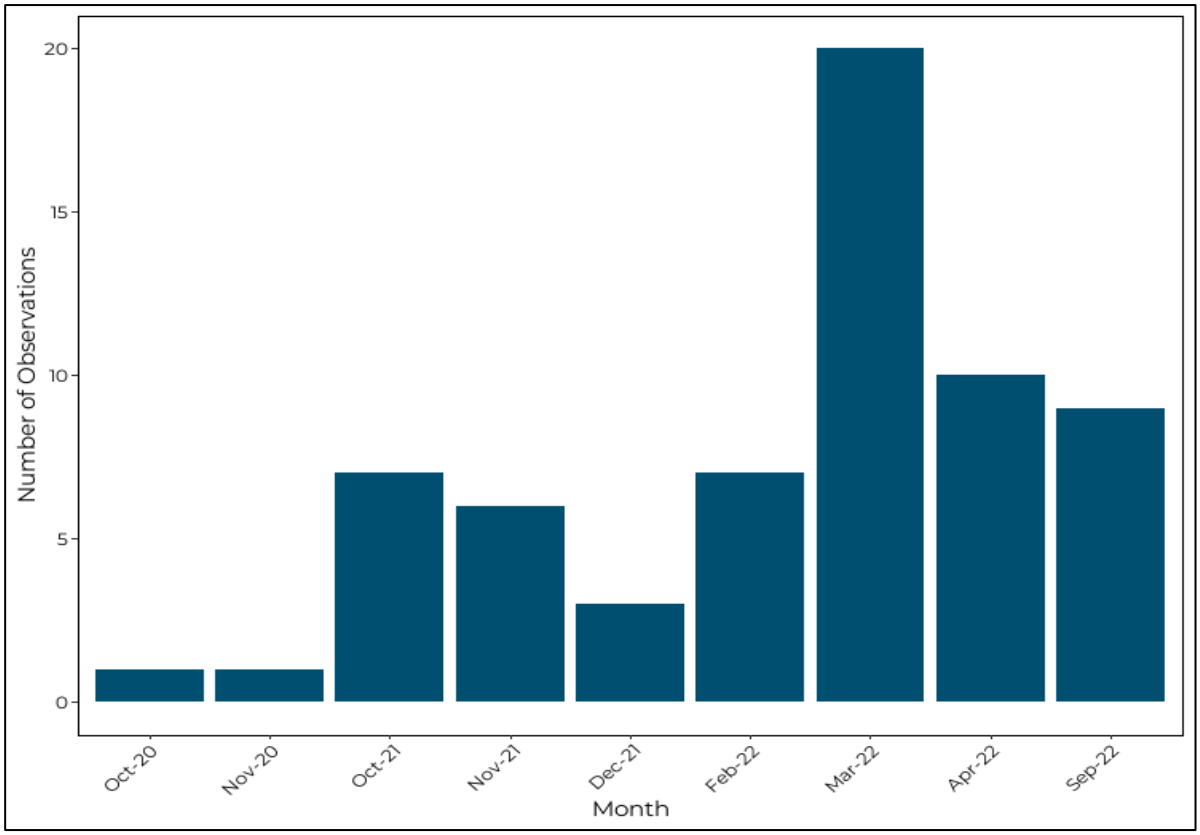
Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

There were only two observations of golden plover during the winter 2020/21 season both from VP2. On the 6th of October 2020, 27 golden plover were recorded flying in the height band 50 – 100m for a total time of 75 seconds. The birds were noted as flying in a northerly direction in a tight flock formation, circling back at times and calling. The second and final

record of the species during the first winter of surveys was recorded on the 21st of November 2020. A flock of 60 birds was observed for 60 seconds circling frequently and gradually moving northwards. Neither of these two sightings involved the species landing within the site.

During the second winter season 2021/22 golden plover was recorded on 43 occasions from all VPs, with the majority (23) from VP1. Golden plover were recorded across all months during VP surveys with the exception of January 2022. The highest number of observations was recorded in March 2022 (20 observations), with 7 observations each in October 2021 and February 2022, 6 observations in November 2021 and 3 in February 2022 (see Graph 7-1). Over the winter period 28 observations were of flocks of golden plover in flight while 15 observations involved the species on the ground, roosting, or foraging. These included 8 sightings in March, no. 3 each in October and November with one sighting of a flock of 500m birds landing on heath / acid grassland in Broemountain. The core foraging and roosting area for the species at Broemountain is indicated in **Volume III** Figure 7.73. The area is made up of 17.63 hectares of dry acid grassland and dry heath habitat with intermittent stands of dense bracken. Dense bracken which is present as monoculture stands dominated by the species and as part of mosaics with other habitat does not provide suitable roosting or foraging habitat for the species. Removing monoculture stands dominated with bracken (total area 1.18 hectares) from the total area provides a conservative estimate of 16.45 hectares of potential habitat for the species.

Across both seasons numbers varied from one bird to 500, with an average of 146.5 birds (stdev +/- 160.78). The largest number recorded during surveys were a flock of 500 birds recorded in flight from VP1 on the 22nd of February 2022. A total of 28,558 (all 45 records) seconds of activity was recorded over the combined winter seasons. Of these 28,558 seconds, 6,788 seconds occurred in the rotor sweep zone.



Graph 7-1: Number of observations of golden plover per month[3] during vantage point surveys.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Recorded on three dates during winter walkovers: 5th November 2021 - 21 birds from transect 3; 4th February 2022 – 40 birds from transect 3, and 60 birds on the ground along transect one (Broemountain); and 42 birds from transect 1 on the 23rd March 2022.

Hinterland Surveys (2020, 2021, and 2022)

Recorded three times during winter surveys, with a maximum count of eight birds recorded on the 17th October 2021.

7.3.3.6.5 Great Black-backed Gull

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

A total of six records, involving 9,495 seconds of observation time occurred. Of these six records, just one occurred within the flight activity survey area, when a single adult was seen from VP2 on the 8th September 2022. The record did not occur (nor did any other) in the rotor sweep zone.

[3] Months where no observations were recorded have been omitted from the graph.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Not recording during winter season vantage point surveys.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recording during hinterland surveys.

7.3.3.6.6 Green Sandpiper

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded once from VP2 on the 5th November 2021. The bird was only hear briefly in flight and not seen.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Not recording during winter season vantage point surveys.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recording during hinterland surveys.

7.3.3.6.7 Grey Heron

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded once, in the flight activity survey area, for two seconds at 0-10m (thus not in the rotor sweep zone), from VP2 on the 11th August 2022.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded twice from VP2 on the 8th March for a total of 35 seconds, neither of which occurred within the flight activity survey area.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Recorded on two occasions during winter 2021/22 surveys, with a juvenile noted feeding along the Glenshellane River on the 7th November 2022, and one to two birds noted from the R671 on the 27th December 2021.

7.3.3.6.8 Hen Harrier

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on three occasions, with two sightings from VP1 (22nd September 2020, and 16th September 2022), and an additional sighting from VP2 on the 25th July 2022. All three sightings occurred within the flight activity survey area. A total of 900 seconds of flight time was recorded, of which the majority (503 seconds) was below the rotor sweep zone (23m-185m). However, 397 seconds was spent in the 20-30m rotor swept height band.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded on four occasions between the 21st September 2021 and the 8th March 2022, with two sightings from VP1 and two from VP2. A total of 349 seconds (all four records) of flight time was logged, of which 326 seconds (three records) occurred within the flight activity survey area. Of this 326 seconds, 235 occurred within the rotor sweep zone. Two of the four records involved hunting birds, with the other two seen flying/commuting.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Six sightings recorded on four dates between 17th October 2021 and 8th May 2022, all involving sightings of single birds, four of which were seen hunting and two of which were seen carrying prey. All sightings bar one were of adult males.

7.3.3.6.9 Herring Gull

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on ten occasions from all VPs between the 28th June 2021 and the 20th June 2022. A total of 25,082 (all ten records) seconds were recorded, of which 24,936 seconds occurred within the flight activity survey area (nine records). Of these 24,936 seconds, 628 seconds occurred within the rotor sweep zone.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Not recording during winter season vantage point surveys.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recording hinterland surveys.

7.3.3.6.10 Kestrel

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on 162 occasions from all VPs (see Graph 7-2). A total of 31,912 seconds (all 162 records) of activity was recorded. Of these 31,912 seconds, 18,526 seconds (110 records) occurred within the flight activity survey area. Furthermore, 11,470 seconds occurred in the rotor sweep zone.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded on 63 occasions from all VPs. A total of 12,998 seconds (all 63 records) of activity were recorded. Of these 63 records, 50 occurred within the flight activity survey area, amounting to 11,300 seconds. Furthermore, of these 11,300 seconds, 7,078 also occurred within the rotor sweep zone.

Summer Walkover Surveys (2020, 2021, and 2022)

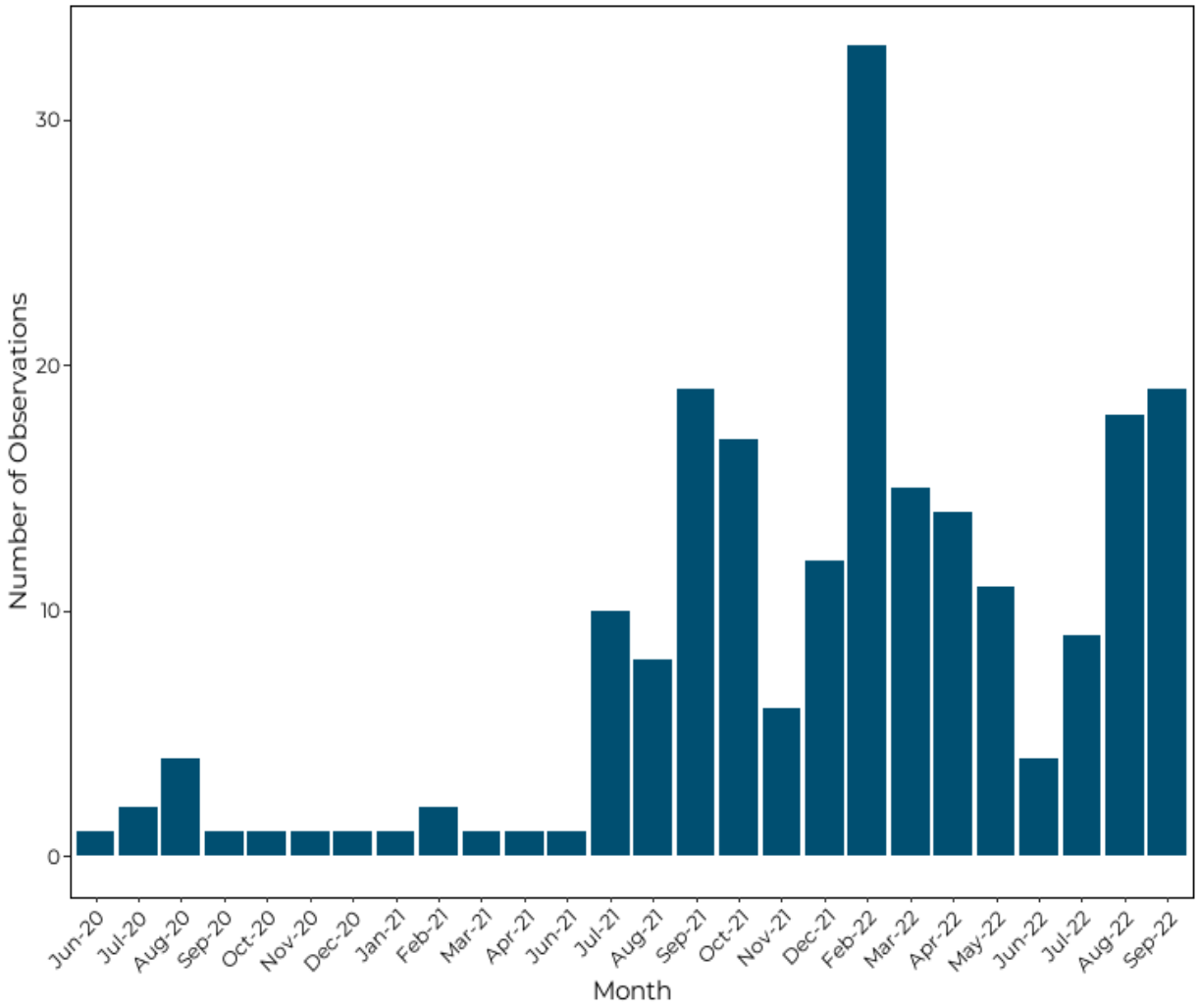
Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Recorded twice from transect 1 on the 23rd March 2022.

Hinterland Surveys (2020, 2021, and 2022)

Recorded on 20 occasions in both summer and winter seasons. Of these records, 14 sightings referred to single birds, five referred to two birds, with an additional record of four birds (referring to a conglomeration of sightings from a number of vantage point) recorded on the 20th October 2021.



Graph 7-2: Number of observations of kestrel per month during vantage point surveys.

7.3.3.6.11 Lapwing

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)
Not recording during winter vantage point surveys.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)
Recorded once from VP3 on the 21st October 2021 when a single bird was noted flying for 19 seconds at 20-30m. This brief sighting was within both the flight activity survey and rotor sweep zone.

Summer Walkover Surveys (2020, 2021, and 2022)
Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)
Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)
Not recording during hinterland surveys.

7.3.3.6.12 Lesser Black-backed Gull

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)
Recorded on 47 occasions, from all VPs (see Graph 7-3), with most sightings referring to single birds, and a peak of 227 birds seen from VP3 on the 27th July 2022. This sighting occurred outside of the study area but was included because of the high count.

In 2020 there were two observations of the species including one on the 16th of June of a single bird flying over the southern section of the site. In 2021, there were a total of 17 observations of the species. The first sightings were recorded in late July with two observations on the 22nd of July 2021 both of single birds in flight. The species was observed subsequently in early August on seven separate occasions (one on the 8th of August 2021 and six observations on the 9th of August 2021). During this period 6 individuals were recorded on three occasions, 1 bird on three occasions and 2 birds on one occasion. The remining eight observations were recorded on the 4th and 16th of September 2021.

Of the 17 observations in total during the summer 2021 season, 12 were of birds in flight and the remaining 5 observations were of the species on the ground. Feeding was observed on

two occasions in low numbers (1 and 2 birds), with one observation each in the months of August and September. There were two observations of the same 6 birds roosing and preening on the 9th of August 2021 as grass cutting finished in a field in the south eastern corner of the site approximately 400m east of Turbine 1. On the same day there was also a separate observation of two gulls briefly landing on the ground in the site at 12:15 in the middle of the day but both were gone by 12:30.

During the summer 2022 surveys there were 28 separate observations of the species across every month of surveys: April 1 observation, May 3 observations, June 4 observations, July 9 observations, August 6 observations and September 5 observations. Of the 28 occasions the species was observed 24 of these occasions were of single birds. Three birds were recorded on two occasions, with a single sighting each of 5, 133 and 227 birds. The largest count of 227 birds was observed on the morning of the 27th of June 2022 outside and to the east of the site (outside of the 500m buffer surrounding turbines). The species was observed to be roosting, preening, foraging and drinking from a cattle trough. The flock had reduced to 133 birds by 11:36 later that morning. On the 25th of July 2020 there were five further sighting of lone individuals roosting, preening, foraging on the ground outside the site. On the 11th of August 5 birds were observed to be roosting at 07:29 in the morning outside of and to the east of the site with two single sightings of individuals on the ground outside the site later that day. On the 8th of September there were three further sightings of the species (two of 1 individual and one of 3 individuals) feeding in agricultural fields outside the site. The remaining records were of the species in flight all single individuals. Breeding was not observed within the site over the 3 years of surveys.

A total of 40,563 seconds of activity was noted in total. Of the 47 records, 32 occurred within the flight activity survey area, amounting to 31,766 seconds, of which 1,648 seconds occurred in the rotor swept area.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded on 33 occasions from VPs 2 and 3 (see Graph 7-3), with numbers ranging from one to 25 birds.

The species was recorded twice during the winter 2020/2021 season once on the 6th of October (flight inside the site) and once on the 21st of November 2020 (outside the site). During the winter 2021/2022 season there were 31 individual observation of the species including 3 in late September, 21 in October, 3 in November, 2 in December and one in February. There were no sightings in January or March 2021.

Of the 33 observations in total during the winter 2021/2022 season, 21 were of birds in flight the remaining 12 observations were of the species on the ground. Feeding was observed on five occasions with low numbers (1 to 19) on three dates in October (the 10th, 20th and 21st of October). One of these observations on the 10th of October also exhibited roosting and preening behaviours in an agricultural field outside of the site. Roosting behaviour was also recorded on the 21st of October, with 11 birds recorded on the ground to the east of that site (outside the 500m buffer around turbines) at the start of the VP at 08:48. By 08:55 later that morning, 5 gulls had departed, heading south. Roosting behaviour was also noted on the 17th of October 2021 when 6 birds were recorded in an agricultural field east of and within the 500m buffer of turbine 5. There were two observations of the same 6 birds roosing and preening on the 9th of August 2021 as grass cutting finished in a field in the south eastern corner of the site approximately 400m east of Turbine 1. One the same day there was also a separate observation of two gulls briefly landing on the ground at the site 12:15 in the middle of the day but both were gone by 12:30. On the 20th of October 3 gull were recorded feeding in a field inside the site near turbine 1.

The remaining five observations were of birds on the ground, one concerning 5 individuals on the 19th of September and the remainder during the month of October with numbers varying between 2 and 11 individuals. On the 10th of October there was one record inside (11 birds east of T1) and one outside of the site (3 birds east of the site). On the 20th of October 2 birds landed briefly (10 seconds) in an agricultural field inside the site east of T1. The following day 2 birds were recorded in another agricultural field outside the site for a large portion of the VP (2,045 seconds).

A total of 14,184 seconds of activity was noted. Of these 32 records, 14 occurred within the flight activity survey area, amounting to 4,807 seconds. Of these 4,807 seconds, 312 occurred in the rotor sweep zone. Roosting and feeding occurred largely outside of the site to the east with only occasional short term instances of low numbers of bird landing on the ground inside the site.

Summer Walkover Surveys (2020, 2021, and 2022)

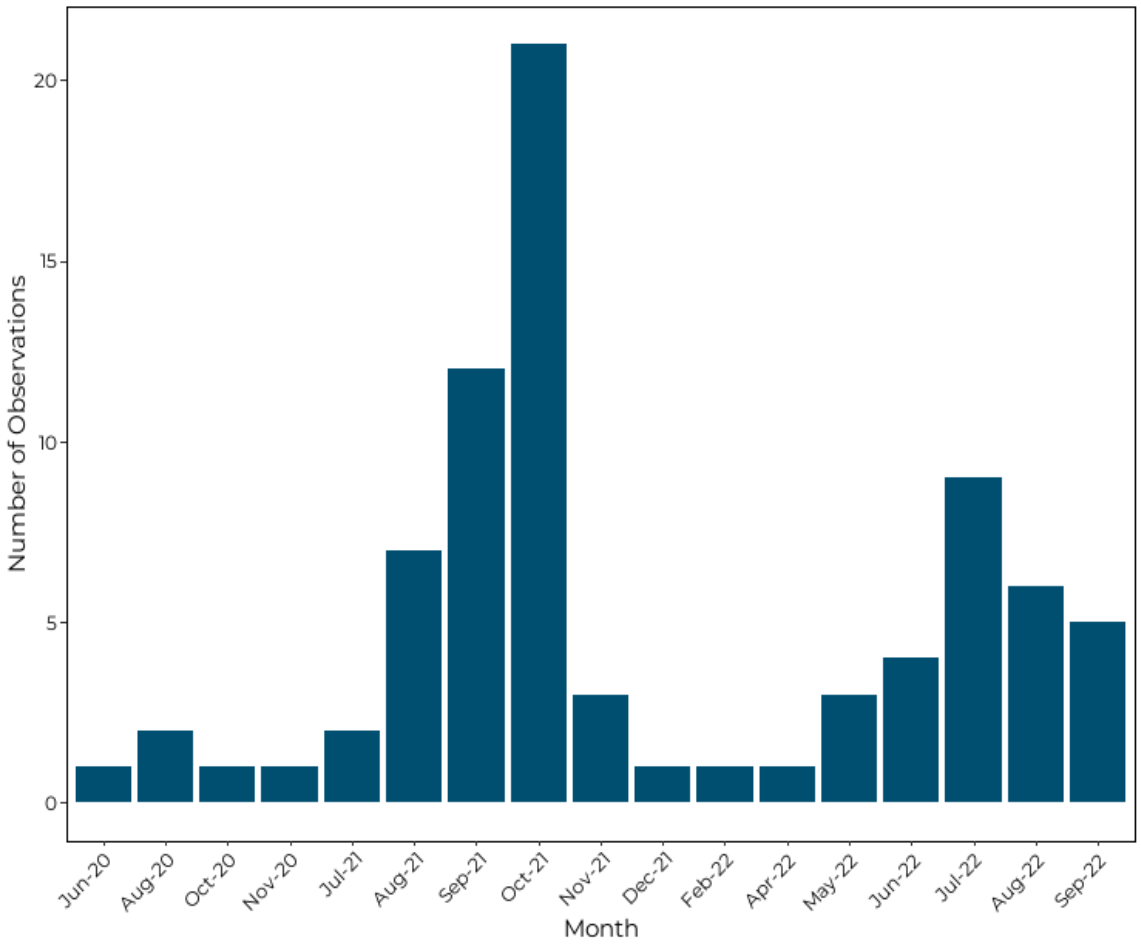
A single bird was recorded once from transect 2 on the 31st July 2021.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

A flock of 11 birds was recorded feeding in a field some 2km southwest of the southern summit of Broemountain on the 20th October 2021.



Graph 7-3: Number of observations of lesser black-backed gull per month during vantage point surveys.

7.3.3.6.13 Mallard

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on eight occasions from VPs 2 (seven records) and VP3 (one record) between the 26th April and the 11th August 2022. Most sightings involved single birds (six records), with high counts of four birds from VP2 on the 26th April 2022, and six birds from VP3 on the 3rd May 2022. A total of 123 seconds (all eight records) of activity was recorded. Just three records occurred within the flight activity survey area, with a total flight time of 76 seconds. Furthermore, of these 76 seconds, just 37 occurred in the rotor sweep zone.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded on 12 occasions, over two dates (8th March 2022 – 9 records, and 21st February 2022 – 3 records) all from VP2. Most sightings involved single birds, with a high count of five birds on the 8th March. A total of 266 seconds of activity was recorded from all 12 records. Just one record occurred within the flight activity survey area, amounting to 60 seconds. Of these 60 seconds, 36 occurred within the rotor sweep zone.

Summer Walkover Surveys (2020, 2021, and 2022)

Recorded once from transect 3 on the 27th April 2022, involving a single male.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Recorded twice from Knocknanask (20th March 2022, and 24th April 2022), with both records referring to single birds.

7.3.3.6.14 Merlin

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Not recording during summer vantage point surveys.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded twice during winter vantage point surveys. On the 21st February 2022, a single bird was observed from VP2, flying outside of the flight activity survey area for 34 seconds at 10. On the 19th February 2022, a single bird was observed flying inside the flight activity survey area for 82 seconds at 30-50m (rotor sweep zone).

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Recorded once at Knocknanask on the 25th September 2022, when a single bird was seen flying at a height range of 5-30m, whilst carrying prey and simultaneously being chased by a kestrel.

7.3.3.6.15 Osprey

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

This scarce to rare passage migrant (in an Irish context) was recorded once from VP1 on the 1st September 2021, flying for 480 seconds at 100-185m, inside the flight activity survey and rotor sweep zones.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Not recording during winter vantage point surveys.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recording during hinterland surveys.

7.3.3.6.16 Peregrine

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on five occasions from all VPs. A total of 744 seconds of activity was logged. Of these five records, four occurred in the flight activity survey area, amounting to 711 seconds, of which 373 occurred in the rotor sweep zone. All records refer to single birds, with both hunting and commuting behaviours noted.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded on four occasions from all VPs, all involving single birds either commuting or feeding (one occasion). A total of 459 seconds of activity was logged. Of these four records, two occurred in the flight activity survey area, amounting to 118 seconds, of which 66 occurred in the rotor sweep zone.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Recorded once from Knocknanask on the 25th September 2022

7.3.3.6.17 Red Kite

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

A single bird was recorded from VP1 in the flight activity survey area on the 9th April 2022 in flight for a total of 335 seconds, of which 200 seconds was in the rotor sweep zone. The remaining 135 seconds (occurred above the rotor sweep zone.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Not recording during winter vantage point surveys.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recording during hinterland surveys.

7.3.3.6.18 Snipe

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on four occasions, three of which came from VP2, with the remaining sighting from VP1. Two sightings were of single birds, and two were of two birds. A total of 72 seconds of activity was recorded. Just one record occurred within the flight activity survey area, amounting to two seconds of flight time. It did not occur in the rotor sweep zone.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded on ten occasions from VPs 1 and 2. Most sightings (six) referred to records of single birds, however, high counts of 8 and 30 birds were noted from VP2 on the 17th October 2021. Nine records occurred within the flight activity survey area, amounting to 399 seconds, of which 134 occurred in the rotor sweep zone.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

A single bird was recorded from transect 1 on the 23rd March 2022.

Hinterland Surveys (2020, 2021, and 2022)

A single bird was recorded at Knocknanask on the 25th September 2022.

Breeding Wader Surveys (2020, 2021, and 2022)

Not recorded during breeding wader surveys.

7.3.3.6.19 Sparrowhawk

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on 16 occasions from all VPs, all involving single birds. A total of 1,706 seconds of activity time was logged. Ten records occurred within the flight activity survey area, amounting to 1,358 seconds, of which 600 occurred in the rotor sweep zone.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded on ten occasions from all VPs, all involving single birds. A total of 396 seconds of activity time was logged. Eight records occurred within the flight activity survey area, amounting to 325 seconds, of which 281 occurred in the rotor sweep zone.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

A single female was recorded from transect 3 on the 23rd March 2022.

7.3.3.6.20 Stock Dove

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on 52 occasions from all VPs. A total of 16,594 seconds of activity time was logged. A total of 29 records occurred within the flight activity survey area, amounting to 3,727 seconds, of which 522 occurred in the rotor sweep zone. Most sightings referred to records of one or two birds, with a high count of four birds recorded from VP1 on the 20th June 2022.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded on six occasions from VPs 2 and 3 between the 10th October 2021, and the 21st February 2022.

Summer Walkover Surveys (2020, 2021, and 2022)

Recorded twice on the 27th April 2022, from transects 2 and 3, both of which refer to records of two birds.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recording during hinterland surveys.

7.3.3.6.21 Swift

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Recorded on 16 occasions from all VPs. A total of 272 seconds of activity time was logged. In all, seven records occurred within the flight activity survey area, amounting to 181 seconds, of which 163 occurred in the rotor sweep zone.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Not recording during winter vantage point surveys.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recording during hinterland surveys.

7.3.3.6.22 Teal

Vantage Point Surveys: Summer Season (2020, 2021, and 2022)

Not recording during summer vantage point surveys.

Vantage Point Surveys: Winter Season (2020/21, and 2021/22)

Recorded once (nine birds) from VP2 on the 7th February 2022, flying from a stream outside the flight activity survey area for 12 seconds, before returning.

Summer Walkover Surveys (2020, 2021, and 2022)

Not recording during summer walkover surveys.

Winter Walkover Surveys (2020/21, and 2021/22)

Not recording during winter walkover surveys.

Hinterland Surveys (2020, 2021, and 2022)

Not recording during hinterland surveys.

7.4 AVIFAUNA EVALUATION

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the proposed development are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM 2018). Table 7-20 outlines the key receptors selected for assessment and the rationale for same based on NRA guidance (NRA, 2009a); the overall importance or sensitivity evaluation for each key receptor, taken from guidance such as Percival 2007 is also illustrated.

Table 7-20: Avifauna Key Receptor Evaluations

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
Black-headed Gull	Amber	No	County Importance	Medium	No	Just two flightlines were recorded: a single record with no flight details occurred from VP2 on the 4th September 2021 and a single flightline was recorded from VP3 on 7th November 2021, when two birds were noted flying for a total of 246 seconds in the 185m+ height band. Neither records occurred within the flight activity survey area.
Buzzard	Green	No	Local Importance (Higher Value)	Low	Yes	Recorded on various surveys throughout. A total of 49,249 seconds were logged in the flight activity survey area.
Common Gull	Amber	No	County Importance	Medium	No	Historical record in the 10km grid square S10, last recorded on 29/02/1984. The lack of modern desktop records combined with a total lack of sightings in 2.5 years of surveys means that this species is not included as a key receptor.
Coot	Amber	No	County Importance	Medium	No	Recorded within the last 10 years in the 10km grid square S10, however, not observed during two and half years of surveys at Dyrick Hill.
Cormorant	Amber	No	County Importance	Medium	No	Not recorded within the flight activity survey area. A single bird was noted passing outside and east of the VP3 viewsheds (flightline not drawn as the bird was beyond 2km) at approximately 100m, heading in a north-westerly direction on the 31st July. Not included as a key receptor because of a lack of records in the flight activity survey area, as well as a general lack of suitable habitat for both breeding and foraging on site.
Curlew	Red	No	National Importance	High	No	Historical record in the 10km grid square S10, last recorded on 31/07/1991. The lack of modern desktop records combined with a total lack of sightings in 2.5 years of surveys means that this species is not included as a key receptor.
Goldcrest	Amber	No	County Importance	Medium	Yes	Recorded on both breeding and winter walkover surveys as well as a non-target species during vantage point surveys.

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
Golden Plover	Red	Yes	International Importance	Very High	Yes	Recorded on vantage point surveys in the flight activity survey area, with 69,803 seconds logged, of which 12,778 were in the rotor sweep zone. Also recorded on winter walkover surveys.
Great Black-backed Gull	Green	No	Local Importance (Higher Value)	Low	Yes	A single adult was seen from VP2 on the 8th September 2022. A total of 9,495 seconds of observation time occurred, none of which occurred in the rotor sweep zone.
Great Spotted Woodpecker	Green	No	Local Importance (Higher Value)	Low	Yes	Recorded as a non-target species during vantage point surveys. Although green-listed, great spotted woodpecker is a recent arrival to Ireland and currently has a scarce but expanding population in a national context.
Green Sandpiper	Green	No	Local Importance (Higher Value)	Low	No	Not recorded within the flight activity survey area. Recorded once from VP2 on the 5th November 2021. The bird was only heard briefly in flight and not seen. Not included as a key receptor as the species does not breed in Ireland and is just a scarce passage migrant/wintering species. Insufficient/suboptimal habitat for the species on site.
Greenfinch	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys.
Green-listed non-passerine sp.	Green	No	Local Importance (Low Value)	Low	No	Recorded on various surveys throughout. Not recorded as key receptors because of the common and widespread status of green-listed non-passerine species in both a local and national context.
Green-listed passerine sp.	Green	No	Local Importance (Low Value)	Low	No	Recorded on various surveys throughout. Not recorded as key receptors because of the common and widespread status of green-listed passerine species in both a local and national context.
Grey Heron	Green	No	Local Importance (Higher Value)	Low	No	Recorded on three occasions during vantage point surveys, with two seconds spent in the flight activity survey area, none of which were in the rotor sweep zone. Not included as a key receptor because of a paucity of

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
						records and time spent in the flight activity survey area, combined with the species' green-listed status.
Grey Wagtail	Red	No	National Importance	High	Yes	Recorded as a non-target species during vantage point surveys.
Hen Harrier	Amber	Yes	International Importance	Very High	Yes	Recorded during both summer and winter season vantage point surveys, on a total of seven occasions. A total of 1,226 seconds of flight time occurred within the flight activity survey area, of which 632 seconds were in the rotor sweep zone.
Herring Gull	Amber	No	County Importance	Medium	Yes	Recorded on 14 occasions during summer season vantage point surveys from all VPs between the 28th June 2021 and the 20th June 2022. A total of 24,936 seconds were logged in the flight activity survey area, of which 628 were in the rotor sweep zone.
House Martin	Amber	No	County Importance	Medium	Yes	Recorded during breeding walkover surveys as well as a non-target species during vantage point surveys.
House Sparrow	Amber	No	County Importance	Medium	Yes	Recorded during breeding and winter walkover surveys, as well as a non-target species during vantage point surveys.
Kestrel	Red	No	National Importance	High	Yes	Recorded on 162 occasions from all VPs during summer vantage point surveys as well as on 63 occasions from all VPs during winter vantage point surveys. A total of 29,826 seconds was logged in the flight activity survey area, of which 18,548 seconds occurred in the rotor sweep zone. Recorded twice from transect 1 on the 23rd March 2022.
Lapwing	Red	No	National Importance	High	Yes	Recorded once from VP3 on the 21st October 2021 when a single bird was noted flying for 19 seconds in the flight activity survey area at 20-30m (in the rotor sweep zone).
Lesser Black-backed Gull	Amber	No	County Importance	Medium	Yes	Recorded on 47 occasions, from all VPs, during winter vantage point surveys as well as on 32 occasions from VPs 2 and 3, during summer vantage point surveys. A total of 36,573 seconds were recorded in the flight activity survey area, of which 1,960 seconds were in the rotor sweep zone.

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
Linnet	Amber	No	County Importance	Medium	Yes	Recorded during breeding and winter walkover surveys, as well as a non-target species during vantage point surveys.
Little Grebe	Green	No	Local Importance (Higher Value)	Low	No	Historical record in the 10km grid square S10, last recorded on 05/03/2016. The lack of suitable habitat on site combined with a total lack of sightings in 2.5 years of surveys means that this species is not included as a key receptor.
Mallard	Amber	No	County Importance	Medium	Yes	Recorded on eight occasions from VPs 2 (7 records) and VP3 (one record) between the 26th April and the 11th August 2022. Most sightings involved singled birds (6 records), with high counts of four birds from VP2 on the 26th April 2022, and six birds from VP3 on the 3rd May 2022. Recorded on 12 occasions, over two dates (8th March 2022 – 9 records, and 21st February 2022 – 3 records) all from VP2. Most sightings involved single birds, with a high count of five birds on the 8th March. A total of 136 seconds were logged in the flight activity survey area, of which 73 seconds occurred in the rotor sweep zone.
Meadow Pipit	Red	No	National Importance	High	Yes	Recorded during breeding and winter walkover surveys, as well as a non-target species during vantage point surveys.
Merlin	Amber	Yes	International Importance	Very High	Yes	Recorded twice during winter vantage point surveys. On the 21st February 2022, a single bird was observed from VP2, flying for 34 seconds at 10-20m (below the rotor sweep zone). On the 19th February 2022, a single bird was observed flying for 82 seconds at 30-50m. The latter 82 seconds occurred both in the flight activity survey area and rotor sweep zone.
Moorhen	Green	No	Local Importance (Higher Value)	Low	No	Historical record in the 10km grid square S10, last recorded on 05/03/2016. The lack of suitable habitat on site combined with a total lack of sightings in 2.5 years of surveys means that this species is not included as a key receptor.

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
Mute Swan	Amber	No	County Importance	Medium	No	Recorded within the last 10 years in the 10km grid square S10. However, not observed during two and half years of surveys at Dyrick Hill. As a result of this, combined with the fact that there is a general lack of suitable habitat for both breeding and foraging on site, the species has not been included as a key receptor
Osprey	Green	No	Local Importance (Higher Value)	Low	Yes	Recorded once during summer vantage point surveys from VP1 on the 1st September 2021, flying for 480 seconds at 100-185m, in the rotor sweep zone. A scarce passage migrant in Ireland – included as a precautionary measure because of its occurrence in the rotor sweep zone.
Peregrine	Green	Yes	International Importance	Very High	Yes	Recorded on five occasions from all VPs during summer vantage point surveys as well as an additional five times during winter vantage point surveys. A total of 829 seconds were logged in the flight activity survey area, of which 439 seconds were in the rotor sweep zone.
Pochard	Red	No	National Importance	High	No	Recorded within the last 10 years in the 10km grid square S10. However, not observed during two and half years of surveys at Dyrick Hill. Not included as a key receptor due to lack of on-site records as a well as a lack of suitable habitat.
Red Grouse	Red	No	National Importance	High	Yes	Not observed during two and half years of surveys, however, the species has been recorded within the last 10 years in the 10km grid square S10, and this the species has been included as a precautionary measure. Although unlikely, and not noted during surveys, heath habitat (largely degraded through trampling and overgrazing) in the commonage on site could host breeding/foraging grouse.
Red Kite	Red	Yes	International Importance	Very High	Yes	A single bird was recorded from VP1 on the 9th April 2022 in flight for a total of 335 seconds, of which 200 seconds was in the rotor sweep zone. The remaining 135 seconds occurred above the rotor sweep zone.
Redwing	Red	No	National Importance	High	Yes	Recorded during winter walkover surveys, as well as a non-target species during vantage point surveys.

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
Sand Martin	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys.
Skylark	Amber	No	County Importance	Medium	Yes	Recorded during breeding and winter walkover surveys, as well as a non-target species during vantage point surveys.
Snipe	Red	No	National Importance	High	Yes	Recorded on four occasions during summer vantage point surveys, three of which came from VP2, with the remaining sighting from VP1. Two sightings were of single birds, and two were of two birds. Recorded on ten occasions from VPs 1 and 2, during winter vantage point surveys. Most sightings (six) referred to records of single birds, however, high counts of 8 and 30 birds were noted from VP2 on the 17th October 2021. A total of 401 seconds were logged in the flight activity survey area, of which 134 occurred in the rotor sweep zone. A single bird was recorded from transect 1 on the 23rd March 2022, during winter walkover surveys.
Sparrowhawk	Green	No	Local Importance (Higher Value)	Low	Yes	During summer vantage point surveys, recorded on 16 occasions from all VPs, all involving single birds. During winter vantage point surveys, recorded on ten occasions from all VPs, all referring to sightings of single birds. A total of 1,683 seconds were logged in the flight activity survey area, of which 881 seconds were in the rotor sweep zone.
Spotted Flycatcher	Amber	No	County Importance	Medium	Yes	Recorded during breeding walkover surveys, as well as a non-target species during vantage point surveys.
Starling	Amber	No	County Importance	Medium	Yes	Recorded during breeding and winter walkover surveys, as well as a non-target species during vantage point surveys.
Stock Dove	Red	No	National Importance	High	Yes	Recorded on 60 occasions from all VPs during summer vantage point surveys, as well as on six occasions from VPs 2 and 3 during winter vantage point surveys. A total of 3,727 seconds were logged in the flight activity survey area, of which 522 seconds were in the rotor sweep zone. During breeding walkover surveys, recorded twice

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
						on the 27th April 2022, from transects 2 and 3, both of which refer to records of two birds.
Swallow	Amber	No	County Importance	Medium	Yes	Recorded during breeding walkover surveys, as well as a non-target species during vantage point surveys.
Swift	Red	No	National Importance	High	Yes	During summer vantage point surveys, recorded on 16 occasions from all VPs, with all records referring to one or two birds. A total of 181 seconds was logged in the flight activity survey area, of which 163 seconds occurred in the rotor sweep zone.
Teal	Amber	No	County Importance	Medium	Yes	Neither recorded in the flight activity survey area nor the rotor sweep zone. Recorded once (nine birds) from VP2 on the 7th February 2022, flying from a stream for 12 seconds, before returning. All flight time occurred below 10m and thus did not occur in the rotor sweep zone.
Wheatear	Amber	No	County Importance	Medium	Yes	Recorded during breeding walkovers.
Willow Warbler	Amber	No	County Importance	Medium	Yes	Recorded during breeding walkover surveys, as well as a non-target species during vantage point surveys.
Woodcock	Red	No	National Importance	High	No	Historical record in the 10km grid square S10, last recorded on 31/12/2011. The lack of suitable habitat on site combined with a total lack of sightings in 2.5 years of surveys means that this species is not included as a key receptor.
Yellowhammer	Red	No	National Importance	High	No	Historical record in the 10km grid square S10, last recorded on 31/12/2011. The lack of suitable habitat on site combined with a total lack of sightings in 2.5 years of surveys means that this species is not included as a key receptor.

Red-listed red grouse (high sensitivity) was recorded within the 10km grid square encompassing the study area (S10) within the last 10 years (last recorded in 2021) and has been included as a key receptor as a precautionary measure, because of the presence of suitable (although highly degraded, so unlikely) habitat on site.

Coot (medium sensitivity, last recorded in 2016), common gull (medium sensitivity, last recorded in 1984), curlew (high sensitivity, last recorded in 1991), little grebe (low sensitivity, last recorded in 2016), moorhen (low sensitivity, last recorded in 2016), mute swan (medium sensitivity, last recorded in 2016), pochard (high sensitivity, last recorded in 2016), woodcock (high sensitivity, last recorded in 2011), and yellowhammer (high sensitivity, last recorded in 2011) were recorded in the desktop study only, either in modern times (within the last ten years) or historically (more than ten years ago) within the 10km grid square S10 (encompassing the study area) and were not observed during two and half years of surveys and consequently are therefore not listed as key receptors.

7.5 POTENTIAL EFFECTS ON AVIFAUNA

The effects of infrastructure such as wind farms on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitat affected and the numbers and species of birds present (Drewitt, A., and Langston, R., 2006). Developments such as wind farms in general have many effects on birds, including potential direct habitat loss and fragmentation, displacement due to disturbance, death, and injury due to collisions and disruption of local or migratory movements, with a consequent increase in energy expenditure (Drewitt, A., and Langston, R., 2008). However, the principal concerns in terms of adverse effects on birds are (1) disturbance / displacement, (2) collision, (3) habitat loss/change and (4) barriers to movement (Langston, R., 2010). Of these, only two are applicable during construction: 1) disturbance and / or displacement and 2) habitat loss/alteration. Habitat loss is the primary potential direct impact during constructions and although disturbance and / or displacement could be viewed as effective habitat loss, it is essentially indirect (SNH, 2017) and therefore covered under Indirect Impacts.

With regard to impacts on bird species, it is considered that the main potential source of impacts on avian fauna is the construction of the wind farm, particularly the construction of turbines and the associated road network.

The potential likely significant impact of wind turbines on birds may be considered as:

- Possible loss or deterioration of habitats; and

- Disturbance or displacement of birds.

Consideration of the survey data against Table 7-20 indicates that five 'Very High' sensitivity species have been recorded within the project study area:

- Golden plover (red-listed, annex I);
- Hen harrier (amber-listed, annex I);
- Merlin (amber-listed, annex I);
- Peregrine (green-listed, annex I);
- Red kite (red-listed, annex I);

Consideration of the survey data against Table 7-20 indicates that nine 'High' sensitivity species have been recorded within the project study area (main wind farm site and grid connection) or have the potential to occur (red grouse).

- Grey wagtail (red-listed);
- Kestrel (red-listed);
- Lapwing (red-listed);
- Meadow pipit (red-listed);
- Red grouse (red-listed);
- Redwing (red-listed);
- Snipe (red-listed);
- Stock dove (red-listed);
- Swift (red-listed).

'Medium' sensitivity species recorded in the study area are also considered in this assessment, amounting to the following 16 species:

- Goldcrest (amber-listed);
- Greenfinch (amber-listed);
- Herring gull (amber-listed);
- House martin (amber-listed);
- House sparrow (amber-listed);
- Lesser black-backed gull (amber-listed);
- Linnet (amber-listed);
- Mallard (amber-listed);
- Sand martin (amber-listed);
- Skylark (amber-listed);
- Spotted flycatcher (amber-listed);

- Starling (amber-listed);
- Swallow (amber-listed);
- Teal (amber-listed);
- Wheatear (amber-listed);
- Willow warbler (amber-listed).

Seven 'Low' sensitivity species are considered in this assessment:

- Buzzard (green-listed);
- Great Black-backed gull (green-listed);
- Great spotted woodpecker (green-listed);
- Osprey (green-listed);
- Sparrowhawk (green-listed).

7.5.1 Potential Construction Effects

The proposed grid connection shall be placed fully within existing roads (16.43km, with the remaining 368m within the site of the Development) and therefore there shall be minimal vegetation clearance or resultant habitat loss.

It is proposed that the turbine nacelles, tower hubs and rotor blades will be landed in Waterford Port. From there, they will be transported to the Site via the public road corridor to the site entrance. There are three areas on the haul route (TDR) that will require works in third party lands.

Table 7-21: Areas of Works on Haul Route in Third Party Lands

No.	Area	ITM (Easting)	ITM (Northing)	Description
1	R672/L5071 Junction	620394	605624	A swept path assessment has been undertaken and indicates that loads will need to utilise an offline track in order to 'cut the corner'. A load bearing surface should be laid in **third party land** and a stone wall, trees and wire fence should be removed. Embankment to be reprofiled. Detailed design of the proposed track is required. *An indicative road edge has been provided from this point to the site entrance based on the available aerial mapping where the road is considered to be greater than 4.5m.* *An indicative 4.5m has been provided for the remaining section as this is the minimum required running width required by turbine manufacturers.* *All marking up is beyond this 4.5m road width.* *A clearance width of 5.5m is required. **Third party land** may be required to achieve the above mitigation.*

No.	Area	ITM (Easting)	ITM (Northing)	Description
2	L5071 Northeast of Clooncogaile	619481	605121	A swept path assessment has been undertaken and indicates that loads will oversail the verge on the inside of the left bend where the embankment will need to be reprofiled. **Third party land** required.
3	River Finisk Bridge / R671 Junction	618628	604027	A swept path assessment has been undertaken and indicates that loads will oversail into **third party land** on both sides of the road and trees / vegetation should be cleared throughout the section. A load bearing surface will be required in the eastern verge on approach to the bridge. Suspension settings should be raised to allow oversail of the bridge parapets by loads and care should be taken to ensure adequate clearance is still available to overhead utilities. Discussions with the council should be held to ensure that the bridge has suitable bearing capacity for the proposed loads. Loads will overrun the western verge following the bridge where the land will need to be reprofiled and a load bearing surface laid. A total of seven utility poles and two road signs will need to be removed through the section. Loads will turn right onto the unclassified road to the south of the bridge. This road will require full reconstruction and widening to meet the turbine manufacturer minimum 4.5m running width and 5.5m clearance width. Land reprofiling will be required on both sides of the road and a retaining structure may be required on the inside.

It is noted that the construction of the proposed grid connection will progress in a sequential manner along the grid connection route and, therefore, the works in any one location will be of a temporary duration only. Because the works will progress relatively quickly along a linear corridor, any fugitive noise will be highly localised, temporary and are not expected to be of sufficient magnitude to create any disturbance or displacement impacts outside of areas contiguous or adjacent to the corridor. These adjacent habitats are widespread in the surrounding area therefore any resident species can easily move in response to any temporary disturbance.

7.5.1.1 Direct Effects: Habitat Loss or Alteration

Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to the above factors. For direct effects during construction, land take of potential breeding or foraging habitat is the primary effect. This may constitute land stripping or vegetation removal affecting ground nesting birds, hedgerow removal or trimming if this takes place during the breeding season and loss of nesting or roosting sites such as trees. Some species (for example sand martin) may also be affected through material extraction requirements for construction purposes.

Effects on avifauna are to be assessed following guidance in Percival (2007). As outlined previously, key avian receptors have been assigned an evaluation of importance (or sensitivity) for assessment. Following this, the significance of potential effects are rated as a product of both the magnitude of the predicted effect and the importance value (sensitivity) of the key receptor affected, based on the probability of the likely effect occurring.

The construction of the wind farm tracks, turbine foundations and hardstandings, the substation compound, temporary site compound and excavation of the on-site borrow pit will result in some habitat damage and loss. Turbines T04, T05, T06, T08 and T09 are surrounded by forestry. Subsequently, tree felling will be required as part of the project. To facilitate the access roads, civil works, and turbine hardstands. A total of 8.1Ha of forestry will need to be clear-felled. This forestry to be clear-felled is mostly consisting of Sitka Spruce and additional broadleaved species and is expected to take up to 3 months. This forestry will need to be replaced. During additional works along several areas of the TDR there will be trimming of hedgerows, treelines and foliage of woodland that overhang the TDR (in two locations) which will result in a temporary loss of foliage within these habitats. For further details on predicted habitat losses please see **Chapter 6: Biodiversity**.

For the purpose of the consideration of the potential effects on birds, species have been grouped into four categories namely passerines, birds of prey, game birds and waders/waterfowl.

A passerine is any bird of the order Passeriformes, which includes more than half of all bird species. A notable feature of passerines is the arrangement of their toes (three pointing forward and one back) which facilitates perching. The group are sometimes known as perching birds or, less accurately, as songbirds. Pigeon/dove belong to the order Columbidae comprised of birds with stout bodies, short necks, and slender bills which primarily feed on seed, fruits, and plants. Bird of prey are raptors that actively hunt other bird species. Gamebirds are birds that traditionally could be hunted, and terrestrial species often include pheasants and grouse, of which red grouse is an example. Waders are shorebirds with the majority of species eating small invertebrates picked out of mud or exposed soil. Waterfowl are swimming gamebird and are comprised of duck, geese, and swan.

Passerines/Non-target Species

The loss of habitat due to the construction of the project has the potential to affect some passerines. Habitat loss is inevitable in the development of any wind farm, especially when the development of turbine foundations and hard stands, access roads and other associated

construction is considered. This can result in reduced feeding and nesting opportunities for birds. However, direct habitat loss by the development of wind farms tends to be relatively small (Drewitt and Langston 2006).

The main wind farm site is predominantly improved agricultural grassland (44.92%), as well as wet grassland (11.86%), dry acid grassland (9.92%), conifer plantation (9.75%), heath/grassland/bracken mosaic (7.85%), and dry heath (7.75%). Other habitats on site are dense bracken (2.49%), buildings and artificial surfaces (1.83%), scrub (1.62%), poor fen and flush (1.02%), broad-leaved woodland (0.63%), mixed woodland (0.32%), and recolonising bare ground (0.04%).

The proposed development will result in the loss of 4.87 Ha (11.44%) dry acid grassland, 3.4 Ha (10.23%) dry heath, 2.8 Ha (6.7%) conifer plantation, 12.06 Ha (6.26%) improved agricultural grassland, 0.55 Ha (5.13%) dense bracken, 1.51 Ha (4.5%) heath/grassland/bracken mosaic, 0.26 Ha (3.71%) scrub, and 0.58 Ha (1.14%) wet grassland. Additional works along the TDR will result in the removal of trees as well as the trimming of branches along the corridor of the route.

Goldcrest (Percival sensitivity: Medium), great spotted woodpecker (Percival sensitivity: Low), greenfinch (Percival sensitivity: Medium), linnet (Percival sensitivity: Medium), spotted flycatcher (Percival sensitivity: Medium) and willow warbler (Percival sensitivity: Medium), typically use woodland, and treelines on and bordering the site.

Goldcrest, great spotted woodpecker, spotted flycatcher, and willow warbler typically forage within woodland and scrub, of which there will be a combined loss of 5.12 Ha (5.26% of total available habitat). Thus, these species have a Percival effect of **Medium** (5-20% population/ habitat lost).

Linnet and greenfinch are seed-eaters, and although they do require trees and shrubs for breeding, they also need open spaces, with seed, for foraging. Both species would use a number of habitats on site, and to understand predicted effects the summed loss of these habitats have been assessed, rather than looking at each habitat type as a separate entity. Combined losses of habitats suited to greenfinch and linnet amount to 26.03 (6.24%) which is classed as a **Medium** Percival effect significance (5-20% of population/ habitat lost). Similar habitat is present at a number of TDR Nodes but is less suitable due to high levels of disturbance, however open habitats with seed sources, as well as scrub and tree cover exists commonly in the surround landscape. The resultant loss for these species is deemed to be a *Long-term Not Significant Effect* and *Reversible in a local context*.

Starlings (Percival sensitivity: Medium) primarily forage in grassland and open habitats, and typically nest in the eaves of old buildings, but also use cavities in mature trees. There will be a loss of 19.02 Ha (5.73%) of suitable habitat. Percival impact significance is **Medium** (5-20% habitat loss for nesting and open foraging habitats), however, there is an abundance of grassland habitats in the surrounding area with ample trees and buildings for nesting, thus a *Temporary Imperceptible Effect* and *Reversible in a local context* is predicted for starling.

House sparrow (Percival sensitivity: Medium) breeds throughout Ireland and usually stays close to human habitation - mainly around farm buildings and built-up areas including parks and gardens. Nests in cavity in building, especially under eaves or holes formed by missing brickwork. There will be a loss of 0.26 Ha (1.76%) of suitable habitat. Percival impact significance is **Medium** (5-20% habitat loss for nesting and open foraging habitats). There is an abundance of manmade structures in the area, with supporting needs for the species, thus a *Temporary Imperceptible Effect* and *Reversible in a local context* is predicted for house sparrow.

Redwing (Percival sensitivity: High) are winter visitors which uses trees and open habitats onsite to forage in. This species has been added to the red list due to the severity of long and short-term declines in its wintering population. There will be a loss of 22.05 Ha (6.62%) of suitable habitat. Percival effect significance is **Medium** (5-20% population/habitat lost). Furthermore, suitable foraging habitat is generally abundant in agricultural landscapes which are commonplace in the surrounding landscape. Thus, a *Temporary Imperceptible Effect* and *Reversible in a local context* is predicted for redwing.

Barn swallow, house martin and sand martin (Percival significance: Medium) are aerial species which forage over open habitats. Barn swallows and house martins require buildings for nesting, and sand martins typically nest in sand banks or occasionally crevices in walls or bridges. There is no suitable breeding habitat sand martin on site. Percival effect significance is **Medium** (5-20% habitat loss for open habitats for aerial feeding). The majority of the wind farm site is open and there will be a predicted loss of 26.03 Ha (6.06%) of such open habitats (note that scrub is included in this instance, as is a source of flying invertebrates, and is relatively low) plus buildings and artificial surfaces for nesting on site. Loss of these habitats for these species will give rise to a *Temporary Imperceptible Effect Reversible in a local context*.

Meadow pipit (Percival sensitivity: High) and skylark (Percival sensitivity: Medium) are ground-nesting species which use open habitats with some low-lying vegetative cover (typically

grassland and heath) for breeding and foraging. Meadow pipit were observed to be common in open areas throughout study area and evidence of breeding was ascertained. Similarly, skylark were also recorded displaying over open habitats on site. The entire wind farm site is open and there will be a predicted loss of 6.26% of such open habitats on site which will give rise to a *Short-term Slight Effect in a local context* which is *Reversible*. Percival effect significance is **Medium** (5-20% habitat loss for open habitats).

Wheatear (Percival sensitivity: Medium) is similar to meadow pipit and skylark in that it requires open habitats with low lying vegetative cover, but with interspersed rocky areas for perching and feeding. This species was recorded once during breeding walkover surveys and was not encountered during VP surveys, and hence it is considered to be an occasional passage migrant on site. There is a predicted loss of 4.91% of upland dry heath. Percival effect significance is **Low** (1-5% habitat loss).

Grey wagtail forage along watercourses and may nest in bridges and buildings. As such this species will not be subject to the direct effect of habitat loss.

It is not expected that the wind farm development will cause a reduction in the baseline population of passerines as the area of nesting/foraging habitat lost will be *Imperceptible to Slight*. It is considered that the proposed effect of habitat loss will be a *Permanent Imperceptible to Not Significant Effect in a local context* which is *Reversible*. However, the trimming of vegetation along with the removal of scrub or felling of trees during the nesting season for birds could result in a *Localised Temporary Significant Reversible Effect* to nesting birds if it were to be undertaken during the bird nesting season (1st March – 31st of August).

Birds of Prey, Red Grouse and Waders/Waterfowl – Other Target Species

Table 7-22 below displays the direct effect character during construction as well as the significance of effects without the implementation of mitigation.

Table 7-22: Effect of habitat loss to target species

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
Buzzard (Low)	Recorded on various surveys throughout. A total of 49,249 seconds were logged in the flight activity survey area. The fact that pairs were noted displaying and lingering in suitable habitat, and the continued presence of the species during the summer seasons, indicates breeding is likely nearby. Buzzards require tall mature trees for nesting which occur at several locations on site.	**Sensitivity:** Low **Magnitude:** Medium (<10% habitat loss) **Overall significance:** Very Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Slight Effect** based on the fact that

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
	Buzzards often feed in open areas, for example, the species regularly takes earthworms from short grassy habitats. Looking at a worst-case scenario, there will be a loss of 20.31 Ha of suitable habitat which equates to 6.03% of total available suitable habitat for the species. However, conifer plantations and open habitats are common in the surrounding area.	breeding on habitat on site is scarce but scattered throughout the surrounding landscape and the species is common and increasing (Criteria: EPA, 2022)
Golden Plover (Very High)	Recorded on vantage point surveys in the flight activity survey area, with 68,803 seconds logged, of which 12,778 were in the rotor sweep zone. Also recorded on winter walkover surveys. Golden Plover breed on open upland habitats (which includes blanket bogs, heather dominated areas and marginal grasslands), where they are known to favour areas of short vegetation (<10 cm), particularly dominated by heather mixed with grasses (Parr, 1980; Whittingham et al., 2001). The species has a restricted range in Ireland, breeding in upland areas in the north-west. No birds were noted during the breeding season (except for outliers in April and September), and birds appear to use the site and surrounding areas only in the non-breeding season, thus suggesting that habitats are not suitable for breeding birds on site. The core foraging and roosting area for the species located at Broemountain is indicated in Volume III Figure 7.73. Looking at a worst-case scenario, there will be a loss of 16.45 Ha of suitable habitat (directly and indirectly via disturbance) which equates to 4.66% of total available suitable habitat for the species. GIS analysis (outlined in detail in the accompanying NIS) was completed to estimate the area of potentially suitable habitat occurring within the wider area surrounding the Dungarvan Harbour SPA. This analysis was completed in order to establish a baseline estimate of the potential suitable habitat for the Dungarvan Harbour SPA golden plover population against which the loss of suitable habitat for golden plover arising from the proposed wind farm could be considered. The landcover within a 15km buffer area surrounding the Dungarvan Harbour SPA was examined so that the area of potentially suitable habitat could be estimated. Adopting this approach only 50% of the area of pasture, arable and upland moorland within the 15km buffer zone of the SPA is identified as being of potential suitable habitat for golden plover. This equates to approximately 20,000 Ha. When assessed again this area of potentially suitable golden plover habitat within a 15km buffer zone of the Dungarvan Harbour SPA, the loss of 16.45 Ha will equate to a loss of c. 0.1% of potentially suitable golden plover habitat. Such a loss is representative of a negligible impact and an effect of low significance over the long-term for golden plover.	**Sensitivity:** Very High **Magnitude:** Low (1-5% habitat loss) locally **Overall significance:** Medium (Criteria: Percival, 2003) Loss of wintering and/or foraging habitat will be a **Long-term Moderate Effect Locally and a Long-term Slight Effect at a county level** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
Great Black-backed Gull (Low)	A single adult was seen from VP2 on the 8th September 2022. A total of 9,495 seconds of observation time occurred, of which 9,382 (98,81%) took place in the 0-10m height band. Looking at a worst-case scenario, there will be a loss of 17.51 Ha of suitable habitat which equates to 6.12% of total available suitable habitat for the species.	**Sensitivity:** Low **Magnitude:** Medium (<10% habitat loss) **Overall significance:** Very Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** based on a paucity of sightings, unsuitable breeding habitat/location, and general abundance of GA1 in immediate area in which they occasionally feed after heavy rain or spreading of slurry (Criteria: EPA, 2022)
Hen Harrier (Very High)	Recorded during both summer and winter season vantage point surveys, on a total of seven occasions. A total of 1,211 seconds of flight time occurred within the flight activity survey area, of which 632 seconds were in the rotor sweep zone. No birds were recorded breeding on site, although it is important to note that nesting has occurred in historical times, with the local landowner quoting from memory the fact that he was mobbed be a territorial adult (Noel Linehan pers comm.). Habitat on site is highly degraded as a result of intensive livestock grazing and trampling and is deemed unlikely to be suitable for breeding hen harrier in current times, and likewise, foraging is deemed suboptimal. Hen harrier typically forage over heath bog, low intensively farmed grassland with well-established hedgerows and areas of scrub (Irwin et al., 2012). Looking at a worst-case scenario, there will be a loss of 11.17 Ha of suitable habitat which equates to 6.27% of total available suitable habitat for the species.	**Sensitivity:** Very High **Magnitude:** Medium (<10% habitat loss) **Overall significance:** Very High (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Slight to Moderate Effect** based on a lack of breeding on site as well as low number of sightings (seven in total) (Criteria: EPA, 2022).
Herring Gull (Medium)	Recorded on 14 occasions during summer season vantage point surveys from all VPs between the 28th June 2021 and the 20th June 2022. A total of 24,936 seconds were logged in the flight activity survey area, of which 628 were in the rotor sweep zone. Although this species nests primarily on the coast, it is also known to nest on buildings, in larger towns and cities. Birds nesting inland occur near larger waterbodies, and thus there is no scope for breeding on-site. Habitats on site are also largely unsuitable for foraging birds, although foraging by the species in ploughed or slurried land is a common occurrence (although it is very much an opportunistic occurrence during a very small window frame) and as such there is potential for limited foraging habitat to occur. Seasonal flooding in fields may also provide foraging habitat for the species, but again this is not a permanent fixture in the landscape. It is worth noting that improved agricultural grassland is abundant in the area as is slurrying/ploughing. Looking at a worst-case scenario, there will be a loss of 17.51 Ha of suitable habitat which equates to 6.27% of total available suitable habitat for the species.	**Sensitivity:** Medium **Magnitude:** Medium (<10% habitat loss) **Overall significance:** Very Low (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** based on a low number of sightings, unsuitable breeding habitat/location, and general abundance of GA1 in immediate area, in which they occasionally feed after heavy rain or spreading of slurry (Criteria: EPA, 2022)
Kestrel (High)	Recorded on 162 occasions from all VPs during summer vantage point surveys as well as on 63	**Sensitivity:** High **Magnitude:** Medium

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
	occasions from all VPs during winter vantage point surveys. A total of 28,679 seconds was logged in the flight activity survey area, of which 18,548 seconds occurred in the rotor sweep zone. Recorded twice from transect 1 on the 23rd March 2022. Conifer plantation, dry heath, dry meadows, grassy verges, improved agricultural grassland, recently-felled woodland and scrub all provide potential breeding and foraging habitats - thus the species is rather flexible in its habitat needs. Although breeding was not proven, it is considered that kestrel probably breeds in the vicinity of the site. The site is used frequently by foraging birds. There will be the permanent loss of 6.09 Ha (6.09% of all habitat) of suitable habitat for Kestrel; habitat which is also present in the general area.	**Overall significance:** High (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-Term Slight to Moderate Effect** based on the fact that there were a high number of sightings (162) on site, however, breeding habitat on site is scarce but is scattered throughout the surrounding landscape (Criteria: EPA, 2022).
Lapwing (High)	Recorded once from VP3 on the 21st October 2021 when a single bird was noted flying for 19 seconds in the flight activity survey area at 20-30m (in the rotor sweep zone). Now a rare breeding species in Co. Waterford, breeding on open farmland, and appear to prefer nesting in fields that are relatively bare (particularly when cultivated in the spring) and adjacent to grassland. Wintering distribution in Ireland is widespread. Large flocks regularly recorded in a variety of habitats, including most of the major wetlands, pasture, and rough land adjacent to bogs. Whilst breeding does not currently occur, and is unlikely to, the habitat does occur in form of pasture and rough ground. Again, although foraging was not noted, there is suitable habitat present, and it could occur. Looking at a worst-case scenario, there will be a loss of 10.36 Ha of suitable habitat which equates to 6.29% of total available suitable habitat for the species.	**Sensitivity:** High **Magnitude:** Medium **Overall significance:** High (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long Term Imperceptible Effect** based on the fact that there was just a single sighting of a bird which did not land on site, and that there is suitable foraging habitat in the general area (Criteria: EPA, 2022).
Lesser Black-backed Gull (Medium)	Recorded on 47 occasions, from all VPs, during winter vantage point surveys as well as on 32 occasions from VPs 2 and 3, during summer vantage point surveys. A total of 34,488 seconds were recorded in the flight activity survey area, of which 1,968 seconds were in the rotor sweep zone. Breeding was not observed within the site over the 3 years of surveys. Roosting and feeding occurred largely outside of the site to the east with only occasional short-term instances of low numbers of bird landing on the ground inside the site. Although this species nests primarily on the coast, it is also known to nest on buildings, in larger towns and cities. Birds nesting inland occur near larger waterbodies, and thus there is no scope for breeding on-site. Habitats on site are also largely unsuitable for foraging birds, although foraging by the species in ploughed or slurried land is a common occurrence (although it is very much an opportunistic occurrence during a very small time frame) and as such there is potential for limited foraging habitat to occur. Seasonal flooding in fields may also provide foraging habitat for the	**Sensitivity:** Medium **Magnitude:** Low (1-5% habitat loss) **Overall significance:** Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** based on a low number of sightings, unsuitable breeding habitat/location, and general abundance of GA1 in immediate area, in which they occasionally feed after heavy rain or spreading of slurry (Criteria: EPA, 2022)

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
	species, but again this is not a permanent fixture in the landscape. It is worth noting that improved agricultural grassland is abundant in the area as is slurrying/ploughing and thus any habitat lost or disturbed is amply available in the surrounding landscape. Looking at a worst-case scenario, there will be a loss of 17.51 Ha of suitable habitat which equates to 6.12% of total available suitable habitat for the species in the site boundary. However, the species was predominantly observed outside the site utilising agricultural field to the east of the site that will remain unaffected by the project. Therefore a percentage range of habitat loss of 1-5% provides a conservative range for this species locally.	
Mallard (Medium)	Recorded on eight occasions from VPs 2 (7 records) and VP3 (one record) between the 26th April and the 11th August 2022. Most sightings involved singled birds (6 records), with high counts of four birds from VP2 on the 26th April 2022, and six birds from VP3 on the 3rd May 2022. Recorded on 12 occasions, over two dates (8th March 2022 – 9 records, and 21st February 2022 – 3 records) all from VP2. Most sightings involved single birds, with a high count of five birds on the 8th March 2022. A total of 136 seconds were logged in the flight activity survey area, of which 73 seconds occurred in the rotor sweep zone. There will be no loss of suitable habitat.	**Sensitivity:** Medium **Magnitude:** Negligible (<1% habitat loss) **Overall significance:** Very Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** based on a low number of sightings, as well as a lack of suitable breeding/foraging habitat on site (Criteria: EPA, 2022)
Merlin (Very High)	Recorded twice during winter vantage point surveys. On the 21st February 2022, a single bird was observed from VP2, flying for 34 seconds at 10-20m (below the rotor sweep zone). On the 19th February 2022, a single bird was observed flying for 82 seconds at 30-50m. The latter 82 seconds occurred both in the flight activity survey area and rotor sweep zone. Merlin have largely shifted to nesting in 10 year+ conifer plantations, using old corvid nests, and require open ground (heath, natural grassland, bog, etc) for hunting. Thus, whilst breeding was not detected on site, it is a possibility with both upland heath and conifer plantation occurring side-by-side. Also, although there were just two sightings of birds in the winter season, suitable hunting habitat occurs, and the species will be affected by construction. Looking at a worst-case scenario, there will be a loss of 26.03 Ha of suitable habitat which equates to 6.18% of total available suitable habitat for the species.	**Sensitivity:** Very High **Magnitude:** Medium (<10% habitat loss) **Overall significance:** Very High (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Not Significant to Slight Effect** (Criteria: EPA, 2022). Based on low number of sightings and a loss of 6.18% of suitable habitat.
Osprey (Low)	Recorded once during summer vantage point surveys from VP1 on the 1st September 2021, flying for 480 seconds at 100-185m, in the rotor sweep zone. Osprey does not breed in Ireland (although it did in historic times) and is now just a rare passage migrant, presumably mostly relating to Scottish birds. On passage birds need access to large water bodies for fishing. As this habitat does not occur on site, there is no potential for foraging or breeding.	**Sensitivity:** Low **Magnitude:** Negligible (<1% habitat loss) **Overall significance:** Very Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** based on a paucity of sightings (just one), and total lack of suitable breeding/foraging habitat (Criteria: EPA, 2022)

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
Peregrine (Very High)	Recorded on five occasions from all VPs during summer vantage point surveys as well as an additional five times during winter vantage point surveys. A total of 829 seconds were logged in the flight activity survey area, of which 439 seconds were in the rotor sweep zone. Peregrines require tall cliff-faces or man-made structures which resemble these, for breeding. No such habitats or structures occur on site. Peregrines are aerial hunters which dive on prey from above and as such are not strictly limited to any particular habitat, instead they require sufficient numbers of avian prey. As such, there are no envisaged habitat loss impacts on the species.	**Sensitivity:** Very High **Magnitude:** Negligible (<1% habitat loss) **Overall significance**: Low (Criteria: Percival, 2003). Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible to Slight Effect,** based on a lack of suitable breeding habitat and resultant loss of, as well as low number of sightings (five in total) (Criteria: EPA, 2022).
Red Grouse (High)	Not observed during two and half years of surveys, however, the species has been recorded within the last 10 years in the 10km grid square S10, and this the species has been included as a precautionary measure. Requires heather for both food and shelter/nesting, and thus can be found in heath and bog habitats, where heather is abundant (where overgrazing isn't an issue). Although unlikely, and not noted during surveys, heath habitat (largely degraded through trampling and overgrazing) in the commonage on site could host breeding/foraging grouse. Looking at a worst-case scenario, there will be a loss of 4.91 Ha of suitable habitat which equates to 7.33% of total available suitable habitat for the species.	**Sensitivity:** High **Magnitude:** Medium (<10% habitat loss) **Overall significance:** Very Low (Criteria: Percival, 2003). Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible to Not Significant Effect** due to lack of sightings on site, and degradation of heath due to trampling and overgrazing by cattle (Criteria: EPA, 2022).
Red Kite (Very High)	A single bird was recorded from VP1 on the 9th April 2022 in flight for a total of 335 seconds, of which 200 seconds (59.7% of total flight time) was in the rotor sweep zone. The remaining 135 seconds (40.3% of total flight time) occurred above the rotor sweep zone. Breeding is currently still confined to the east coast (the nest consists of a large platform of twigs, usually constructed high above the ground in the fork of a deciduous tree branch), close to the original reintroduction sites in Co's. Wicklow, Dublin and Down, although birds are wandering as far as Waterford and even Co. Cork. As a result it is entirely possible that the species range could extend to Dyrick in the lifespan of the proposed wind farm, thus removal of tall trees could impede the expansion of the species into the site. Diet is highly flexible: mainly eats carrion, including roadkill, preferring to scavenge rather than hunt. They will happily take live prey if necessary, however, including rats, mice, rabbits, pigeons, young crows and even earthworms and other invertebrates. Thus the predicted loss of foraging habitat on site is not an envisage issue with this species. Looking at a worst-case scenario, there will be a loss of 2.8 Ha of suitable habitat which equates to 6.09% of total available suitable habitat for the species.	**Sensitivity:** Very High **Magnitude:** Medium (<10% habitat loss) **Overall significance:** Very High (Criteria: Percival, 2003). Loss of breeding and/or foraging habitat will be a **Long-term Slight Effect** despite the Very High Overall significance, as a result of the paucity of records (just one) and the slow spread of the species (currently still more or less restricted to Dublin and Wicklow on the East Coast (Criteria: EPA, 2022).
Snipe (High)	Recorded on four occasions during summer vantage point surveys, three of which came from VP2, with the remaining sighting from VP1. Two sightings were of single birds, and two were of two birds. Recorded on ten occasions from VPs 1 and	**Sensitivity:** High **Magnitude:** Negligible (<1% habitat loss) **Overall significance**: Very Low (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
	2, during winter vantage point surveys. Most sightings (six) referred to records of single birds, however, high counts of 8 and 30 birds were noted from VP2 on the 17th October 2021. A total of 401 seconds were logged in the flight activity survey area, of which 134 occurred in the rotor sweep zone. A single bird was recorded from transect 1 on the 23rd March 2022, during winter walkover surveys. Overgrazing is an issue on-site as is the case in most upland areas of Ireland. This limits snipe densities. Although drumming was heard not heard, it is likely that the species breeds in low densities in wetter parts of the site. Predicted loss of wet habitats on site amounts to 0.58 Ha or 1.05%.	Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** due to paucity of sightings, and a low loss of habitat (Criteria: EPA, 2022).
Sparrowhawk (Low)	During summer vantage point surveys, recorded on 16 occasions from all VPs, all involving single birds. During winter vantage point surveys, recorded on ten occasions from all VPs, all referring to sightings of single birds. A total of 1,683 seconds were logged in the flight activity survey area, of which 881 seconds were in the rotor sweep zone. Requires mature trees for nesting and are commonly found in coniferous plantations. A second key requirement is an abundance of small birds, including meadow pipit and skylark. Both components are present on site and thus, although breeding by sparrowhawk has not been proven, it is highly plausible that it breeds close to, but not on site, given its secretive nature. Looking at a worst-case scenario, there will be a loss of 2.8 Ha of suitable habitat which equates to 6.09% of total available suitable habitat for the species.	**Sensitivity:** Low **Magnitude:** Negligible (<1% habitat loss) **Overall significance:** Very Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022)
Stock Dove (High)	Recorded on 60 occasions from all VPs during summer vantage point surveys, as well as on six occasions from VPs 2 and 3 during winter vantage point surveys. A total of 3,727 seconds were logged in the flight activity survey area, of which 522 seconds were in the rotor sweep zone. During breeding walkover surveys, recorded twice on the 27th April 2022, from transects 2 and 3, both of which refer to records of two birds. A widespread resident throughout Ireland favouring areas of cereal cultivation. Breeds in lowlands of eastern and southern Ireland, almost invariably near agricultural areas, especially cereal. Nests in holes in trees.	**Sensitivity:** High **Magnitude:** Negligible (<1% habitat loss) **Overall significance**: Very Low (Criteria: Percival, 2003). Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** due to paucity of sightings, and a low loss of habitat (Criteria: EPA, 2022).
Swift (High)	During summer vantage point surveys, recorded on 16 occasions from all VPs, with all records referring to one or two birds. A total of 181 seconds was logged in the flight activity survey area, of which 163 seconds occurred in the rotor sweep zone. Breeds throughout Ireland, usually in small recesses in buildings, both occupied and derelict. Less frequently in holes in trees or caves in uplands or coastal areas. Feeds exclusively on various invertebrates (midges, flies, spiders) caught in flight. Optimal breeding habitat does not occur on site, and forages in open aerial habitats,	**Sensitivity:** High **Magnitude:** Negligible (<1% habitat loss) **Overall significance**: Very Low (Criteria: Percival, 2003). Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** due to paucity of sightings, and a low loss of habitat (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
	thus habitat loss is not envisaged to be a big factor with this species.	
Teal (Medium)	Neither recorded in the flight activity survey area nor the rotor sweep zone. Recorded once (nine birds) from VP2 on the 7th February 2022, flying from a stream for 12 seconds, before returning. All flight time occurred below 10m and thus did not occur in the rotor sweep zone. Usually nests near small freshwater lakes or pools and small upland streams away from the coast, and also in thick cover. Forages in similar habitats - thus the site has potential to host both breeding and foraging birds, and, despite not being recorded in the flight activity survey area, the secretive nature of the species, lends to the possibility of this species being under recorded.	**Sensitivity:** Medium **Magnitude:** Negligible (<1% habitat loss) **Overall significance:** Very Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a **Long-term Imperceptible Effect** based on a low number of sightings, as well as a lack of suitable breeding/foraging habitat on site (Criteria: EPA, 2022)

7.5.1.2 Indirect Effects: Disturbance and Displacement

High levels of activity and disturbance during construction may cause birds to vacate territories close to works, especially for species vulnerable to disturbance. The displacement of birds from areas within and surrounding developments can effectively amount to habitat loss (Drewitt, A. L. and Langston, R. H., 2006). If a habitat is therefore avoided as a result of the disturbance, then effective habitat loss can occur. Examples of causes of disturbance during construction which may lead to displacement are vehicle and personnel movements, vibration and noise impacts from the construction process and visual intrusion (Drewitt, A. L. and Langston, R. H., 2006).

Additional effects may occur during the construction process due to road works along turbine delivery routes, the laying of cabling, the placement of underground cabling, re-working structures such as bridges along turbine delivery routes, and excavation of materials.

Studies both during construction (Pearce-Higgins *et al*., 2012) and during operational effects of wind farms (Pearce-Higgins *et al*., 2009) have shown that certain species (e.g. large wading species) can be affected particularly as a result of construction impacts (in that the affected species fail to recover to pre-construction densities).

Indirect effects may occur on species linked to aquatic habitats through pollution events, sediment laden runoff and dust deposition.

Table 7-23: Indirect Construction Effects on Avifauna

Key Receptor (Sensitivity)	Construction Indirect Effect Character	Significance without mitigation
Black-headed Gull (Medium)	Just two flightlines were recorded: a single record with no flight details occurred from VP2 on the 4th September 2021 and a single flightline was recorded from VP3 on 7th November 2021, when two birds were noted flying for a total of 246 seconds in the 185m+ height band. Neither records occurred within the flight activity survey area. Breeding does not occur on site nor is there habitat to support breeding, with the species typically preferring small islands/islets on lakes and ponds. Foraging by the species in ploughed or slurried land is a common occurrence (although it is very much an opportunistic occurrence during a very small window frame) and as such there is potential for limited foraging habitat to occur. Seasonal flooding in fields may also provide foraging habitat for the species, but again this is not a permanent fixture in the landscape. Possible noise/visual intrusion disturbance to foraging birds within the site. It is worth noting that improved agricultural grassland is abundant in the area as is slurrying/ploughing and thus any birds displaced by noise/visual intrusion can find similar foraging sites in abundance in the surrounding lands.	**Sensitivity:** Medium. **Magnitude:** Negligible – based on low number of sightings, with none occurring in the flight activity survey area. **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Not Significant Effect** (Criteria: EPA, 2022).
Buzzard (Low)	Recorded on various surveys throughout. A total of 49,249 seconds were logged in the flight activity survey area. The fact that pairs were noted displaying and lingering in suitable habitat, and the continued presence of the species during the summer seasons, indicates breeding is likely nearby. Buzzards require tall mature trees for nesting which occur at several locations on site. Buzzards often feed in open areas, for example, the species regularly takes earthworms from short grassy habitats. Possible noise/visual intrusion disturbance to foraging birds within the site.	**Sensitivity:** Low. **Magnitude:** Medium – high number of sightings on site and evidence of probable breeding **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Coot (Medium)	Not observed during two and half years of surveys, however, the species has been recorded within the last 10 years in the 10km grid square S10, and this the species has been included as a precautionary measure. No suitable breeding or foraging habitat on site. Not noted breeding or foraging on site, thus noise or visual disturbance is unlikely.	**Sensitivity:** Medium. **Magnitude:** Negligible (zero sightings during survey period) **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Cormorant (Medium)	Not recorded within the flight activity survey area. A single bird was noted passing outside and east of the VP3 viewsheds (flightline not drawn as the bird was beyond 2km) at approximately 100m, heading in a north-westerly direction on the 31st July. Although a number of small streams occur on site, none are substantial enough for foraging birds, nor is there any suitable breeding habitat for the species. Not noted breeding or foraging on site, thus noise or visual disturbance is unlikely.	**Sensitivity:** Medium. **Magnitude:** Negligible (not recorded in flight activity survey area). **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Golden Plover (Very High)	Recorded on vantage point surveys in the flight activity survey area, with 69,803 seconds logged, of which 12,778 were in the rotor sweep zone. Also recorded on winter walkover surveys. Golden Plover breed on open upland habitats (which includes blanket bogs, heather dominated areas and marginal grasslands), where they are known to favour areas of short vegetation (<10 cm), particularly dominated by heather mixed with grasses (Parr, 1980; Whittingham et al., 2001). The species has a restricted range in Ireland, breeding in upland areas in the north-west. No birds were noted during the	**Sensitivity:** Very High. **Magnitude:** High (high number of sightings, large flock size, four turbines to be erected in key habitat). **Overall significance:** Very High. (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Indirect Effect Character	Significance without mitigation
	breeding season (except for outliers in April and September), and birds appear to use the site and surrounding areas only in the non-breeding season, thus suggesting that habitats are not suitable for breeding birds on site. It is clear, however that the upland area of commonage, with predominant heath is an important feeding area for the species in winter. Possible noise/visual intrusion disturbance to foraging birds within the site - turbines proposed in core wintering area where a large flock occurs. Flocks are flighty and often spend prolonged periods of time in the air after being spooked.	Disturbance and/or displacement will be a **Short-term Significant Effect at a local level** if works were to be carried out within the commonage area during the winter period. Outside of the area and period it will result in a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Great Black-backed Gull (Low)	A single adult was seen from VP2 on the 8th September 2022. A total of 9,495 seconds of observation time occurred, none of which occurred in the rotor sweep zone. Does not breed and does it have the potential to breed on site, and just one foraging record indicates that noise or visual disturbance is highly unlikely to be an issue with this species.	**Sensitivity:** Low. **Magnitude:** Negligible (just one sighting). **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Grey Heron (Low)	Recorded on three occasions during vantage point surveys, with two seconds spent in the flight activity survey area, none of which were in the rotor sweep zone. Grey heron typically require tall trees, often conifers for breeding. Nesting occurs close to waterbodies. Although conifers do occur on site, the waterbodies in their vicinity are small and are not really suiting to support a breeding pair, although it isn't out of the question. Possible noise/visual intrusion disturbance to foraging birds within the site.	**Sensitivity:** Low. **Magnitude:** Negligible (only three sightings, with just two seconds spent within the flight activity survey area). **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Hen Harrier (Very High)	Recorded during both summer and winter season vantage point surveys, on a total of seven occasions. A total of 1,226 seconds of flight time occurred within the flight activity survey area, of which 632 seconds were in the rotor sweep zone. No birds were recorded breeding on site, although it is important to note that nesting has occurred in historical times, with the local landowner quoting from memory the fact that he was mobbed be a territorial adult (Noel Linehan pers comm.). Habitat on site is highly degraded as a result of intensive livestock grazing and trampling and is deemed unlikely to be suitable for breeding hen harrier in current times, and likewise, foraging is deemed suboptimal. Hen harrier typically forage over heath bog, low intensively farmed grassland with well-established hedgerows and areas of scrub (Irwin et al., 2012). Possible noise/visual intrusion disturbance to foraging birds within the site.	**Sensitivity:** Very High. **Magnitude:** Low (seven sightings – not common but sightings not low enough to consider negligible). **Overall significance:** Medium. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Herring Gull (Medium)	Recorded on 14 occasions during summer season vantage point surveys from all VPs between the 28th June 2021 and the 20th June 2022. A total of 24,936 seconds were logged in the flight activity survey area, of which 628 were in the rotor sweep zone. Although this species nests primarily on the coast, it is also known to nest on buildings, in larger towns and cities. Birds nesting inland occur near larger waterbodies, and thus there is no scope for breeding on-site. Habitats on site are also largely unsuitable for foraging birds, although foraging by the species in ploughed or slurried land is a common occurrence (although it is very much an opportunistic occurrence during a very small window frame) and as such there is potential for limited foraging habitat to occur. Seasonal flooding in fields may also provide foraging habitat for the species, but again this is not a permanent fixture in the landscape. It is worth noting	**Sensitivity:** Medium. **Magnitude:** Low – sightings are highly tied to slurrying/field flooding events, and there is an abundance of GA1 in the immediate area and beyond. **Overall significance:** Low (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Slight Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Indirect Effect Character	Significance without mitigation
	that improved agricultural grassland is abundant in the area as is slurrying/ploughing and thus any habitat lost or disturbed is amply available in the surrounding landscape. Possible noise/visual intrusion disturbance to foraging birds within the site.	
Kestrel (High)	Recorded on 162 occasions from all VPs during summer vantage point surveys as well as on 63 occasions from all VPs during winter vantage point surveys. A total of 29,679 seconds was logged in the flight activity survey area, of which 18,548 seconds occurred in the rotor sweep zone. Recorded twice from transect 1 on the 23rd March 2022. Conifer plantation, dry heath, dry meadows and grassy verges, improved agricultural grassland, recently-felled woodland and scrub all provide potential breeding and foraging habitats - thus the species is rather flexible in its habitat needs. Although breeding was not proven, it is considered that kestrel probably breeds in the vicinity of the site. The site is used frequently by foraging birds. Possible noise/visual intrusion disturbance to foraging birds within the site.	**Sensitivity:** High. **Magnitude:** Medium **Overall significance**: High. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Slight to Moderate Effect** (Criteria: EPA, 2022) based on the fact that there were a high number of sightings (162) on site, however, breeding habitat on site is scarce but is scattered throughout the surrounding landscape.
Lapwing (High)	Recorded once from VP3 on the 21st October 2021 when a single bird was noted flying for 19 seconds in the flight activity survey area at 20-30m (in the rotor sweep zone). Now a rare breeding species in Co. Waterford, breeding on open farmland, and appear to prefer nesting in fields that are relatively bare (particularly when cultivated in the spring) and adjacent to grassland. Wintering distribution in Ireland is widespread. Large flocks regularly recorded in a variety of habitats, including most of the major wetlands, pasture, and rough land adjacent to bogs. Whilst breeding does not currently occur, and is unlikely to, the habitat does occur in form of pasture and rough ground. Again, although foraging was not noted, there is suitable habitat present, and it could occur. It is unlikely that noise/visual intrusion disturbance will be an issue with this species due to the paucity of records.	**Sensitivity:** High. **Magnitude:** Negligible (just one sighting). **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Lesser Black-backed Gull (Medium)	Recorded on 47 occasions, from all VPs, during winter vantage point surveys as well as on 32 occasions from VPs 2 and 3, during summer vantage point surveys. A total of 36,573 seconds were recorded in the flight activity survey area, of which 1,960 seconds were in the rotor sweep zone. Breeding was not observed within the site over the 3 years of surveys. Habitats on site are also largely unsuitable for foraging birds, although foraging by the species in ploughed or slurried land is a common occurrence (although it is very much an opportunistic occurrence during a very small time frame) and as such there is potential for limited foraging habitat to occur. Seasonal flooding in fields may also provide foraging habitat for the species, but again this is not a permanent fixture in the landscape. Roosting and feeding occurred largely outside of the site to the east with only occasional short-term instances of low numbers of bird landing on the ground inside the site. It is worth noting that improved agricultural grassland is abundant in the area as is slurrying/ploughing and thus any habitat lost or disturbed is amply available in the surrounding landscape. Possible noise/visual intrusion disturbance to foraging birds within the site.	**Sensitivity:** Medium. **Magnitude:** Low **Overall significance:** Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be **a Short-term Slight Effect** (Criteria: EPA, 2022).
Mallard (Medium)	Recorded on eight occasions from VPs 2 (7 records) and VP3 (one record) between the 26th April and the 11th August 2022. Most sightings involved single birds (6 records), with high counts of four birds from VP2 on the 26th April 2022, and six birds from VP3 on the 3rd May 2022. Recorded on 12 occasions, over two dates (8th March 2022 – 9 records, and 21st February 2022 – 3 records) all from VP2. Most sightings involved single birds, with a high count of five birds	**Sensitivity:** Medium. **Magnitude:** Low (relatively low number of sightings, no indication of breeding). **Overall significance:** Low. (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Indirect Effect Character	Significance without mitigation
	on the 8th March. A total of 136 seconds were logged in the flight activity survey area, of which 73 seconds occurred in the rotor sweep zone. Most sightings involved single birds, with a high count of five birds on the 8th March 2022. A total of 136 seconds were logged in the flight activity survey area, of which 73 seconds occurred in the rotor sweep zone. Habitats on site are suboptimal and although there has been no indication of breeding on site, it could occur, however it is unlikely. Possible noise/visual intrusion disturbance to foraging birds within the site.	Disturbance and/or displacement will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Merlin (Very High)	Recorded twice during winter vantage point surveys. On the 21st February 2022, a single bird was observed from VP2, flying for 34 seconds at 10-20m (below the rotor sweep zone). On the 19th February 2022, a single bird was observed flying for 82 seconds at 30-50m. The latter 82 seconds occurred both in the flight activity survey area and rotor sweep zone. Merlin have largely shifted to nesting in 10 year+ conifer plantations, using old corvid nests, and require open ground (heath, natural grassland, bog, etc) for hunting. Thus, whilst breeding was not detected on site, it is a possibility with both upland heath and conifer plantation occurring side-by-side. Possible noise/visual intrusion disturbance to foraging birds within the site.	**Sensitivity:** Very High. **Magnitude:** Low (just two sightings, no evidence of breeding). **Overall significance:** Medium. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Mute Swan (Medium)	Not observed during two and half years of surveys, however, the species has been recorded within the last 10 years in the 10km grid square S10, and the species has been included as a precautionary measure. Mute swans require substantial waterbodies, of which there are none on site and thus there are no envisaged disturbance effects.	**Sensitivity:** Medium. **Magnitude:** Negligible (zero sightings). **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Osprey (Low)	Recorded once during summer vantage point surveys from VP1 on the 1st September 2021, flying for 480 seconds at 100-185m, in the rotor sweep zone. Osprey does not breed in Ireland (although it did in historic times) and is now just a rare passage migrant, presumably mostly relating to Scottish birds. On passage, birds need access to large water bodies for fishing. As this habitat does not occur on site, there is no potential for foraging or breeding, with a consequential lack of disturbance effects during construction.	**Sensitivity:** Low. **Magnitude:** Negligible (one sighting of what is considered to be a scarce Irish passage migrant). **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Peregrine (Very High)	Recorded on five occasions from all VPs during summer vantage point surveys as well as an additional five times during winter vantage point surveys. A total of 829 seconds were logged in the flight activity survey area, of which 439 seconds were in the rotor sweep zone. Peregrines require tall cliff-faces or man-made structures which resemble these, for breeding. No such habitats or structures occur on site. Peregrines are aerial hunters which dive on prey from above and as such are not strictly limited to any particular habitat, instead they require sufficient numbers of avian prey. Low risk of visual/noise disturbance although it's a species which is very adaptable, often breeding in active quarry sites, thus proving that noise and visual disturbance isn't a big hindering factor.	**Sensitivity:** Very High. **Magnitude:** Low (low number of sightings and lack of breeding on site). **Overall significance:** Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Pochard (High)	Not observed during two and half years of surveys, however, the species has been recorded within the last 10 years in the 10km grid square S10, and this the species has been included as a	**Sensitivity:** High.

Key Receptor (Sensitivity)	Construction Indirect Effect Character	Significance without mitigation
	precautionary measure. Uncommon breeding species in Ireland with largest populations centred at Lough Neagh and the Shannon region. Nests on the ground among waterside vegetation. Show a preference for large shallow eutrophic waters, particularly those with well-vegetated marshes and swamps and slow flowing rivers. Conditions for neither breeding nor foraging occur on site, thus disturbance not deemed to be an issue with this species	**Magnitude:** Negligible (zero sightings). **Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Red Grouse (High)	Not observed during two and half years of surveys, however, the species has been recorded within the last 10 years in the 10km grid square S10, and this the species has been included as a precautionary measure. Requires heather for both food and shelter/nesting, and thus can be found in heath and bog habitats, where heather is abundant (where overgrazing isn't an issue). Although unlikely, and not noted during surveys, heath habitat (largely degraded through trampling and overgrazing) in the commonage on site could host breeding/foraging grouse. Possible noise/visual intrusion disturbance to foraging birds within the site.	**Sensitivity:** High. **Magnitude:** Low – although not recorded on site, it has been recorded in grid square S10 in the last 10 years, and some suitable habitat occurs. **Overall significance:** Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible to Not Significant Effect** (Criteria: EPA, 2022).
Red Kite (Very High)	A single bird was recorded from VP1 on the 9th April 2022 in flight for a total of 335 seconds, of which 200 seconds (59.7% of total flight time) was in the rotor sweep zone. The remaining 135 seconds (40.3% of total flight time) occurred above the rotor sweep zone. Breeding is currently still confined to the east coast (the nest consists of a large platform of twigs, usually constructed high above the ground in the fork of a deciduous tree branch), close to the original reintroduction sites in Cos. Wicklow, Dublin and Down, although birds are wandering as far as Waterford and even Co. Cork. As a result it is entirely possible that the species range could extend to Dyrick in the lifespan of the proposed wind farm, thus removal of tall trees could impede the expansion of the species into the site. Diet is highly flexible: mainly eats carrion, including roadkill, preferring to scavenge rather than hunt. They will happily take live prey if necessary, however, including rats, mice, rabbits, pigeons, young crows and even earthworms and other invertebrates. As this record referred to one-off wandering individual disturbance is deemed unlikely to be a factor with this species.	**Sensitivity:** Very High. **Magnitude:** Imperceptible – just one sighting. **Overall significance:** Medium. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).
Snipe (High)	Recorded on four occasions during summer vantage point surveys, three of which came from VP2, with the remaining sighting from VP1. Two sightings were of single birds, and two were of two birds. Recorded on ten occasions from VPs 1 and 2, during winter vantage point surveys. Most sightings (six) referred to records of single birds, however, high counts of 8 and 30 birds were noted from VP2 on the 17th October 2021. A total of 401 seconds were logged in the flight activity survey area, of which 134 occurred in the rotor sweep zone. A single bird was recorded from transect 1 on the 23rd March 2022, during winter walkover surveys. Overgrazing is an issue on-site as is the case in most upland areas of Ireland. This limits snipe densities. Although drumming was heard not heard, it is likely that the species breeds in low densities in wetter parts of the site. Possible noise/visual intrusion disturbance to foraging/breeding birds on site.	**Sensitivity:** High. **Magnitude:** Low – low number of sightings (four). **Overall significance:** Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be **Short-term Slight Effect** (Criteria: EPA, 2022).
Sparrowhawk (Low)	During summer vantage point surveys, recorded on 16 occasions from all VPs, all involving single birds. During winter vantage point surveys, recorded on ten occasions from all VPs, all referring to sightings of single birds. A total of 1,683 seconds were logged in the flight activity survey area, of which 881 seconds were in the rotor sweep zone. Requires mature trees for nesting and are commonly	**Sensitivity:** Low. **Magnitude:** Low – relatively low number of sightings (14), although breeding probably occurs.

Key Receptor (Sensitivity)	Construction Indirect Effect Character	Significance without mitigation
	found in coniferous plantations. A second key requirement is an abundance of small birds, including meadow pipit and skylark. Both components are present on site and thus, although breeding by sparrowhawk has not been proven, it is highly plausible that it breeds close to, but not on site, given its secretive nature. Possible noise/visual intrusion disturbance to foraging/breeding birds on site.	**Overall significance:** Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Stock Dove (High)	Recorded on 60 occasions from all VPs during summer vantage point surveys, as well as on six occasions from VPs 2 and 3 during winter vantage point surveys. A total of 3,727 seconds were logged in the flight activity survey area, of which 522 seconds were in the rotor sweep zone. During breeding walkover surveys, recorded twice on the 27th April 2022, from transects 2 and 3, both of which refer to records of two birds. A widespread resident throughout Ireland favouring areas of cereal cultivation. Breeds in lowlands of eastern and southern Ireland, almost invariably near agricultural areas, especially cereal. Nests in holes in trees. Possible noise/visual intrusion disturbance to foraging/breeding birds on site.	**Sensitivity:** High. **Magnitude:** Medium – moderate number of sightings (60), breeding probably occurs. **Overall significance:** High. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Slight to Moderate Effect** (Criteria: EPA, 2022).
Swift (High)	During summer vantage point surveys, recorded on 16 occasions from all VPs, with all records referring to one or two birds. A total of 181 seconds was logged in the flight activity survey area, of which 163 seconds occurred in the rotor sweep zone. Breeds throughout Ireland, usually in small recesses in buildings, both occupied and derelict. Less frequently in holes in trees or caves in uplands or coastal areas. Feeds exclusively on various invertebrates (midges, flies, spiders) caught in flight. Optimal breeding habitat does not occur on site, and forages in open aerial habitats. Low potential for noise/visual intrusion disturbance to foraging birds on site.	**Sensitivity:** High. **Magnitude:** Low – relatively low number of sightings, highly mobile, aerial hunting methods, lack of breeding on site. **Overall significance**: Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Not Significant to Slight Effect** (Criteria: EPA, 2022).
Teal (Medium)	Neither recorded in the flight activity survey area nor the rotor sweep zone. Recorded once (nine birds) from VP2 on the 7th February 2022, flying from a stream for 12 seconds, before returning. All flight time occurred below 10m and thus did not occur in the rotor sweep zone. Usually nests near small freshwater lakes or pools and small upland streams away from the coast, and also in thick cover. Forages in similar habitats - thus the site has potential to host both breeding and foraging birds, and, despite not being recorded in the flight activity survey area, the secretive nature of the species, lends to the possibility of this species being under recorded. Possible noise/visual intrusion disturbance to foraging/breeding birds on site.	**Sensitivity:** Medium. **Magnitude:** Low – recorded once but outside the flight activity survey area. **Overall significance:** Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a **Short-term Imperceptible to Not Significant Effect** (Criteria: EPA, 2022).

7.5.2 Potential Operational Effects

7.5.2.1 Direct Effects: Collision Risk

Studies on operational impacts of wind farms (Pearce-Higgins *et al*., 2009) have shown that certain species do exhibit levels of turbine avoidance during operational phases which may be extrapolated to reductions in breeding bird densities; however, this may not be as significant as previously thought, certainly in comparison to impacts during construction (Pearce-Higgins *et al*., 2012). It seems that there is little evidence for consistent post-construction population declines in any species, suggesting for the first time that wind farm

construction can have greater effects on birds than wind farm operation; this is supported in the literature (Devereux *et al*., 2008).

A recent study on the effects of wind turbines on the distribution of wintering farmland birds (Devereux *et al*., 2008) did not find any consistent patterns of turbine avoidance across the species groups studied (corvids, seed-eaters, gamebirds, and skylark).

The primary cause of direct effects on birds during the operational phase of a development is collision risk. Collision risk behavioural observations of birds in relation to operational wind farms provide the basis of studies on collision risk. Fixed point observations of flight behaviour, flight lines into, through and out of the area and information about the birds' use of the area help to inform the environmental evaluation of the proposed wind farm development. Bird mortality may result from potential bird collision with turbine structures or turbine blades.

Not all bird species are equally susceptible to collision, and some species suffer proportionately high levels of collision mortality (Drewitt and Langston, 2008). Morphology, physical flight characteristics and differences in vision are all influencing factors. Martin and Shaw (2010) suggest that it is the characteristics of the section of a birds visual field that projects forward and hence 'looks' that are the key factors.

In some species the vertical extent of the forward binocular vision is reduced and therefore the bird is rendered blind, if, whilst in the process of flying, it undertakes behaviour such as the detection of conspecifics, remote food sources, etc. (Martin, 2011 and Martin and Shaw, 2010).

Other species have reduced fovea, are emmetropic (default focus is distant) or may contain blind spots in their field of vision (as an evolutionary trait) which may cause susceptibility to collision. Flight height or the flight heights which birds habitually use along either migration or local flight paths is also an influencing factor. Relative size and high wing loading (or low manoeuvrability) are influencing factors as larger birds with poor manoeuvrability are generally perceived as at greater risk of collision with structures (see Brown et al., 1992, quoted in Drewitt and Langston, 2006). Various species therefore exhibit different morphological and behavioural attributes which may contribute to collision risk.

Recent studies show that modern, larger multi-MW turbines show comparable fatality estimates with older generation models and expected increases in fatalities due to increases in rotor surface are not as expected, possibly due to increased altitude, increased distance

between turbines and slower rotation speeds (Krijgsveld et al., 2009). Appraisal of collision risk for the proposed development is based on a predicted rotor envelope of 23-185m (see **Chapter 2: Project Description**).

Relatively little is known about collision as a threat to birds. One problem is that most studies rely on the number of corpses found, but this can be extremely unreliable, since it is known that corpses are quickly removed by predators. At a wind farm site in Co. Tipperary in 2011, it was found that 72% of bird corpses left out were removed after five days. At this site in Co. Tipperary in 2012, scavengers were present at a bird corpse within forty-five minutes of it being placed in the vicinity of a turbine (J. Kearney principal ecologist FT, per. comm. 2022).

The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger *et al*., 2010; Gehring *et al*., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. As such, specification of aviation obstruction lighting to minimise effects on birds is included under operational mitigation measures.

7.5.2.2 Collision Risk Model Analysis

The Collision Risk Model Report (see **Appendix 7.2**) presents the results of collision risk modelling for the proposed Dyrick Hill Wind Farm, Co. Waterford. This modelling used data from vantage point surveys carried out in the winters of 2020/21, 2021/22, as well as the summers of 2020, 2021, and 2022. The modelling was carried out using the Scottish Natural Heritage Collision Risk Model (Scottish Natural Heritage, 2000; Band et al., 2007 and Band, 2012). The bird occupancy method (Scottish Natural Heritage, 2000) was used to calculate the number of bird transits through the rotors, and the spreadsheet accompanying the Scottish Natural Heritage report was used to calculate collision probabilities for birds transiting through the rotors.

The following target species were recorded during vantage point surveys: black-headed gull, brent goose, buzzard, cormorant, golden plover, great black-backed gull, grey heron, hen harrier, herring gull, kestrel, lapwing, lesser black-backed gull, mallard, merlin osprey, peregrine, red kite, snipe, sparrowhawk, stock dove, swift, and teal.

Sixteen species were selected for collision risk modelling: buzzard, golden plover, hen harrier, herring gull, kestrel, lapwing, lesser black-backed gull, mallard, merlin, osprey, peregrine, red

kite, snipe, sparrowhawk, stock dove, and swift. These species have been selected because they were recorded within the 500m buffers of the proposed turbines (the flight activity survey area) and at rotor swept heights, and are of conservation concern: i.e., they are red or amber-listed in Birds of Conservation Concern Ireland 2020-2026 (Gilbert *et al*., 2021), and/or are listed on Annex I of the Birds Directive (2009/147/EC) or green-listed and sensitive to wind farm developments (i.e., buzzard). For all the other species recorded but not included for collision risk modelling, the effective collision risk can be assumed to be zero.

As the proposed grid connection will be buried underground there is no resultant collision risk associated with this element of the wind farm project.

Passerines

Collision by resident passerines is not considered likely to be a significant issue as their flight activity is generally well below the height of rotor blades and the proposed impact of collision risk will be a *Long-term Imperceptible Reversible Effect*.

Non-Passerines

Potential collision risk to non-passerine target species is outlined in **Table 7-24** below. The Collision Risk Model Report (see **Appendix 7.2**) provides further information on the predicted collision rate as a percentage of the populations of buzzard, golden plover, kestrel, lapwing and lesser black-backed gull.

Table 7-24: Potential collision risk to target species

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Black-headed Gull (Medium)	Twenty-seven black-headed gull fatalities have been recorded within the European Context, in a review of 46 wind farms up to 2004 (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. This species was not recorded within the 500m turbine buffers at rotor swept heights, so the effective **collision risk for this species is zero.**	**Sensitivity:** Medium. **Magnitude:** Negligible **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Buzzard (Low)	Twenty-seven buzzard fatalities have been recorded within the European Context, in a review of 46 wind farms up to 2004 (Hoetker et al., 2006). However, this number is low in relation to the estimated European population of up to one million pairs (Gensbol, 2008) and best available knowledge suggests mortality due to wind farms is not sufficient to cause significant population declines of this green-listed species. The predicted collision rate for buzzard equates to 0.12% of the national population and 4.62% of the county population. It must be	**Sensitivity:** Low. **Magnitude:** Medium – based on predicted 3.66 collisions per year which is equal to 4.62% of an extremely conservative/out-dated (due to a lack of a more recent figure to work with) national population estimate of 3000 birds

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	noted however that the county population is an estimate based on the proportion of the national population split by county area, used due to a lack of a county estimate. Buzzard is a green-listed species of low conservation concern due to it ongoing increase and population size and range. The national population estimate available for the species was taken from the Article 12 report covering the period 2008-2012. As the data is more 10 years old it does not account for the continued expansion of the species range throughout Ireland and therefore certainly underestimates the current population size for this species. The predicted number of collisions for this species is 3.66 which equates to 4.62% of the county population based on an estimated population size of 79.28 County Waterford. In reality, this percentage is likely to be much less, given the underestimated population size available. **Predicted number of collisions (assuming avoidance) is 3.66 per year (4.62% of the of the county population and 0.12 % of the national population).**	**Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Slight Effect** (Criteria: EPA, 2022).
Coot (Medium)	Published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. This species was not recorded within the 500m turbine buffers at rotor swept heights, so the effective **collision risk for this species is zero.**	**Sensitivity:** Medium. **Magnitude:** Negligible (zero sightings). **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Cormorant (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were two fatalities across 46 European wind farms (Hoetker et al., 2006). Furthermore, the published avoidance rate is 98% (SNH 2010), suggesting cormorant exhibit high levels of micro-avoidance at wind farms. This species was not recorded within the 500m turbine buffers at rotor swept heights, so the effective **collision risk for this species is zero.**	**Sensitivity:** Medium. **Magnitude:** Negligible. **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Golden Plover (Very High)	Golden plover have been recorded in low numbers as collision fatalities at wind farms (Hoetker et al., 2006; Grunkorn 2011). The SNH guidance (SNH, 2018) does not provide a specific avoidance rate for golden plover, but states that for species not covered by the guidance "*we recommend a default value of 98%* ". However 3 years of post-construction monitoring sites included in the CRM (Appendix 7.2) indicates a much higher avoidance rate should be applied for non-breeding golden plover populations. The studies had robust survey methodologies and were carried out at wind farm sites with high levels of golden plover flight activity. The review considers that an avoidance rate of 99.8% is a suitable precautionary estimate for winter golden plover. In further support of a high micro-avoidance rate, a study in the Netherlands of three operational wind farms where golden plovers were both diurnally and nocturnally active found no fatalities (Krijgsveld et al., 2009). Golden plovers were not recorded breeding within the 500m turbine envelope during the survey period which reduces magnitude.	**Sensitivity:** Very High. **Magnitude:** Negligible (SPA and National Population). **Overall significance:** Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Slight Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Predicted number of collisions (assuming 99.8% avoidance) is 6.21[4] per year (0.12% of the local population[5] and 0.008 % of the national population).	
Great Black-backed Gull (Low)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were zero fatalities across 46 European wind farms (Hoetker et al., 2006). Furthermore, the published avoidance rate is 98% (SNH 2010), suggesting great black-backed gulls exhibit high levels of micro-avoidance at wind farms. This species was not recorded within the 500m turbine buffers at rotor swept heights, so the effective **collision risk for this species is zero.**	**Sensitivity:** Low. **Magnitude:** Negligible. Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Grey Heron (Low)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were three fatalities across 46 European wind farms (Hoetker et al., 2006). Furthermore, the published avoidance rate is 98% (SNH 2010), suggesting grey heron exhibit high levels of micro-avoidance at wind farms. This species was not recorded within the 500m turbine buffers at rotor swept heights, so the effective **collision risk for this species is zero.**	**Sensitivity:** Low. **Magnitude:** Negligible. **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Hen Harrier (Very High)	No hen harriers were observed breeding on site, so potential collision risk is significantly reduced due to the absence of the territorial display known as 'sky-dancing', which often occurs at heights within the predicted rotor envelope. Documented as occasionally soaring or arriving at winter roosts 'at height' (Watson, 1977), however no roosting was documented during hinterland surveys in a 10km buffer of the site. Literature suggests flying at low heights is a 'ubiquitous trait' supported by a number of studies (e.g. Whitfield and Madders, 2006). The species has a high, published avoidance rate (99%) (SNH, 2017) in relation to wind turbines. **Predicted number of collisions (assuming avoidance) is 0.02 per year.**	**Sensitivity:** Very High. **Magnitude:** Negligible (138 birds nationally would result in a 0.014% population loss. No SPA for the species occurs in the area, and an extremely conservative estimate of one pair yields a predicted annual loss of 1% of that estimated local population). **Overall significance:** Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Herring Gull (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were 189 fatalities across 46 European wind farms (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting herring gulls exhibit high levels of micro-avoidance at wind farms. **Predicted number of collisions (assuming avoidance) is 0.05 per year.**	**Sensitivity:** Medium. **Magnitude:** Negligible (no local population estimate is available, and species does not breed inland in this location. Annual predicted loss of national population is 0.00048%). **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Kestrel (High)	Twenty-nine fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the	**Sensitivity:** High.

[4] Based on the 99.8% avoidance rate reflecting the high micro-avoidance rate of the species Gittings, (2022) rather than the SNH 2018 default avoidance rate of 98%.

[5] Population figure taken from the Dungarvan Harbour SPA - Population Site (europa.eu) - https://biodiversity.europa.eu/sites/natura2000/IE0004032 accessed May 2023

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	European Context (Hoetker et al., 2006). The published avoidance rate is 95% (SNH, 2016). **Predicted number of collisions (assuming avoidance) is 2.72 per year (0.62% of the of the county population and 0.02 % of the national population)**	**Magnitude:** Negligible, based on 2.72 collisions per year, which represents a loss of 0.62% (an estimate based on proportion of population split by county area, used due to a lack of a county estimate) of the county population. At national level this represents an annual loss of 0.02% of the population. However, whilst it isn't accurately measurable due to a lack of any 'local' kestrel counts, it is likely that the local magnitude would be Moderate. **Overall significance:** Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Slight Effect** on a county level (Criteria: EPA, 2022).
Lapwing (High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were two fatalities across 46 European wind farms (Hoetker et al., 2006). Furthermore, the published avoidance rate is 98% (SNH 2010), suggesting lapwing exhibit high levels of micro-avoidance at wind farms. **Predicted collision risk for this species is zero.**	**Sensitivity:** High. **Magnitude:** Negligible. **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Lesser Black-backed Gull (Medium)	A published review of 46 European wind farms (Hoetker et al., 2006) found 45 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. **Predicted number of collisions (assuming avoidance) is 0.22 per year equating to 0.003% of the national population or 0.08 % of the local population[6].**	**Sensitivity:** Medium. **Magnitude:** Negligible (no local population estimate is available, and species does not breed inland in this location. Annual predicted loss of national population is 0.003%). **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Mallard (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were 18 fatalities across 46 European wind farms between 2004 and 2006 (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. **Predicted number of collisions (assuming avoidance) is 0.02 per year.**	**Sensitivity:** Medium. **Magnitude:** Negligible (0.0001% loss of national population estimate of 18,810 birds. No country/local estimate, however, assuming an *extreme* worst - case scenario population of one pair, the annual predicted loss of this population would be 1%). **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term**

[6] Population figure taken from the Dungarvan Harbour SPA - Population Site (europa.eu) - https://biodiversity.europa.eu/sites/natura2000/IE0004032 accessed May 2023

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Imperceptible Effect (Criteria: EPA, 2022).
Merlin (Very High)	Merlin mainly take prey from a perch, on the ground or low in flight (Gensbol 2008). Wintering birds have been shown to employ low flight attacks for over 64% of total hunts (Dickson 1996). Occasionally birds fly upwards during a pursuit flight, but this only represents 10.8% of total hunts (Dickson 1996), possibly due to increased energy expenditure. Flight patterns during the breeding season are likely to be similar with documented hunting and commuting flight often 1-2m in height (McElheron 2005). **Predicted number of collisions (assuming avoidance) is 0.01 per year.**	**Sensitivity:** Very High. **Magnitude:** Negligible (0.0025% loss of national population estimate of 400 birds. No country/local estimate, however, assuming an *extreme* worst - case scenario population of one pair, the annual predicted loss of this population would be 0.5%.) **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Mute Swan (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were eight fatalities across 46 European wind farms between 2004 and 2006 (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. **Predicted number of collisions (assuming avoidance) is zero per year.**	**Sensitivity:** Medium. **Magnitude:** Negligible. **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Osprey (Low)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were no fatalities across 46 European wind farms between 2004 and 2006 (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. **Predicted number of collisions (assuming avoidance) is 0.04 per year.**	**Sensitivity:** Low. **Magnitude:** Negligible (the species does not breed in Ireland and thus does not have an Irish population – this one record referred to a migrating bird; a rare occurrence nationally). **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Peregrine (Very High)	Evidence of collision fatality is low, with only two birds recorded in published reviews of wind farm fatalities (Hoetker et al., 2006). The SNH recommended avoidance rate for collision-risk modelling is 98% (SNH, 2010), suggesting high micro-avoidance capabilities. **Predicted number of collisions (assuming avoidance) is 0.02 per year.**	**Sensitivity:** Very High. **Magnitude:** Negligible (0.0019% loss of national population estimate of 1,030 birds. No country/local estimate, however, assuming an *extreme* worst - case scenario population of one pair, the annual predicted loss of this population would be 1%. **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Pochard (High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were no fatalities across 46 European wind farms between 2004 and 2006 (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010),	**Sensitivity:** High. **Magnitude:** Negligible.

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	suggesting birds exhibit high levels of micro-avoidance at wind farms. This species was not recorded within the 500m turbine buffers at rotor swept heights, so the **effective collision risk for this species is zero.**	**Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Red Grouse (High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were no fatalities across 46 European wind farms between 2004 and 2006 (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. This species was not recorded within the 500m turbine buffers at rotor swept heights, so the **effective collision risk for this species is zero.**	**Sensitivity:** High. **Magnitude:** Negligible. **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Red Kite (Very High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were 43 fatalities across 46 European wind farms between 2004 and 2006 (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. **Predicted number of collisions (assuming avoidance) is 0.02 per year.**	**Sensitivity:** Very High. **Magnitude:** Negligible (0.0588% loss of national population estimate of [conservative/outdated] 34 birds. No country/local estimate as the species is not yet known to breed in Waterford. **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Snipe (High)	A published review of 46 European wind farms (Hoetker et al., 2006) found 45 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. **Predicted number of collisions (assuming avoidance) is 0.13 per year.**	**Sensitivity:** High. **Magnitude:** Negligible (0.0015% loss of national population estimate of 8,550 birds. No country/local estimate, however an extreme worst-case scenario of 13 birds yields a predicted annual loss of just 1% of this estimated population.) **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Sparrowhawk (Low)	Sparrowhawks are a resident species of the wind farm study area, although no breeding has been recorded within the site. Published fatality rates are low, with two fatalities from a review of 46 wind farms across Europe (Hoetker et al., 2006). **Predicted number of collisions (assuming avoidance) is 0.04 per year.**	**Sensitivity:** Low. **Magnitude:** Negligible (0.0004% loss of national population estimate of 9,100 birds. No country/local estimate, however an extreme worst-case scenario of two pairs yields a predicted annual loss of just 1% of this estimated population.) **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term**

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Imperceptible Effect (Criteria: EPA, 2022).
Stock Dove (High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there was one recorded fatality across wind farms from 46 European wind farms. However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. **Predicted number of collisions (assuming avoidance) is 0.13 per year.**	**Sensitivity:** High. **Magnitude:** Negligible (0.0006% loss of national population estimate of 20,010 birds. No country/local estimate, however an extreme worst-case scenario of 13 birds yields a predicted annual loss of just 1% of this estimated population.) **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Swift (High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were 14 recorded fatalities across wind farms from eight European countries (Netherlands, Belgium, Spain, Sweden, Austria, Britain, Denmark, and Germany) (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. **Predicted number of collisions (assuming avoidance) is 0.03 per year.**	**Sensitivity:** High. **Magnitude:** Negligible (0.0001% loss of national population estimate of 25,520 birds. No country/local estimate, however an extreme worst-case scenario of 3 birds yields a predicted annual loss of just 1% of this estimated population.) **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Teal (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were two recorded fatalities across wind farms from eight European countries (Netherlands, Belgium, Spain, Sweden, Austria, Britain, Denmark, and Germany) (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms. This species was not recorded within the 500m turbine buffers at rotor swept heights, so the **effective collision risk for this species is zero.**	**Sensitivity:** Medium. **Magnitude:** Negligible. **Overall significance:** Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).

7.5.2.3 Indirect Effects: Disturbance and Displacement

There is evidence that the rotor blades of wind turbines during operation can displace or exclude some species, which effectively results in habitat loss for these birds. Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to factors such as perceived collision risk. Birds may therefore avoid areas proximal to turbines until habituation takes place. There are examples in the literature of habituation in species such as geese and swans (see Fijn *et al*., 2012 and Madsen and Boertmann, 2008).

Available evidence suggests that breeding passerines are not adversely affected by the presence of wind turbines, and for this reason they are omitted from Table 7-25. For example, a German study found no effect on numbers or spatial distribution of skylarks within 1km of turbines (Langston and Pullan, 2004).

Whitfield and Madders (2006), suggest that most studies do not detect any significant displacement of raptor species by wind turbines although there are occasional notable exceptions.

Generally speaking, displacement of birds by the presence of turbines is not considered to be a significant effect on the species assemblage given the limited amount of habitat available onsite and the availability of habitat in the greater area. However, the placement of turbines in the commonage area poses a significant risk of displacing Annex-I protected golden plover. This species commonly winters in areas of upland heath, which is a habitat which is becoming increasingly at risk from both wind farm developments and afforestation. There are several other projects which have either been consented or are proposed which also impose a risk to this habitat, thus further implicating the consequences. This discussed at greater length in section **7.1.15: Potential Cumulative Effects**.

Displacement of birds by the presence of turbines is not considered to be a significant effect on the species assemblage given the limited amount of habitat available onsite and the availability of habitat in the greater area.

No further excavation works shall be required along the haul route or the proposed grid route during the operational phase. Only occasional maintenance works will be required (these shall be minimal without the need for large scale construction). No significant operational phase effects are predicted for both elements of the wind farm.

7.5.2.4 Indirect Effects: Barrier Effect

One of the potential operational effects of wind farms is avoidance where the wind farm may act as a barrier to movements (Masden *et al.*, 2009). The effect of birds altering their migration flyways or local flight paths to avoid any infrastructure is a form of displacement (Drewitt and Langston, 2006). The primary effect of barrier effect is increased energy expenditure when birds have to fly further to circumvent an obstacle.

Effects can be highly variable and range from slight 'checks' in-flight direction, height, or speed, through to larger diversions around objects. Studies have shown that birds on

migration may show avoidance of wind farms (Masden, 2009) but the observed distances involved were trivial in regard to total migration distances, and hence energy expenditure.

In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal avoidance rates are comparable to those in periods of lower visibility (Desholm, and Kahlert, 2005). In the same study migrating flocks at night were recorded increasing their distance from individual turbines once inside the wind farm and also travelling in the corridors between turbines (Desholm, and Kahlert, 2005).

Potential disturbance and barrier effects due to the operation of the proposed wind farm are outlined in Table 7-25 below:

Table 7-25: Disturbance and Barrier effect on target species

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
Black-headed Gull (Medium)	**Disturbance:** In a review of the published impacts of wind farms on black-headed gull populations (Hötker et al., 2006), it was found that impacts on black-headed gull populations post-construction in the non-breeding season appeared to have no negative effects, with 14 cases of no negative effects, and four cases of negative effects (results deemed not significant) (Hötker et al., 2006). It should also be noted that just one case of habituation is documented in this study with a second case showing signs of a lack of habituation. Furthermore, just two flightlines of this species were recorded over the entire survey period. **Barrier Effect:** Barrier effects on either migration or regular flights of black-headed gull has been shown at three out of eight (thus five so no barrier effect) studies to date (2004) in a European context (Hötker et al., 2006). The overall barrier effect was not shown to be significant. It should be noted that just two flightlines of this species were recorded over the entire survey period.	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects is assessed as a **Long-term Imperceptible Effect** due to published cases of habituation, as well as a lack of habituation to wind farms, coupled with low number of sightings on site (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Buzzard (Low)	**Disturbance:** In a review of the published impacts of wind farms on buzzard populations (Hötker et al., 2006), it was found that overall, impacts on buzzard populations post-construction, across both winter and breeding seasons was not significant and that buzzards do show	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Low

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
	habituation to the presence of wind farms (Hötker et al., 2006). It should also be noted that just one case of habituation is documented in this study with a second case showing signs of a lack of habituation. **Barrier Effect:** Barrier effects on either migration or regular flights of buzzard has been shown at two out of six studies to date (2004) in a European context (Hötker et al., 2006). The overall barrier effect results were shown to be not significant.	**Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects is assessed as a **Long-term Imperceptible to Slight Effect** due to published cases of habituation, as well as a lack of habituation to wind farms, with the increase in range from Imperceptible to Slight owing to the high number of sightings of this species on site (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Low **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered a **Long-term Imperceptible Slight Effect** (Criteria: EPA, 2022).
Coot (Medium)	**Disturbance:** In a review of the published impacts of wind farms on coot populations (Hötker et al., 2006), just one case of habituation is documented, with zero cases without habituation. **Barrier Effect:** There was no information on barrier effect for coot, Hötker et al., 2006. However, with the lack of sightings, barrier effect is highly unlikely to be an issue in this species on site.	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects is assessed as an Imperceptible Effect due to a total lack of sightings on site; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Cormorant (Medium)	**Disturbance:**	**Disturbance:** **Magnitude:** Negligible

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
	In a review of the published impacts of wind farms on birds (Hötker et al., 2006), there was no information available on cormorant populations post-construction. **Barrier Effect:** Barrier effects on either migration or regular flights of cormorant has been shown for 2/6 studies to date (2004) in a European context (Hötker et al., 2006), with the overall effect significance being non-significant.	**Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects Imperceptible due to lack of sightings or foraging habitat on site; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA 2022).
Goldcrest (Medium)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hötker et al., 2006), there was no information available on goldcrest populations post-construction. However, studies on the impacts of wind farms during both construction (Pearce-Higgins, et al., 2012) and operation (Pearce-Higgins, et al., 2009) have found little evidence of significant disturbance effects on passerine species; direct habitat loss is the main effect through removal of hedgerows and treelines in which goldcrests breed. **Barrier Effect:** Barrier effects on either migration or regular flights of cormorant has been shown for 1/1 studies to date (2004) in a European context (Hötker et al., 2006), with the overall effect significance being non-significant.	**N/A**
Golden Plover (Very High)	**Disturbance:** Possible disturbance during winter months from feeding or roosting locations in broemountain commage area see Volume III figure 7.73. The resultant operational phase of the wind farm may cause some locaised disturbance to the core foraging / roosting habitat at Broemountain. The area is made up of 16.45 hectares of dry acid grassland and dry heath habitat with intermittent stands of dense bracken. Literature suggests differences in densities pre- and post-construction of wind farms is significant (Pearce-Higgins et al., 2012); displacement is not significant but may occur up to 400m (Sansom et al. 2016). **Barrier Effect:**	**Disturbance:** **Magnitude:** Low (1-5% habitat loss) locally **Sensitivity:** Very High **Overall significance:** Medium (Criteria: Percival, 2003) Loss of wintering and/or foraging habitat will be a **Long-term Moderate Effect Locally and a Long-term Slight Effect at a county level** (Criteria: EPA, 2022). **Barrier Effect:**

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
	High published avoidance rates of wind farms (Krijgsveld et al., 2009) and changes in densities within wind farms post construction (Pearce-Higgins et al., 2012), suggests wind farms act as significant barriers to golden plover.	**Magnitude:** Low **Sensitivity:** Very High **Overall Significance:** Medium (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Moderate to Significant; significance of daily barrier effect assessed as Moderate to Significant as literature suggests high published avoidance rates of wind farms; overall significance considered a **Long-term Moderate Effect** (Criteria: EPA, 2022).
Great Black-backed Gull (Low)	**Disturbance:** Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on coastal habitats. It is uncertain that disturbance may effect gull species inland. Furthermore, In a review of the published impacts of wind farms on bird populations (Hötker et al., 2006), it was found that common gulls do show habituation to the presence of wind farms (Hötker et al., 2006). **Barrier Effect:** Gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015).	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Low **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects Imperceptible due to published habituation to wind farms, and general paucity of sightings; overall significance considered be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Low **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Great Spotted Woodpecker (Low)	**Disturbance:** Possible visual/noise disturbance in areas in close proximity to suitable habitat (treelines, woodland, or small copses). No apparent evidence to suggest disturbance to woodpeckers at wind farm sites. **Barrier Effect:** No sufficient evidence to suggest displacement effects in woodpeckers at wind farm sites, with just one case of barrier effect noted in Hötker et al., 2006.	**N/A**
Greenfinch (Medium)	**Disturbance:** Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species.	**N/A**

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
	Barrier Effect: Hötker et al., 2006 found evidence of a barrier effect in greenfinch in two cases, with zero cases of no effect.	
Grey Heron (Low)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hötker et al., 2006), they found that typically, birds of open habitats were avoiding turbines by several hundred metres. Grey herons were an exception to this rule and were frequently found close to or within wind farm sites, suggesting habituation. **Barrier Effect:** Hötker et al., 2006 found evidence of a barrier effect in four out of seven cases, with the remaining three showing no barrier effect. Results were deemed not significant.	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Low **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects Imperceptible due to infrequent sightings and published evidence of habituation to wind farms; overall significance considered **Long-term Imperceptible Effect** (Criteria: EPA 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Low **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered to be a **Long-term Imperceptible Effect** (Criteria: EPA 2022).
Grey Wagtail (High)	**Disturbance:** Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. **Barrier Effect:** Hötker et al. (2006) found evidence of a barrier effect in grey wagtail in one case, with zero cases of no effect.	**N/A**
Hen Harrier (Very High)	**Disturbance:** No breeding or roosting was noted within the subject site. Noise disturbance/visual intrusion unlikely to deter foraging as evidence suggests birds may continue to utilise wind farms post construction (Robinson et al., 2012). **Barrier Effect:** Although barrier effect has been documented in at least one study in the European context; recent evidence suggests that birds continue to use wind farms post construction (Whitfield and Madders, 2006) (Robinson et al., 2012) indicating wind farms may not be significant barriers.	**Disturbance:** **Magnitude:** Low **Sensitivity:** Very High **Overall Significance:** Medium (Criteria: Percival 2003). Significance of effects Not Significant to Slight due to scarcity (eight in total) sightings during the total survey period; overall significance considered as **Long-term Not Significant to Slight Effect** (Criteria: EPA, 2022). **Barrier Effect:**

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
		Significance of effects to birds in terms of energy expenditure assessed as Not Significant; magnitude of daily barrier effect assessed as Not Significant to Slight; overall significance considered **Long-term Not Significant to Slight Effect** (Criteria: EPA, 2022).
Herring Gull (Medium)	**Disturbance:** Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on coastal habitats. It is uncertain that disturbance may effect gull species inland. **Barrier Effect:** Gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as lesser black-backed, herring and great black-backed, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects is assessed as a **Long-term Imperceptible Effect** due to published cases of habituation, as well as a lack of habituation to wind farms, coupled with low number of sightings on site (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
House Martin (Medium)	**Disturbance:** Evidence suggests that flying insects are attracted to turbines (Long, et. al, 2011; Scholz & Voigt, 2021) which in turn, attracts insectivorous birds, especially hirundines and swifts (Ahlén, 2002). This evidence further suggests that construction of wind farms, instead of disturbing birds, may in fact actually lure such bird species into the rotor sweep zone, thus significantly increasing collision risk. **Barrier Effect:** Hötker et al. (2006) found evidence of a barrier effect in house martin in two cases, with zero cases of no effect. As mentioned above, attraction of insects to turbines may further attract insectivorous bird species, which would reduce/preclude barrier effect.	**N/A**
House Sparrow (Medium)	**Disturbance:** Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species.	**N/A**

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
	Barrier Effect: Apparent lack of evidence for or against barrier effect in the species. Species not highly migratory, mostly, and only occasionally prone to smaller internal migrations.	
Kestrel (High)	**Disturbance:** Disturbance (in terms of minimal distance to wind farm) has been recorded in 14 studies on wind farms in Europe (Hötker et al., 2006). Habituation to wind farms has been recorded in one case, however the only other case recorded the opposite (Hötker et al., 2006). A case study on the impacts of wind farms on birds conducted in southern Spain (Farfán et al., 2009), found that raptors utilise the space around the wind farm with lower frequency than prior to its existence, which represented a displacement of the home range of these species. In particular, kestrel was noted to decline sharply in the second year of operation, with other raptor species showing a decline in the first year. **Barrier Effect:** Barrier effects have been shown to a degree in either migrating Kestrel or regular flight paths within the European context (3 of 5 studies; Hötker et al., 2006).	**Disturbance:** **Magnitude:** Medium **Sensitivity:** High **Overall Significance:** High (Criteria: Percival 2003). Significance of effects Moderate due to published cases of disturbance and high usage of the site by kestrel; overall significance considered **Long-term Moderate Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Medium **Sensitivity:** High **Overall Significance:** High (Criteria: Percival 2003). Significance of effects in terms of energy expenditure assessed as Moderate; magnitude of daily barrier effect assessed as Slight as literature suggests low published avoidance rates of wind farms with habituation; overall significance considered a **Slight to Moderate Long-term Effect** (Criteria: EPA 2022).
Lapwing (High)	**Disturbance:** Hötker et al. (2006) found 18 cases of negative effects on density of lapwing post construction during the breeding season, with 11 cases of no negative effects. During the non-breeding season, 29 cases of negative effects were found, with 12 cases of no negative effects. Ketzenberg et al. (2002) found no effect on numbers of lapwing within 1km. Hötker et al. (2006) found six cases of non-habituation in the breeding season, with two cases of habituation. During the non-breeding season, they found three cases of habituation and two cases of non-habituation. **Barrier Effect:** Barrier effects to lapwing have been shown in five cases of out six (Hötker et al., 2006).	**Disturbance:** **Magnitude:** Medium **Sensitivity:** High **Overall Significance:** High (Criteria: Percival 2003). Significance of effects Not Significant due to lack of sightings (just one record); overall significance considered **Long-term Not Significant Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Medium **Sensitivity:** High **Overall Significance:** High (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
		Significance of effects to migrating birds in terms of energy expenditure assessed as Not significant; significance of daily barrier effect assessed as Not Significant; overall significance considered to be a **Long-term Not Significant Effect** (Criteria: EPA, 2022).
Lesser Black-backed Gull (Medium)	**Disturbance:** Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on coastal habitats. It is uncertain that disturbance may effect gull species inland. **Barrier Effect:** Gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as lesser black-backed, herring and great black-backed, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects is assessed as a **Long-term Imperceptible Effect** due to published cases of habituation, as well as a lack of habituation to wind farms, coupled with low number of sightings on site (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Linnet (Medium)	**Disturbance:** Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. **Barrier Effect:** Hötker et al., 2006 found evidence of a barrier effect in linnet in three cases. However, no evidence of breeding was noted on site with all observations occurring during the winter 21/22 season and no observations of the species for the other four seasons of survey onsite. Therefore, the resultant barrier effect to this species is considered to be negligible.	**N/A**
Mallard (Medium)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hötker et al., 2006), there was evidence of habituation to wind farms in three cases. However, a study conducted by Zhao et al. (2020) on the effect of wind farms on wintering ducks at an important wintering ground in China, found that ducks (mostly mallard and eastern spot-billed ducks) tended to	**Disturbance:** **Magnitude:** Low **Sensitivity:** Medium **Overall Significance:** Low (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
	inhabit areas far from wind turbines at Chongming Dongtan, both during the day and at night. **Barrier Effect:** Barrier effect was noted in three cases out of five (Hötker et al., 2006).	Significance of effects Not Significant to Slight due to inconsistent evidence of disturbance and low number of sightings; overall significance considered **Long-term Not Significant to Slight Effect** (Criteria: EPA 2022). **Barrier Effect:** **Magnitude:** Low **Sensitivity:** Medium **Overall Significance:** Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Not Significant to Slight; significance of daily barrier effect assessed as Slight to Moderate; overall significance considered a **Not Significant to Slight Long-term Effect** (Criteria: EPA, 2022).
Meadow Pipit (High)	**Disturbance:** Pearce-Higgins et al. (2009) note a reduction of up to 15% in breeding meadow pipit as a result of turbine displacement, with an approximate distance up 100m. Peare-Higgins et al (2012) found that meadow pipit densities at two UK-based wind farm sites were reduced post construction relative to pre-construction and construction periods. Hötker et al., 2006 found evidence of habituation in three cases out of six. **Barrier Effect:** Hötker et al., 2006 found evidence of a barrier effect in meadow pipit in two out of three cases.	**N/A**
Merlin (Very High)	**Disturbance:** Possible disturbance to wintering birds due to operational maintenance etc. No breeding or roosting was noted within the site. **Barrier Effect:** Barrier effect has been recorded in Europe (Hötker et al., 2006) though this may relate mainly to large scale migration, which is unlikely at the subject site. Numbers recorded on site were low throughout the duration of the study and barrier effects are highly unlikely to apply.	**Disturbance:** **Magnitude:** Low **Sensitivity:** Medium **Overall Significance:** Low (Criteria: Percival 2003). Magnitude is assessed as Low due to low number (two) of sightings over course of study period; species sensitivity is Very High. Overall impact is Medium (Criteria: Percival 2003). Significance of effects Slight; overall significance considered a **Long-term Slight Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Low **Sensitivity:** Medium **Overall Significance:** Low (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
		Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered to be a **Long-term Imperceptible to Slight Effect** (Criteria: EPA, 2022)
Mute Swan (Medium)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hötker et al., 2006), there was no information available on mute swan populations post-construction. It is important to note, that mute swan was not observed during two and half years of surveys, however, the species has been recorded within the last 10 years in the 10km grid square S10, and thus the species has been included as a precautionary measure. The preceding clause combined with the fact that there is no optimal habitat on site, points to a highly unlikely chance of disturbance to this species. Barrier Effect: Likewise, there was no information on barrier effect for mute swan, Hötker et al., 2006. However, with the lack of flight sightings, barrier effect is highly unlikely to be an issue in this species on site.	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects Imperceptible; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered a **Long-term Imperceptible Effect** (Criteria: EPA, 2022)
Osprey (Low)	**Disturbance:** Recorded once during summer vantage point surveys from VP1 on the 1st September 2021, flying for 480 seconds at 100-185m, in the rotor sweep zone. Osprey does not (yet again) breed in Ireland (although it did in historic times) and is now just a rare passage migrant, presumably mostly relating to Scottish birds. On passage, birds need access to large water bodies for fishing. As this habitat does not occur on site, there is no potential for foraging or breeding, with a consequential lack of disturbance effects during operation. Because of the rare status of the species, disturbance is not deemed to be an issue with this species. **Barrier Effect:** For the same reasons as stated above, barrier effect is not deemed to be an issue.	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Low **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects Imperceptible due to rarity of species in an Irish context; overall significance considered to be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Low **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
		significance considered to be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Peregrine (Very High)	**Disturbance:** Possible disturbance to foraging birds through noise, visual intrusion. No displacement from breeding sites due to none being recorded within the proposed site boundary. Peregrines are known to nest in urban areas often in cathedrals with loud ringing bells, as well as quarries where regular rock-breaking works are undertaken. For example, Moore et al. (1997), estimated that 65 quarries were occupied in Ireland between 1991 and 1993. Thus there is evidence to suggest that the species is tolerant to human activity. **Barrier Effect:** Hötker et al., 2006 report one case of barrier effect in peregrines.	**Disturbance:** **Magnitude:** Low **Sensitivity:** Very High **Overall Significance:** Medium (Criteria: Percival 2003). Significance of effects Not Significant to Slight due to low level of sightings within the site and evidence suggesting tolerance to noisy human activities; overall significance considered **Long-term Not Significant to Slight Effect** (Criteria: EPA 2022). **Barrier Effect:** **Magnitude:** Low **Sensitivity:** Very High **Overall Significance:** Medium (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered to be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022)
Pochard (High)	**Disturbance:** Not observed during two and half years of surveys, however, the species has been recorded within the last 10 years in the 10km grid square S10, and this the species has been included as a precautionary measure. Disturbance not envisaged to be an issue with this species, due to lack of suitable habitat and sightings on site. **Barrier Effect:** Hötker et al., 2006 report one case of barrier effect in pochard. Barrier effect not envisaged to be an issue due to reasons outlined above.	**Disturbance:** **Magnitude:** Low **Sensitivity:** High **Overall Significance:** Low (Criteria: Percival 2003). Significance of effects Imperceptible due to lack of sightings or suitable habitat on site; overall significance considered **Long-term Imperceptible Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Low **Sensitivity:** High **Overall Significance:** Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered to be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
Sparrowhawk (Low)	**Disturbance:** In a review of the published impacts of wind farms on sparrowhawk populations (Hötker et al., 2006), it was found that overall, effects on sparrowhawk populations post-construction, across both winter and breeding season was not significant. Sparrowhawk do show habituation to the presence of wind farms (Hötker et al., 2006). Breeding was not proven although activity levels suggest that this secretive species likely breeds on or near site. **Barrier Effect:** Sparrowhawk is considered to be less sensitive or less willing to change their original migration direction when approaching wind farms (Hötker et al., 2006). Three cases of no barrier effect are reported by Hötker et al., 2006, with one case of barrier effect.	**Disturbance:** **Magnitude:** Low **Sensitivity:** High **Overall Significance:** Low (Criteria: Percival 2003). Significance of effects Not Significant due to published habituation to wind farms and low number of sightings (14) on site); overall significance considered **Long-term Not Significant Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Low **Sensitivity:** High **Overall Significance:** Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered as a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Spotted Flycatcher (Medium)	**Disturbance:** Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. **Barrier Effect:** There is no apparent evidence of a barrier effect in this species.	**N/A**
Starling (Medium)	**Disturbance:** Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hötker et al. (2006) found 17 cases of no negative effect post construction during the non-breeding season, with a comparative 5 cases of negative impact (P= 0.05). Furthermore, during the non-breeding season, the average minimal distance (as ascertained from 16 studies) to wind farms was 30m. **Barrier Effect:** Hötker et al., 2006 found evidence of a barrier effect in starling in three cases, with another three cases of no effect - results deemed statistically insignificant. A relatively high number of recorded turbine casualties (28 - the highest of any passerine, as published by Hötker et al., 2006) suggest that	**N/A**

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
	barrier effect is not so much an issue in this species, although this is not necessarily a positive point.	
Stock Dove (High)	**Disturbance:** Information on the disturbance of the species with respect to wind farms is lacking. **Barrier Effect:** Hötker et al., 2006 found evidence of a barrier effect in stock dove in two cases, with zero cases of no effect.	**Disturbance:** **Magnitude:** Low **Sensitivity:** High **Overall Significance:** Low (Criteria: Percival 2003). Significance of effects a conservative Imperceptible to Slight due to a lack of published data on wind farm related disturbance and a relatively high number of sightings (60) on site; overall significance considered **Long-term Imperceptible to Slight Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Low **Sensitivity:** High **Overall Significance:** Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight, owing to two cases of published barrier effect and zero cases of no barrier effect; significance of daily barrier effect assessed as Not Significant to Slight; overall significance considered to be a **Long-term Not Significant to Slight Effect** (Criteria: EPA, 2022).
Swallow (Medium)	**Disturbance**: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Evidence suggests that flying insects are attracted to turbines (Long, et. al, 2011; Scholz & Voigt, 2021) which in turn, attracts insectivorous birds, especially hirundines and swifts (Ahlén, 2002). This evidence further suggests that construction of wind farms, instead of disturbing birds, may in fact actually lure such bird species into the rotor sweep zone, thus significantly increasing collision risk. **Barrier Effect:** Hötker et al., 2006 found evidence of a barrier effect in swallow in four cases. However, as mentioned above, attraction of insects to turbines may further attract insectivorous bird species, which would reduce/preclude barrier effect.	**N/A**
Swift (High)	**Disturbance:** Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012)	**Disturbance:**

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
	and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Evidence suggests that flying insects are attracted to turbines (Long, et. al, 2011; Scholz & Voigt, 2021) which in turn, attracts insectivorous birds, especially hirundines and swifts (Ahlén, 2002). This evidence further suggests that construction of wind farms, instead of disturbing birds, may in fact actually lure such bird species into the rotor sweep zone, thus significantly increasing collision risk. **Barrier Effect:** Hötker et al., 2006 found evidence of a barrier effect in swift in two cases. However, as mentioned above, attraction of insects to turbines may further attract insectivorous bird species, which would reduce/preclude barrier effect.	**Magnitude:** Low **Sensitivity:** High **Overall Significance:** Low (Criteria: Percival 2003). Significance of effects Imperceptible to Not Significant due to relatively low number of sightings, lack of breeding habitat and possible attraction of wind farms to insectivorous species which feed on the wing; overall significance considered **Long-term Imperceptible to Not Significant Effect** (Criteria: EPA, 2022). **Barrier Effect:** Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Not Significant; significance of daily barrier effect assessed as Imperceptible to Not Significant; overall significance considered to be a **Long-term Imperceptible to Not Significant Effect** (Criteria: EPA, 2022).
Teal (Medium)	**Disturbance:** Information on the disturbance of the species with respect to wind farms is lacking. Neither recorded in the flight activity survey area nor the rotor sweep zone, thus disturbance is not envisaged to be an issue with this species. **Barrier Effect:** Hötker et al., 2006 found evidence of a lack of a barrier effect in teal in just one case. Barrier effect not envisaged to be an issue with this species for reasons outlined above.	**Disturbance:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects Imperceptible due to lack of sightings in the flight activity survey area; overall significance considered **Long-term Imperceptible Effect** (Criteria: EPA, 2022). **Barrier Effect:** **Magnitude:** Negligible **Sensitivity:** Medium **Overall Significance:** Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible due to lack of sightings in the flight activity survey area; significance of daily barrier effect assessed as Imperceptible; overall significance considered to be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022).
Wheatear (Medium)	**Disturbance:** Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little	**N/A**

Key Receptor (Sensitivity)	Operational Indirect Effect Character	Significance without mitigation
	evidence of significant disturbance effects on passerine species. Hötker et al., 2006 found one case of habituation and zero cases of the contrary. **Barrier Effect:** Hötker et al., 2006, found evidence of a barrier effect in wheatear in just one case, with zero cases of no effect. However, this species was recorded once during breeding walkover surveys on the 26th June 2022. The lack of subsequent sightings strongly suggests that this bird was a migrant - either a dispersing juvenile or a failed breeding adult. Therefore, the resultant barrier effect to this species is considered to be Imperceptible.	
Willow Warbler (Medium)	**Disturbance:** Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hötker et al., 2006 found one case of non-habituation and zero cases of the contrary. **Barrier Effect:** Hötker et al., 2006, do not describe cases of barrier effect or a lack thereof.	**N/A**

7.5.3 Potential Decommissioning Effects

The decommissioning phase of the proposed wind farm site poses similar risks to potential effects vis-á-vis the construction phase. However, it should be noted that the magnitude of the effect of decommissioning is normally reduced as all infrastructure is already in situ. No works will be required along the haul route as the turbine components will be broken up on site and therefore require less clearance to remove along the same haul road. Grid connection cables will be left in the ground, therefore no potential impacts during decommissioning stage are likely to occur.

7.5.3.1 Direct & Indirect Effects

The following matrix outlines the assessment of direct effects on key avifauna receptors during decommissioning, based on the criteria previously outlined.

Note: the criteria utilised in the current assessment to define duration were as follows, from published guidance (EPA, 2022):

- Momentary: seconds to minutes;
- Brief: less than a day;
- Temporary: up to 1 year;

- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years; and
- Permanent: over 60 years.

It is likely that the time period for decommissioning of the project would be ca. six months.

Passerines and Pigeons/Doves

Decommissioning during the breeding season may result in some minimal disturbance to breeding passerine species due to increased human activity and noise. Tree trimming shall not however be carried out during the bird breeding season. There will be no further habitat loss during the decommissioning phase and the resultant impact to passerine species is a *Temporary Imperceptible Reversible Effect*.

Birds of Prey

Although no raptors were noted breeding or roosting on site, surveys conducted as part of the proposed development indicate that buzzard, kestrel, and sparrowhawk are probably breeding within the vicinity of the study area. Merlin and hen harrier were also noted, to a lesser extent, and although breeding was not proven, these too could be breeding in the immediate vicinity, but not on site. Tree trimming will not be carried out during the bird breeding season. There shall be no further habitat loss during the decommissioning phase. Decommissioning during the breeding or wintering season may result in some minimal disturbance to breeding or roosting kestrel, sparrowhawk, or buzzard (which may occur on the peripheries of the site), due to increased human activity and noise.

Single records of both osprey and red kite occurred, however, both were recorded as flyovers, and both species are rare in the county and thus these records and considered to be of vagrant birds, thus no effects are anticipated for either species.

The resultant impact to birds of prey is a *Temporary Imperceptible Reversible Effect*. As no breeding or roosting of raptors was noted on site, this prediction is worst-case scenario.

Waders and Wildfowl

Three gull species were noted on site: herring gull, great black-backed gull, and lesser black-backed gull. These species do not breed on or in the vicinity of the site, however all three take advantage of feeding opportunities presented during periods of heavy rainfall when improved

agricultural grassland fields have an abundance of earthworms and other invertebrates come to the surface. Spring and early summer slurrying events as well as ploughing events also have the same effect, in that they provide opportunistic feeding events and can temporarily attract large numbers of gulls. However, improved agricultural grassland is the dominant habitat in Ireland, and thus such opportunistic even occur across on a large geographical scale from a local to national level, and as such no effect is anticipated for gulls.

Golden plover were noted on numerous occasions over the winter seasons and involved records of birds landed and in flight over the site. Snipe were noted as being present within and immediately adjacent to the site and potentially breeding. The increase in human activity and noise may result in a minimal temporary disturbance to these species.

A single record of lapwing occurred, referring to a bird flying over the sit, however, it did not land. No effects are anticipated for lapwing.

In terms of wildfowl, just mallard and teal were recorded. Habitats on site are not optimal for either species, although both can use smaller waterbodies including streams, drainage canals and even flooded fields. The increase in human activity and noise may result in a minimal temporary disturbance to these species.

Again, as there will be no further habitat loss during the decommissioning phase, and tree trimming will not be carried out during the bird breeding season. The worst-case scenario resultant impact to waders and waterfowl is a *Temporary Imperceptible Reversible Effect*.

Red Grouse

Red Grouse was not observed on site and thus no effect is anticipated.

Again, as there will be no further habitat loss during the decommissioning phase, and tree trimming will not be carried out during the bird breeding season. The resultant impact to Red Grouse would be a *Temporary Imperceptible Reversible Effect*.

7.5.4 Potential Cumulative Effects

There are five operational, consented, or proposed wind farms within 20km of the proposed wind farm site, with an additional two instances of single turbines (3.5km northeast, and 14.5km southeast, respectively).

The nearest operational wind farm is Woodhouse Wind Farm which is located approximately 10.8km to the south of the site.

Table 7-26: Consented and operational wind farms within 20km of the proposed site.

Wind Farm	Number of Turbines	Distance and Direction from the Development Site Boundary	Status
Coumnagappul Wind Farm	11	7.1km east of site	Pre-planning
Tierney Single Turbine	1	3.5km northeast of site	Operational
Woodhouse Wind Farm	8	10.8km south of site	Operational
Knocknamona Wind Farm	8	11.6km south of site	Consented
Barranafaddock Wind Farm	12	19.3km west of site	Operational
Ballycurreen Wind Farm	2	20km southeast of site	Operational

Bird surveys conducted at **Woodhouse Wind Farm** (*Planning reference 041788, Waterford City and County Council*) took place in in the early 2000s (EIA published September 2004), before rigorous methodologies were in place, and just a very brief mention of birds can be found in the Environmental Impact Statement, and is provided in full as follows:

"Bird species within and around the site were recorded by sight and/or sound. An assessment of the breeding status for each species was made based on behaviour. As a scoping study did not indicate the presence in the area of any bird species of conservation importance, such as hen harrier, specialised single-species bird surveys were not considered necessary for this site.

A typical range of bird species associated with improved grassland and hedgerows occurs within the site. Crows were plentiful, with rook (*Corvus frugilegus*), jackdaw (*Corvus monedula*), hooded crow (*Corvus corone*) and magpie (*Pica pica*) all present. Starlings (*Sturnus vulgaris*) and woodpigeons (*Columba palumbus*) were also recorded in the pasture fields. Meadow pipit (*Anthus pratensis*) was present in several of the fields, while one pair of skylarks (*Alauda arvensis*) was located in one of the northernmost fields within the site.

Small bird species recorded in the hedgerows include robin (*Erithacus rubecula*), wren (*Troglodytes troglodytes*), blackbird (*Turdus merula*), song thrush (*Turdus philomelus*), blue tit (*Parus caeruleus*), coal tit (*Parus ater*), long-tailed tit (*Aegithos caudatus*), goldcrest (*Regulus regulus*), chiffchaff (*Phylloscopus collybita*) and chaffinch (*Fringilla coelebs*). Most of these species would probably nest locally.

Reed bunting (*Emberiza schoeniclus*) breeds in the wet marsh habitat in the north-west sector and moorhen (*Gallinula chloropus*) has a presence. A grey wagtail (*Motacilla cinerea*) flew over the northern farm complex and probably nests locally."

An EIAR prepared by Malachy Walsh (2014) at **Knocknamona Wind Farm** found the following sensitive species (please note that the BoCCI statuses quoted were different to the current list and so they have been amended to align with the 2020-2026 assessment):

High Sensitivity:

- Curlew (Red-listed)
- Woodcock (Red-listed)
- Meadow Pipit (Red-listed)
- Kestrel (Red-listed)
- Swift (Red-listed [outside site])

Medium Sensitivity:

- Sand martin (amber-listed)
- Goldcrest (amber-listed)
- Barn swallow (amber-listed)
- Skylark (Amber-listed [outside site])
- Linnet (Amber-listed [outside site])
- Starling (Amber-listed [outside site])

An additional EIAR was produced in September 2020 for proposed larger turbines and a meteorological mast at **Knocknamona Wind Farm** and found the following sensitive species:

High Sensitivity:

- Meadow pipit (Red-listed)
- Woodcock (Red-listed)
- Kestrel (Red-listed)
- Swift (Red-listed)

Medium Sensitivity:

- Skylark (Amber-listed)
- Goldcrest (Amber-listed)
- House martin (Amber-listed)

- Linnet (Amber-listed)
- Stonechat (Amber-listed)
- Starling (Amber-listed)
- Swallow (Amber-listed)
- Tree Sparrow (Amber-listed)

Although not listed as a key receptor in any of the above detailed surveys at Knocknamona, golden plover is the most relevant target species requiring cumulative analysis. The following summary text is provided in the 2020 report:

"The results of surveys for the area indicate that golden plover do not rely on the wind farm site and surrounding area, are not resident or regularly occurring in the area and that the potential for interactions between the proposed larger turbines and golden plover will be negligible. Based on the negligible potential for interactions between the proposed larger turbines, potential significant impacts to golden plover can be ruled out and therefore this species is not identified as a key sensitive receptor and is not considered further in the assessment."

An 'Environmental Report' was produced by Natura Environmental Consultants on behalf of Jennings O'Donovan & Partners (January 2010) for **Ballycurreen Wind Farm** which found "no birds of high conservation concern".

Barranafaddock Wind Farm is an active 12-turbine wind farm at which surveys first commenced in 2010 for a 9-turbine layout. This was later extended to reach 12 turbines, with ongoing post-construction surveys at the time of writing (March 2023). Remedial surveys to address a change in turbine dimensions were conducted between 2016 and 2019 and found the following sensitive species on site:

Very High Sensitivity:

- Golden Plover (Annex-I, Red-listed)
- Hen harrier (Annex-I, Amber-listed)
- Peregrine (Annex-I, Green-listed)

High Sensitivity:

- Kestrel (Red-listed)
- Snipe (Red-listed)

Medium Sensitivity:

- Lesser black-backed gull (Amber-listed)
- Mallard (Amber-listed)

Low Sensitivity:

- Buzzard (Green-listed)
- Sparrowhawk (Green-listed)
- Grey heron (Green-listed)

Of most relevance is the occurrence of golden plover, which has a predicted 6.21 strikes/annum (assuming avoidance of 99.8%) at Dyrick Hill. At Barranafaddock, surveys in 2011 detected the species in November 2010 and March 2011. In November, one large flock flew over the site for 30 seconds and in March, various sized flocks were noted on four occasions flying over the site for approximately 12 minutes overall (0.6% of total winter VP survey time of 36 hours across the single VP).

Golden plover was only noted once during summer 2016 surveys, and not at all during summer 2017 surveys. However, as the species no longer breeds in County Waterford (and hasn't for several decades) this is not relevant, as wintering flocks migrate further north to breed in summer.

This species was observed four times in winter 2019 all during March. Two out of four observations were calls only and birds were observed on site twice. On 2nd March five birds were observed flying at rotor height for 20 seconds and on 8th March a flock of 15 birds were observed flying at rotor height for 25 seconds. Seven flight lines were recorded in summer 2019, all during April. A single bird was recorded flying at 35 seconds inside the site on 17th April. On 16th April 15 birds were recorded below rotor height, as were another five, 30, 43, and five birds, respectively. On the same date a flock of thirty birds was recorded flying for 90 seconds at rotor height within the site and a flock of thirty for 30 seconds at rotor height. No golden plover were recorded for the remainder of 2019, all of 2020 or the first three months of 2021. Thus it appears that golden plover numbers have decreased since surveys were first commenced in 2011, with a large flock noted in November 2011, and various flocks noted in March 2012, to no birds recorded in late 2019 to early 2021.

In terms of collision risk, the predicted number of collisions per year at Barranafaddock was negligible with a predicted 0.0026 birds per year (assuming avoidance). Thus, collision risk in the species is not considered to be a cumulative impact from Barranafaddock.

The second species of note is kestrel. Kestrel is predicted to have 2.72 collisions per year (assuming avoidance) at Dyrick Hill. Although this registers low on a county (0.62%) and national (0.02%) level in terms of population loss. At Barranafaddock there was a noted increase in kestrel sightings between pre- and post-construction periods. For example, kestrel was not recorded during winter 2010/11 and summer 2011 surveys (pre-construction). However, kestrel was noted on 11 occasions between April 2016, once in summer 2017, six times between February and April, and nine times between May 2019, and March 2021. However, collision risk for kestrel was predicted to be between just 0.004 and 0.007 collisions per year (assuming avoidance). Thus, it is not anticipated that any cumulative impacts for kestrel arise from Barranafaddock.

Coumnagappul Wind Farm is an 11-turbine wind farm in the pre-planning stage, situated 7.1km east of Dyrick Hill. Surveys conducted between April 2019 and September 2022 found the following sensitive species:

Very High Sensitivity:

- Golden Plover (Annex-I, Red-listed)
- Hen Harrier (Annex-I, Amber-listed)
- Merlin (Annex-I, Amber-listed)
- Peregrine (Annex-I, Green-listed)

High Sensitivity:

- Kestrel (Red-listed)
- Red Grouse (Red-listed)
- Snipe (Red-listed)

Medium Sensitivity:

- Herring Gull (Amber-listed)
- Lesser Black-backed Gull (Amber-listed)
- Mallard (Amber-listed)
- Ringed Plover (Amber-listed)

Low Sensitivity:

- Buzzard (Green-listed)
- Great Black-backed Gull (Green-listed)
- Grey Heron (Green-listed)
- Sparrowhawk (Green-listed)

Again, golden plover was a relatively well-represented target species and was recorded on 20 occasions over the course of the whole survey period and present in five of the seven survey seasons. This species was observed at all VP locations and over half of the observations pertained to flocks of 40 birds or greater flying over 100m with the remaining relating to singles birds or flocks of less than 20. Predicted collision rate was 1.356 birds per year (assuming avoidance). In terms of collision risk, it will have a cumulative impact and would increase the predicted collision rate of 6.21 per annum to 7.56 per annum which increases the local population loss by 0.03% (0.12% increases to 0.15%) per annum. The proposed impact of collision risk will be a *Long-Term Slight Cumulative Effect* on a county level.

Kestrel was recorded on over 100 occasions in all seven survey seasons, from all VP locations. However, predicted collision rate was low, at 0.23 per year, and thus there are no anticipated cumulative impacts for kestrel.

7.5.4.1 Cumulative Effects During Construction

Direct effects on avifauna during construction are primarily land take related, mainly due to the loss of nesting habitats to key species. Other sources of land take as outlined above do have the potential for cumulative effects on nesting or resident farmland or woodland species (the typical landscape characters) in addition to specialist species such as kestrel (potentially affected by forestry operations). Species such as robin, goldcrest, and willow warbler may be affected cumulatively by further loss of hedgerows due to farming practices, etc. Even though in-combination land take is unlikely to result in range loss of any species which frequent the subject site, mitigation may be required to neutralise the effect of the proposed wind farm. Disturbance or effective habitat loss indirectly is more difficult to quantify; especially as most species of birds may habituate to disturbance over time. Any cumulative effects on birds during the construction phase would be a *Long-Term Imperceptible Cumulative Effect*.

7.5.4.2 Cumulative Effects During Operation

Direct effects on avifauna during operation which may be cumulatively added to by other existing pressures or proposed developments include collision related mortality, ongoing disturbance/displacement, and barrier effect. Flight height or the flight heights which birds habitually use along either migration or local flight paths is an influencing factor in determining whether the proposed development will combine with additional wind farms to produce additive, synergistic or antagonistic effects.

These effects include increased Barrier Effect (potentially obstructing migratory flightpaths), increased collision risk (through combined mortality in susceptible species) and increased disturbance to birds utilising foraging grounds whilst on migration.

Considering the distances of the five previously listed wind farm sites in relation to the proposed Dyrick Hill study area, the lack of migration paths during surveys, along with the results of hinterland surveys undertaken for the proposed development, the cumulative collision risk on any avian receptors is considered negligible for all species, except golden plover. Furthermore, studies have found that local wintering birds will habituate to the presence of turbines and therefore avoid collision (Langston & Pullan, 2004). For most species, cumulative collision mortality combined with other wind farm developments is predicted to be a *Long-Term Imperceptible Cumulative Effect*. However for golden plover it is predicted to be *a Long-Term Slight Cumulative Effect*. However this is considered to be a highly cautious increase as adding the cumulative impacts in terms of predicted annual risk from both previously mentioned wind farms with golden plover, both national and local loss rates remain as negligible, with 0.008 remaining unchanged and 0.12 increasing to 0.15, respectively.

As the predicted annual collision rate of kestrel at Dyrick Hill is greater than one per year, this also warrants further thought in terms of cumulative impact. Adding the cumulative impacts in terms of annual predicted collisions from both wind farms (0.007 at Barranafaddock, and 0.23 at Coumnagappul), the Dyrick Hill figure of 2.72 predicted collisions per year (0.02% of national population – 0.62% of the of the county population), to 2.957 predicted collisions per year, which equates to 0.02% of national population – 0.68% of the of the county population. This does not change the Percival Negligible status of kestrel, and thus is is considered to be *Long-Term Imperceptible Cumulative Effect*.

7.6 MITIGATION MEASURES FOR AVIFAUNA

Mitigation measures are described below which will avoid, reduce and where possible, offset potential negative effects arising in relation to avifauna from the construction, operation and decommissioning of the site. These mitigation measures shall be implemented in full.

7.6.1 Mitigation by Avoidance and Design

See **Chapter 6: Biodiversity.**

7.6.2 Mitigation measures during the construction phase of the project

7.6.2.1 Introduction

Construction of this project is expected to cause temporary (disturbance) adverse effects on local ecological receptors, as outlined in **Section 7.5** above. The mitigation measures described below will reduce these effects significantly.

7.6.2.2 Project Ecologist/ECoW

A Project Ecologist/Ecological Clerk of Works (ECoW) with appropriate experience and expertise (in implementing ecological mitigation measures for wind farm developments) will be employed for the duration of the construction phase to ensure that all the mitigation measures outlined in relation to the environment are implemented. The Project Ecologist/ ECoW will be awarded the authority to stop construction activity if there is potential for significant adverse ecological effects to occur.

7.6.2.3 Avifauna

Subject to other environmental concerns (e.g., run-off), the removal of vegetation and scrub as well as trimming of trees along the TDR and general wind farm area will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). This will help protect nesting birds.

This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt, A. L. and Langston, R. H., 2006).

Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds

(Drewitt and Langston, 2006). Limited operations such as concrete pours, turbine erection and installation of the grid connection may require night-time operating hours; these works will be supervised by the project ecologist/ECoW.

Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance. This is in line with best practice recommendations for mitigation measures with regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).

Where/if removed or altered, re-instated hedgerows will be planted with locally sourced native species. This will result in habitat enhancement for local species of conservation importance such as meadow pipit. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).

A re-confirmatory survey (March/April) will be conducted of the proposed turbine locations to assess any evidence of target species activity or occupation of new territories (e.g. in the case of breeding snipe). Should any nesting locations be recorded, works at these locations will be restricted to outside the breeding season (March 1st to August 31st inclusive) or until chicks are deemed to have fledged (following monitoring).

No construction works shall be undertaken within the common area (Turbine 10, 11, 12 and 13) during the winter season. Preconstruction surveys for golden plover occupancy within the commonage area to re-confirm the findings of the EIAR, shall inform this restriction period typically between the months of October and March annually.

The use of "white lights" on the turbines will not occur as these can attract night flying birds such as migrants, and insects, which in turn can attract bats. Certain turbines will be illuminated with medium intensity fixed red obstacle lights of 2000 candelas where required by the IAA Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

7.6.3 Mitigation measures during operation

A post construction monitoring programme is to be implemented at Dyrick Hill in order to confirm the efficacy of the mitigation measures; the results of this will be submitted annually to the competent authority and NPWS. Published guidance on assessing the impacts of wind

farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure (Drewitt and Langston, 2006).

In addition, published recommendations on swans and wind farms (Rees, 2012) suggests that systematic post construction monitoring; adapted to quantify collision, barrier, and displacement, be conducted over a period of sufficient duration to allow for annual variation or in combination effects. The following individual components are proposed:

1) Fatality Monitoring (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction)- A comprehensive fatality monitoring programme is to be undertaken following published best practice (Shawn et al., 2010; Fijn et al., 2012 and Grunkorn, 2011); the primary components are as follows:
    a. Initial carcass removal trials to establish levels of predator removal of possible fatalities.

       This is to be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results (Shawn et al., 2010). No turbines which are used for carcass removal trials are to be used for subsequent fatality monitoring. Carcass removal trials shall be continued for the duration of fatality searches.
    b. Turbine searches for fatalities are to be undertaken following best practice (Fijn et al., 2012 and Grunkorn, 2011) in terms of search area (minimum radius hub height) and at intervals selected to effectively sample fatality rates based on carcass removal rates (e.g. 1 per month). To be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.
    c. A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).
    d. Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Reports will be submitted to the competent authority and NPWS following each round of surveys.

2) Flight Activity Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction) - A flight activity survey is to be undertaken during the summer and winter months to include both vantage point and hinterland surveys as Per SNH (2017) guidance:
   a. Record any barrier effect i.e. the degree of avoidance exhibited by species approaching or within the wind farm (Drewitt and Langston, 2006). Target species to be all raptors and owls, all wild goose and duck species, all swan species, and all wader species.
   b. Record changes in flight heights of key receptors post construction.

Reports will be submitted to the competent authority and NPWS following each round of surveys. This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

3) Monthly Wildfowl Census (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A monthly wildfowl census, following the methods utilised for the baseline survey, is to be repeated on a monthly basis during the winter period. This aims to:
   a. Assess displacement levels (if any) of wildfowl such as swans post construction
   b. Assess overall habitat usage changes within the vicinity of the Dyrick Hill Wind Farm Development post construction.

This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS. Reports will be submitted to the competent authority and NPWS following each round of surveys.

4) Breeding Bird Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey (moorland breeding bird and Common Bird Census), following methods used in the baseline survey to be repeated yearly between early April to early July. This aims to:
   a. Assess any displacement effects such as those recorded on breeding birds. Overall density of breeding birds to be annually recorded.

5) Breeding Wader Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey, following methods used in the baseline survey to be repeated yearly April-May-June.

Both of the above surveys are to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

7.7 RESIDUAL EFFECTS FOR AVIFAUNA

To minimise effects on those species which the literature suggests can be negatively impacted, a re-confirmatory survey (March/April) will be conducted of the proposed turbine locations to assess any evidence of target species activity or the occupation of new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

A comprehensive monitoring program will also be implemented following construction of the proposed wind farm; this will monitor the degree of barrier effect, if any, on existing species as a result of the development, in addition to comprehensively monitoring any bird fatalities.

It is considered that with the implementation of mitigation, the proposed wind farm development will have an *Imperceptible to Slight Reversible Residual Effect and in the local context* on birds. The residual effect for golden plover will be an *Imperceptible to Slight effect in the Local context*. In relation to habitat loss a *moderate residual effect at a local level* is envisaged, reduced to a *slight effect* at a *County level* for the species.

7.8 BIBLIOGRAPHY

Ahlén, I. 2002. Fladdermöss och fåglar dödade av vindkraftverk. Fauna och flora 97, 14-22

Band, W., Madders, M., and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: de Lucas, M., Janss, G.F.E. and Ferrer, M. (eds.) Birds and Wind farms: Risk Assessment and Mitigation, pp. 259-275. Quercus, Madrid.

Band, B. (2012) Using a Collision Risk Model to Assess Bird Collision Risks for Offshore Windfarms. Guidance document. SOSS Crown Estate.

Bibby, C. J., Burgess, N. D., Hill, D. A. & Mustoe, S. H. 2000. Bird census techniques (second edition). Academic Press, London.

Brown, A.F and Shepherd, K.B. (1993). A method for censuring upland breeding waders: Bird Study. Vol. 40, pp. 189-185.

CIEEM. (2006). Guidelines for Ecological Impact Assessment in the United Kingdom. CIEEM.

CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester

CIEEM (2019) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, 3rd edition. Chartered Institute of Ecology and Environmental Management, Winchester

Colhoun, K. and Cummins, S. (2013). Birds of Conservation Concern in Ireland 2014-2019. BirdWatch Ireland.

Cook, A.S.C.P., Humphreys, E.M., Masden, E.A. and Burton, N.H.K. (2014). The avoidance rates of collision between birds and offshore turbines. BTO.

Crowe, O. (2005) Ireland's Wetlands and their Waterbirds: Status and Distribution, Birdwatch Ireland, Newcastle, Co. Wicklow.

Department of Environment Community and Local Government [DoECLG], (2018). Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment

Desholm, M., Kahlert, J. (2005). Avian Collision Risk at an offshore windfarm.: Biology Letters, 2005, Vol.1, pp. 296-298.

Devereux, C.L., Denny, M.J.H., Whittingham, M.J. (2008). Minimal Effects of wind turbines on the distribution of wintering farmland birds. 45, Journal of Applied Ecology, 2008, pp. 1689-1694.

Dickson, R.C. (1996). The hunting behaviour of Merlins in Galloway. Scottish Birds, 1996, Vol. 18, pp. 165-169.

DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019

Downie, I., Gillings, S., Balmer, D., Fuller, R., Swann, B., Caffrey, B. (2014). Bird Atlas 2007-11: The Breeding and Wintering Birds of Britain and Ireland. United Kingdom: HarperCollins Publishers.

Drewitt, A. L. and Langston, R. H. (2006). Assessing the impacts of wind farms on birds. Ibis, Vol. 148, pp. 29-42.

Drewitt, A. L. and Langston, R.H. (2008). Collision Effects of Wind-power Generators and Other Obstacles on Birds. 1134, Annals of the New York Academy of Sciences, pp. 233-266.

Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation on Environmental Impact Statements). EPA, Wexford.

Environmental Protection Agency (September 2017): Draft - Advice Notes on Current Practice (in the preparation on Environmental Impact Statements). EPA, Wexford.

EPA, (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports Draft May 2017

European Council (2009). Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds.

European Commission 'Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment' 2013

European Commission (2020). Guidance document on wind energy developments and EU nature legislation. wind_farms_en.pdf

European Union (2013). http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf Retrieved from http://ec.europa.eu.

Farfán, M.A., Vargas, J.M., Duarte, J. and Real, R., 2009. What is the impact of wind farms on birds? A case study in southern Spain. *Biodiversity and Conservation*, *18*, pp.3743-3758.

Fijn, R., Krijgsveld, K., Tijsen, W.l, Prinsen, H and Dirksen Sjoerd (2012). Habitat use, disturbance, and collision risks of Bewick's Swans Cygnus columbianus bewickii wintering

near a wind farm in the Netherlands.: Wildfowl and Wetlands Trust, 2012, Wildfowl, Vol. 69, pp. 97-116.

Gehring, J., Kerlinger, P. and Manville, A.M., 2009. Communication towers, lights, and birds: successful methods of reducing the frequency of avian collisions. Ecological Applications, 19(2), pp.505-514.

Gensbol, B. (2008). Birds of Prey. London: HarperCollinsPublishers Ltd., 2008.

Gilbert, G., Stanbury, A., & Lewis, L. (2021). Birds of conservation concern in Ireland 4: 2020–2026. Irish Birds, 43, 1-22.

Gittings, T (2022), Ballivor Wind Farm: Golden Plover Avoidance Rates Collision Risk Assessment (pleanala.ie) Bord Pleanála Case reference: PA25M.316212

Grunkorn, T. (2011). Proceedings: Conference on wind energy and wildlife impacts, 2-5 May 2011, Trondheim, Norway. Trondheim: NINA.

Hoetker, H., Thompson, K.H., Jeromin, H. (2006), Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats- facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Bergenheim: Michael-Otto-Institut im NABU.

Humphreys, E.M., Cook, A.S.C.P., Burton, N.H.K. (2015). Collision, Displacement and Barrier Effect Concept Note BTO Research Report No. 669. The British Trust for Ornithology, The Nunnery, Thetford

Irwin, S., Wilson, W., O'Donoghue, B., O'Mahony, B., Kelly, T., O'Halloran, J. (2012). Optimum senarios for Hen Harrier Conservation in Ireland; Final Report 2012. Prepared for the Department of Agriculture, Food and the Marine by the School of Biological, Earth and Environmental Sciences, University College Cork.

IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney and Company for the Irish Wind Energy Association.

Kerlinger, P., Gehring, J.L., Erickson, W.P., Curry, R., Jain, A. and Guarnaccia, J., 2010. Night migrant fatalities and obstruction lighting at wind turbines in North America. The Wilson Journal of Ornithology, 122(4), pp.744-754.

Ketzenberg, C. et al., 2002. Einfluss von Windkraftanlagen auf brütende Wiesenvögel. Natur und Landschaft, 77, pp.144–153.

Krijgsveld, K.L., Akershoek, K., Schenk, F., Dijk, F. and Dirksen, S., 2009. Collision risk of birds with modern large wind turbines. Ardea, 97(3), pp.357-366.

Langston, R.H.W and Pullan, J.D. (2004). Effects of Wind Farms on Birds. Convention on the Conservation of European Wildlife and Habitats (Bern Convention). Nature and Environment, No. 139.Council of Europe Publishing, Strasbourg.

Long, C.V., Flint, J.A. Lepper, P.A., Insect attraction to wind turbines: does colour play a role? Eur J Wildl Res (2011) 57:323–331; DOI 10.1007/s10344-010-0432-7

Lynas, P., Newton, S.F. and Robinson, J.A. (2007). The status of birds in Ireland: an analysis of conservation concern. Irish Birds. 8: 149-166

Madsen, J., Boertmann, D. (2008) Animal behavioural adaptation to changing landscapes: spring-staging geese habituate to wind farms. Landscape Ecology, Vol. 23, pp. 1007-1011.

Masden, E.A., Haydon, D.T., Fox, A.D., Furness, R.W., Bullman, R., Desholm, M. (2009) Barriers to movement: impacts of wind farms on migrating birds. ICES, 2009, Journal of Marine Science, Vol. 66, pp. 746–753.

Martin, G. Understanding bird collisions with man-made objects: a sensory ecology approach. Birmingham: Ibis, 2011, Vol. 183, pp. 239-254.

Martin, G.R. and Shaw, J.M. (2010), Bird collisions with power lines: Failing to see the way ahead? Biological Conservation, Vol. 143, pp. 2695-2702.

McElheron, A. (2005). Merlins of the Wicklow Mountains. Currach Press, 2005.

Moore, N.P., Kelly P.F., Lang F.A., Lynch, J.M. & Langton, S.D. (1997). The Peregrine Falco peregrinus in quarries: current status and factors influencing occupancy in the Republic of Ireland, Bird Study, 44:2, 176-181, DOI: 10.1080/00063659709461053

Nairn, R. & Partridge, K. (2013). Assessing wind energy impacts on birds - towards best practice. CIEEM 2013 Irish Section Conference: Presentations.

NBDC (2023) Biodiversity Maps [online] available at: https://maps.biodiversityireland.ie/Map (accessed 10/02/2023)

Newton, S., Donaghy, A., Allen, D. & Gibbons, D. 1999. Birds of conservation concern in Ireland. Irish Birds 6: 333-344.

NRA (2008b). Environmental Impact Assessment of National Road Schemes – A practical guide. NRA.

NRA (2008a). Guidelines for the Crossing of Watercourses during the construction of National Road Schemes. National Roads Authority.

NRA (2009a). Guideline for the Assessment of Ecological Impacts of National Road Schemes, National Roads Authority

Parr, R., 1980. Population study of Golden Plover Pluvialis apricaria, using marked birds. Ornis Scandinavica, pp.179-189.

Percival, S. M., (2003). Birds and wind farms in Ireland: a review of potential issues and impact assessment. Report to S.E.I.

Percival, S.M. (2007) Predicting the effects of wind farms on birds in the UK: the development of an objective assessment method. [ed.] M., Janss, F.E., Ferrer, M. De Lucas. Madrid: Quercus, 7, pp. 137-152.

Pearce-Higgins, J.W., Leigh, S., Langston, R.H.W., Bainbridge, Ian P., Bullman, R. (2009). The distribution of breeding birds around upland wind farms. Journal of Applied Ecology, 2009, Vol. 46, pp. 1323-1331.

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

Rees, E.C. (2012). Impacts of wind farms on swans and geese: a review. Wildfowl 62: 37-72. Wildfowl and Wetlands Trust.

Robinson, C., Lye, G. Battleby (2012). Pauls Hill Windfarm: Flight Activity and Breeding success of Hen Harrier.: Scottish Natural Heritage/Natural Power Consultants, 2012. Sharing Good Practice: Assessing the Impacts of Windfarms on Birds.

Scottish Natural Heritage (2005). Survey methods for use in assessing the impacts of onshore windfarms on bird communities. Scottish Natural Heritage Guidance. November 2005.

Scottish Natural Heritage (2000). Windfarms and Birds: Calculating a Theoretical Collision Risk Assuming No Avoiding Action. Scottish Natural Heritage.

Scottish Natural Heritage (2010). Survey methods for use in assessing the impacts of onshore windfarms on bird communities. Battleby: SNH.

Scottish Natural Heritage (2010). Avoidance Rate Information and Guidance Note. www.snh.gov.org.
[Online] http://www.snh.gov.uk/docs/B721137.pdf

Scottish Natural Heritage (2018). Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model. Scottish Natural Heritage

Scottish Natural Heritage (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage.

Scottish Natural Heritage (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. Version 2. Battleby: SNH.

Shawn, K. et al. (2010). Novel scavenger removal trials increase wind turbine-caused avian fatality estimates. Smallwood, 5, Journal of Wildlife Management, Vol. 74, pp. 1089-1097.

Waterford County Council Development Plan: 2011-2017. Accessed 10/02/23.

Waterford County Council Development Plan: 2022-2028. Accessed 10/02/23.

Watson, D. (1977). The Hen Harrier: T and AD Poyser,

Whitfield, D.P. and Madders, M. (2006). Upland Raptors and the Assessment of Wind farm Impacts. Ibis 148, 43-56. British Ornithologists Union.

Whittingham, M.J., Percival, S.M. and Brown, A.F., 2001. Habitat selection by golden plover Pluvialis apricaria chicks. Basic and Applied Ecology, 2(2), pp.177-191.

Zhao, S., Xu, H., Song, N., Wang, Z., Li, B. and Wang, T., 2020. Effect of wind farms on wintering ducks at an important wintering ground in China along the East Asian–Australasian Flyway. *Ecology and Evolution*, *10*(17), pp.9567-9580.