MWP

Chapter 7 Ornithology

Ballinlee Green Energy

Ballinlee Green Energy Ltd

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7. Ornithology

7.1 Introduction

Ballinlee Green Energy Ltd. is seeking planning consent for a renewable energy development comprising seventeen (17) wind turbines, collectively referred to as the Ballinlee Wind Farm (hereafter the Development).

The 'Development' refers to all elements associated with the construction and operation of Ballinlee Wind Farm, including the Turbine Delivery Route (TDR) and the Grid Connection Route (GCR). A full description of the Development including a site location map is presented in Chapter 2 Description of the Development.

The 'Development Boundary' refers to the boundary as described in Chapter 2 Description of the Development, at Figure 2-7.

This chapter assesses the likely significant effects of the Development on ornithological receptors, including breeding, wintering, and passage bird species, as well as designated sites with ecological or hydrological connectivity to the Development (e.g., SPAs, pNHAs). The assessment draws on baseline study data, desk-based studies, and published guidance to identify potential impacts and sets out proposed mitigation measures designed to avoid, reduce, or offset any likely significant effects. Residual effects on Important Ornithological Features (IOFs) are then evaluated.

7.1.1 Scope of assessment

This chapter has been prepared by APEM Group Woodrow (Woodrow) to examine the potential effects that the Development (described in Chapter 2 Description of the Development) may have on ornithological interests present within the Study Area (as defined in Section 7.2.1), including IOFs. The assessment considers the potential effects during each phase of the Development: construction phase, operational phase, and decommissioning phase. Appropriate mitigation measures are described to avoid, or reduce, potential adverse effect(s). The mitigation measures detailed within this chapter should be read in conjunction with mitigation measures contained in Chapter 6 Biodiversity which addresses mitigation measures for ecological features.

This chapter of the EIAR is supported by the following technical appendices:

- Appendix 7A: Statement of Competencies
- Appendix 7B: Baseline Ornithology Report
- Appendix 7C: Collision Risk Modelling Report
- Appendix 7D: Whooper Swan Management Plan (WSMP)

A Construction Environmental Management Plan (CEMP) is appended to the EIAR in Appendix 2A. This document will be a key construction contract document, which will ensure that all mitigation measures and any biodiversity enhancement measures that are considered necessary to protect the environment, are implemented.

This Chapter was written by Adrian Walsh, Ecologist, Aron Sapsford, Principal Ornithologist and has been technically reviewed by Matthew Rea, Principal Ornithology, and Maeve Maher-McWilliams, Associate Director. All contributors are suitably qualified and experienced to undertake the tasks completed in preparing the impact assessment. Competency of personnel who have contributed to the chapter are outlined in Appendix 7A Statement of Competencies.

7.1.2 Description and summary of the Development

The Development is located in a rural landscape approximately 18 km southeast of Limerick City and 3 km southwest of Bruff, Co. Limerick, spanning the townlands of Ballincurra, Ballinlee South, Ballingayrour, Ballinrea, Knockuregare, Ballinlee North, Carrigeen, and Camas South. Land use is predominantly agricultural, with fields bounded by hedgerows, drainage ditches, and small conifer plantations. Habitats within and surrounding the Development are important for breeding, wintering, and passage bird species, including hedgerows, wetlands, and riparian zones.

The Development Boundary covers approximately 255 ha (Figure 7-1) and comprises seventeen (17) turbines of 160m tip height (T6 150m tip height) and associated infrastructure includes access tracks, crane hardstands, underground cabling, a substation, a clear-span bridge over the Morningstar River, two borrow pits, nine permanent material deposition areas, two temporary deposition areas, three temporary construction compounds, and a permanent meteorological mast. To facilitate the TDR there will be one section of new temporary access track constructed. This is proposed to cross lands within the townland of Tullovin approximately 3.3 km southeast of Croom, Co. Limerick and consists of hedgerows and improved agricultural grassland. The proposed GCR follows a route from the existing 220/110 kV Killonan Substation along the N24 in a westerly direction and then proceeds along the L1171 to the intersection with the L1170 (Ballysimon Commons Road) going south until it intersects with the R512. It then follows south along the R512 through Ballyneety to Hollycross, west onto the L1412 road, south along the L8011 road to the R516 where it turns west towards the Development site entrance.

The Development has been designed to minimise potential adverse effects on birds and their habitats. The turbine layout, infrastructure siting, and construction timing have been informed by baseline ornithological surveys and stakeholder consultation. Key considerations include avoidance of sensitive breeding and foraging habitats, minimisation of disturbance to wintering and migratory species, and reduction of collision risk. Embedded mitigation through design forms part of the Development but is not solely relied upon to mitigate potential significant effects. Further targeted mitigation and long-term monitoring measures are detailed in Sections 7.7 and 7.8 and in Appendix 7D Whooper Swan Management Plan. The evolution of the site layout, including how ecological sensitivities have been addressed, is further detailed in Chapter 3 Consideration of Alternatives.

IOFs assessed include breeding, wintering, and passage birds recorded during baseline surveys (Section 7.3.3) and those identified through desk-based data within a 10 km radius with additional consideration of designated sites up to 20 km where hydro-ecological connections or species movements could create potential pathways of effect. IOFs include breeding, wintering, and passage birds potentially sensitive to construction or operational effects, as well as designated sites with biological, hydrological, or functional connectivity to the Development (e.g., SPAs, pNHAs).

Figure 7-1: Overview of the Development

7.1.3 Legislation, Policy and Guidance

This assessment was undertaken considering the following key legislation, planning policy, guidance, and other information. Guidance specific to Collision Risk Modelling (CRM) is listed within Appendix 7C. The Legislation identified in this section has been considered in this chapter, in the assessment of the effects on ornithology features occurring in and surrounding the Development.

7.1.3.1 European Legislation

- EIA Directive 2011/92/EU as amended by Directive 2014/52/EU
- EU Habitats Directive 92/43/EEC
- EU Birds Directive 2009/147/EC
- Nature Restoration Regulation (EU) 2024/1264

7.1.3.2 Irish Legislation

- The European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) (S.I. No. 477 of 2011) (transposes EU Birds Directive 2009/147/EC and EU Habitats Directive 92/43/EEC into Irish law)
- Irish Wildlife Acts 1976 to 2018 (as amended)
- Planning and Development Regulations 2001 (as amended)
- Planning and Development Act 2004 (transposes the EU Habitats Directive (Part XAB) and the EIA Directive (Part X) for the purpose of land use planning and development consent.

7.1.3.3 Plans and Policies

The following plans, and their policies relevant to biodiversity and ornithology, were considered in this chapter and the assessment of effects on ornithological features of interest occurring within the Development.

- Limerick Development Plan 2022-2028[1]
- National Biodiversity Action Plan 2023-2030[2]
- Limerick Biodiversity Action Plan 2025-2030[3]

7.1.3.4 Guidance

In considering the ornithological assessment of effects of the Development, regard was made to the following guidance and information documents:

- CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.3 September 2024. Chartered Institute of Ecology and Environmental Management, Winchester.

[1] Limerick City & County Council (2022) Limerick Development Plan 2022-2028. May 2023.

[2] Department of Housing, Local Government and Heritage (2024) Ireland's 4th National Biodiversity Action Plan. Draft for Public Consultation.

[3] Limerick City and County Council (2024) Draft Limerick Biodiversity Action Plan 2025-2023. November 2024.

- EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Report (May 2022). Environmental Protection Agency, Dublin.
- European Commission (2017) Environmental Impact Assessment of Projects. Guidance on the preparation of the Environmental Impact Assessment Report. (Directive 2011/92/EU as amended).
- NPWS (2019a) *Guidance on Addressing Data Gaps in Ecological Impact Assessment of Species and Habitats under EU Directives*. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin.
- NPWS (2009, updated 2023) *Strict Protection of Certain Species: Guidance for Local Authorities and Developers*. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Dublin.
- DHLGH (2021) *Guidelines for Planning Authorities on Biodiversity and Environmental Assessment*. Department of Housing, Local Government and Heritage, Dublin.
- OPR (2021) *Practice Note PN01: Environmental Impact Assessment Screening*. Office of the Planning Regulator, Dublin.

Guidance for ornithological impact assessment:

- Cutts, N., Hemingway, K. & J Spencer, J. (2013). Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning & Construction Projects. University of Hull, TIDE – Tidal River Development, Environment Agency.
- Goodship, N. M. & Furness, R. W. (2022). Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species. *NatureScot Research Report* No. 1283.
- Mc Guinness, S., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S. & Crowe, O. (2015). *Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland*. BirdWatch Ireland, Kilcoole, Wicklow.
- Percival, S.M. (2003). *Birds and Wind Farms in Ireland: A Review of Potential Issues and Impact Assessment.* Sustainable Energy Ireland
- Scottish National Heritage, now NatureScot - SNH (2016). *Assessing Connectivity with Special Protection Areas (SPAs)*. SNH Guidance Note.
- Scottish National Heritage, now NatureScot - SNH (2018b). *Assessing significance of impacts from onshore wind farms out with designated areas*. Scottish Natural Heritage, Inverness, Scotland.
- Scottish National Heritage, now NatureScot - SNH (2018c). *Assessing the cumulative impacts of onshore wind farms on birds*. Scottish Natural Heritage, Inverness, Scotland.

7.2 Methodology

7.2.1 Study Area

Ornithological Study Areas for each survey method are outlined in **Section 7.2.7** and presented in **Figure 7-2**. The overall Study Area for this assessment encompasses the development boundary as described in **Chapter 2** Description of the Development, at **Figure 2-**7 (for the purpose of this Chapter 7 "the Development Boundary"). The specific Ornithological Study Areas required to characterise bird populations and habitats extend beyond the Development Boundary, with additional areas identified in accordance with guidance on potential connectivity to designated sites and other Important Ornithological Features (IOFs) (SNH, 2016a).

For certain ornithological features, the Zone of Influence (ZoI), as described in Section 7.2.2, extends beyond the defined Study Area where potential effects, such as disturbance, displacement, or impacts on roosting, foraging, or flight path connectivity to designated sites, may occur. In such cases, this is explicitly set out in the relevant methodological sections below.

7.2.2 Survey Year Overview

Baseline ornithological surveys were undertaken over three consecutive years to capture both breeding and non-breeding season activity across the Study Area. The survey programme is summarised by year and season below:

- Year 1 (2021–22)
    - Non-breeding season: October 2021 – March 2022
        - Winter walkover surveys
        - Whooper swan VP surveys
    - Breeding season: April – August 2022
        - Breeding bird surveys
        - Breeding raptor surveys
        - Barn owl surveys (June – August)
        - Vantage Point (VP) watches (six locations)
- Year 2 (2022–23)
    - Non-breeding season: October 2022 – March 2023
        - Winter walkover surveys
        - Wintering waterbird surveys (adapted I-WeBS methodology)
        - Whooper swan VP surveys
        - Bioacoustics monitoring at Camas South (six-hour recording periods)
    - Breeding season: April – August 2023
        - Breeding bird surveys
        - Breeding raptor surveys
        - Barn owl surveys (May – August)
        - Crepuscular/dusk surveys (April – June)
        - VP watches (seven locations, including additional VP in eastern Core Study Area)
- Year 3 (2023–24)
    - Non-breeding season: October 2023 – March 2024
        - Winter walkover surveys
        - Wintering waterbird surveys (full 5 km buffer coverage)
        - Whooper swan VP surveys and flight speed monitoring

        - Bioacoustics monitoring at Camas South (24-hour continuous operation, expanded spatial coverage)
        - Hen harrier roost surveys (November – February 2023–24)
    - Breeding season: April – August 2024
        - Breeding bird surveys
        - Breeding raptor surveys
        - Crepuscular/dusk surveys (June – August)

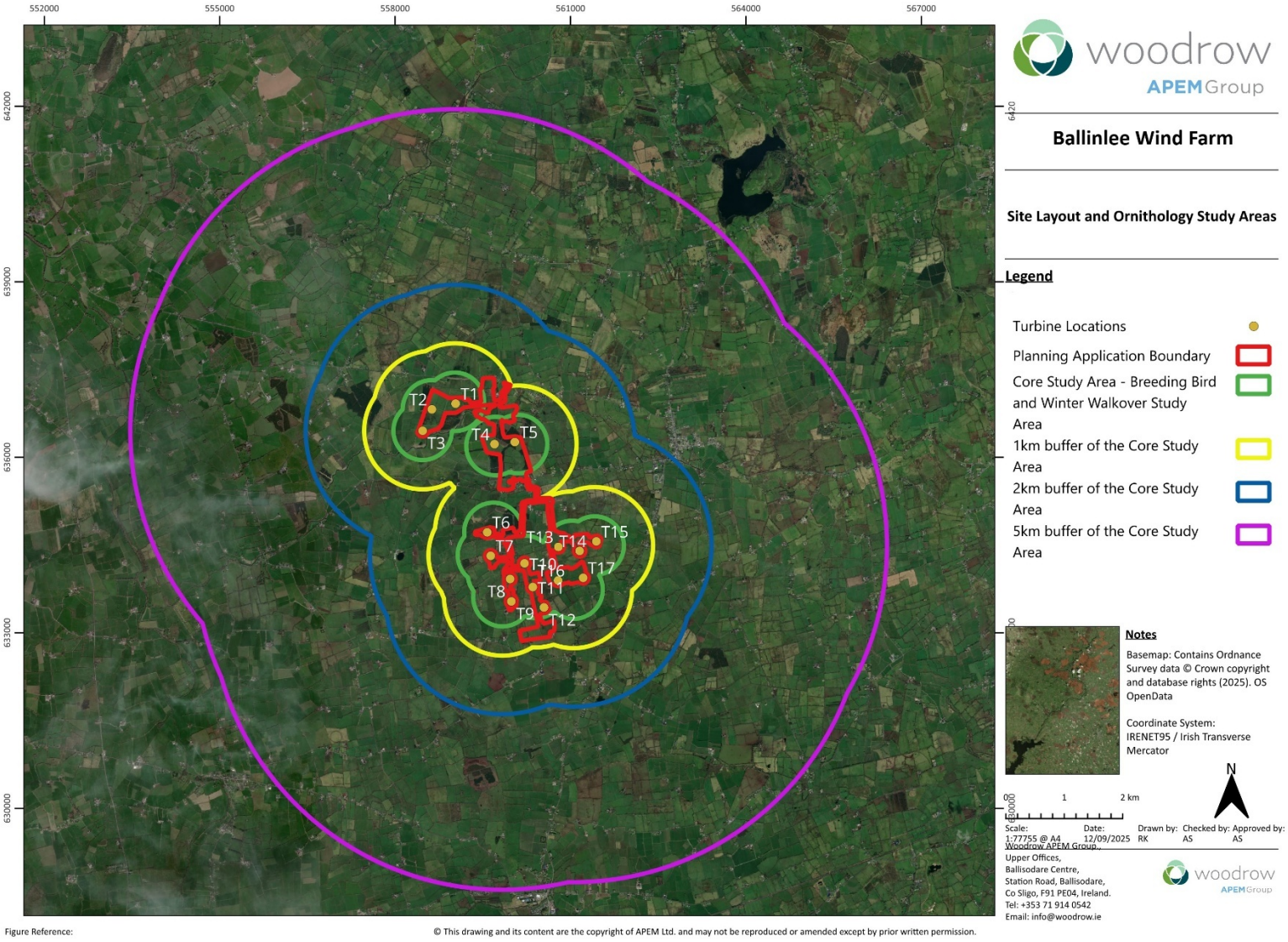

Figure 7-2: Overview of Development Boundary and Ornithological Study Areas

7.2.3 Zone of Influence

Information obtained through desk study and field surveys has been used to identify ornithological features within the ZoI of the Development, as defined following CIEEM (2018) as:

"The 'zone of influence' for a project is the area over which ecological features may be affected by biophysical changes as a result of the Development and associated activities."

For ornithological features, the ZoI encompasses areas where key breeding, foraging, roosting, or other important habitats could potentially be affected directly or indirectly by the Development. This area may extend beyond the Development Boundary where ecological or hydrological connections exist, including wetlands, fields, or flight corridors used by sensitive bird species. Features with no functional connection to the Development are considered outside the ZoI.

A Source–Pathway–Receptor (SPR) model (OPR Practice Note PN02, 2021a) has been applied to identify potential pathways for effects between the Development and IOFs. This structured approach ensures that both direct (e.g., habitat alteration, disturbance) and indirect (e.g., displacement, behavioural changes) effects are systematically considered.

7.2.4 Assessment Criteria

The assessment of potential ornithological effects requires a consistent framework for evaluating the relative importance of ornithological features that may occur within the Zone of Influence of the Development. A geographic hierarchy of importance, ranging from International to Local, is applied in line with established guidance (CIEEM, 2018; NRA 2009). The authors professional ornithological judgement (see Appendix 7A Statement of Competencies) is used throughout, with consideration of conservation status, species abundance, functional role within the landscape, and the seasonal or temporal context of activity recorded during surveys. The criteria used for evaluation are presented in Section 7.2.4.1 and summarised in Table 7-1.

7.2.4.1 Criteria for Evaluation of Ornithological Features

Ornithological features within the ZoI, including designated sites, bird habitats, and species of conservation concern, have been evaluated according to the geographic hierarchy of importance as outlined in Table 7-1. Importantly, the presence of a species with international conservation status (e.g., Annex I of the EU Birds Directive) does not in itself confer an international importance; the site must support a functionally significant population or play a demonstrably important role in that species' life cycle.

For this assessment, an IOF is defined as any bird species, assemblage, habitat, or designated ornithological site that:

- Occurs within the Zone of Influence;
- Is of Local Importance (Higher value) or greater; and
- May be subject to potential adverse effects from the Development.

IOFs are the focus of detailed consideration in this assessment because of their conservation significance, potential vulnerability, or functional reliance on habitats within or surrounding the Development.

Table 7-1: Evaluation criteria for determining the importance of ornithological features

Importance	Criteria
International Importance	• Special Protection Area (SPA) or proposed Special Protection Area (pSPA) within the zone of influence. • Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). • Resident or regularly occurring populations (assessed to be important at the national level) of a bird species listed in Annex I and/or referred to in Article 4(2) of the Birds Directive. • Resident or regularly occurring bird population occurring in numbers qualifying as important in a European context, i.e. occurring in numbers meeting 1% thresholds for international importance. • Features essential to maintaining the coherence of the Natura 2000 Network. • Other ornithologically important sites or populations associated with these sites occurring within the zone of influence, including: - Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). - Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). - Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
National Importance	• Bird populations of importance in a national context, including any site designated or proposed as a Natural Heritage Area (NHA), Statutory Nature Reserve, Refuge for Fauna and Flora protected under the Wildlife Acts and/or National Park. This also includes any undesignated site fulfilling the criteria for designation as any of the aforementioned sites. • Resident or regularly occurring populations (assessed to be important at the national level) of bird species, - Protected under the Wildlife Acts; and/or - That are Red-listed species (Gilbert *et al*., 2021). Typically, 1% of the national population of such species qualifies as a nationally important population. However, a smaller population may qualify as nationally important where

Importance	Criteria
	the population forms a critical part of a wider population, or the species is at a critical phase of its life cycle.
County / Regional Importance	• Area of Special Amenity. • Area subject to a Tree Preservation Order. • Area of High Amenity, or equivalent, designated under the County Development Plan. • Resident or regularly occurring populations (assessed to be important at the County level) of bird species: - Listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; - Protected under the Wildlife Acts Ireland); and/or - Listed as Red-listed species (Gilbert *et al*., 2021). • County important populations of species identified in the National or Local Biodiversity Action Plans (BAP); if this has been prepared. • Sites containing bird species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (Higher Value)	• 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. • Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; • Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (Lower Value)	• Habitats and species populations of less than local importance but of some value; and • Sites or features containing non-native species that are of some importance in maintaining habitat links.

Ornithological features assessed as being of less than Local Importance (Higher Value), i.e. Local Importance (Lower Value), are considered to be of negligible importance in the context of this assessment and are therefore

scoped out of further detailed evaluation. Effects on such features are not considered to be significant and are not discussed further in this chapter in accordance with NRA, 2009.

The importance of an ornithological feature has been determined using the geographical scale of value (see definition above in Table 7-1) and is informed by the following criteria.

For conservation status:

- Inclusion of a species on Annex I of the EU Birds Directive (Directive 2009/147/EC), indicating European conservation concern; and
- Listing on the Birds of Conservation Concern in Ireland (BoCCI) Red or Amber lists (Gilbert *et al*., 2021), reflecting national population declines or conservation priority.

For species abundance at a relevant geographic scale:

- The numbers of individuals recorded during baseline surveys were evaluated against established thresholds at site, county, national, and international levels; and
- This allows determination of whether the site supports a population of sufficient size or function to contribute meaningfully to the species' conservation status at the relevant geographic scale.

7.2.4.2 Description of Effects

In accordance with the terminology outlined in the CIEEM (2018) guidelines, when describing ecological effects, reference should be made to the following characteristics:

- **Beneficial or adverse:** beneficial and adverse impacts/effects should be determined according to whether the change is in accordance with nature conservation objectives and policy;
- **Extent:** Extent should be predicted in a quantified manner and relates to the area over which the impact occurs;
- **Magnitude:** The magnitude of potential effects is defined by a series of factors including the spatial extent of any interaction, the likelihood, duration, frequency, and reversibility of a potential effect. The criteria for defining magnitude in this chapter is outlined in Table 7-2;
- **Duration:** Duration is intended to refer to the time during which the effect is predicted to continue, until recovery or re-instatement (which may be longer than the impact-causing activity). Duration should be defined in relation to ecological characteristics (such as species' lifecycle). The duration and reversibility of effect that may be caused is outlined by EPA (2022) Guidelines which are shown in Table 7-3;
- **Frequency and Timing:** The timing of effects in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and associated effects) would take place can be an important determinant of the effect on features and should also be assessed and described;
- **Reversibility:** An irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.

The evaluation of ecological effects considers both the duration and reversibility of effects in the context of the species or habitats impacted. The EPA (2022) guidance provides general definitions for duration (e.g. short-term, medium-term, long-term), these have been adapted where appropriate to reflect ecological characteristics such as species' life cycles, population resilience, and habitat recovery potential. Reversibility is assessed based on the likelihood of a feature returning to baseline conditions, either naturally or through mitigation, with justification

provided for the assumed timeframe. This approach ensures that impact characterisation is both ecologically relevant and transparent.

Table 7-2: Criteria for assessing impact significance[4]

Magnitude	Criteria
High	Extent: High proportion of the population is affected. Duration: The effect is expected to be long-term, resulting in behavioural changes that last for the lifetime of the project. Frequency: The effect is expected to occur constantly throughout a relevant project phase. Probability: The effect is reasonably expected to occur. Consequence (Adverse): The impact would affect the behaviour and distribution of sufficient numbers of individuals, with sufficient severity, to affect the favourable conservation status and/or the long-term viability of the population at a generational scale.
Medium	Extent: Medium proportion of the population is affected. Duration: The effect is expected to be short-term, resulting in behavioural changes that last up to seven years. Frequency: The effect is expected to occur constantly throughout a relevant project phase. Probability: The effect is reasonably expected to occur. Consequence (Adverse): Temporary changes in behaviour and/or distribution of individuals at a scale that would result in potential reductions to lifetime reproductive success to some individuals although not enough to affect the population trajectory over a generational scale. Permanent effects on individuals that may influence individual survival but not at a level that would alter population trajectory over a generational scale.
Low	Extent: Small proportion of the population is affected. Duration: The effect is expected to be temporary, resulting in behavioural changes that last less than a year. Frequency: The effect is expected to occur frequently throughout a relevant project phase. Probability: The effect is unlikely to occur. Consequence (Adverse): Short-term and/or intermittent and temporary behavioural effects in a small proportion of the population. Reproductive rates of individuals may be impacted in the short term (over a limited number of breeding cycles). Survival and reproductive rates very unlikely to be impacted to the extent that the population trajectory would be altered.
Negligible	Extent: Very small proportion of the population is affected. Duration: The effect is expected to be brief, resulting in behavioural changes that last less than a day. Frequency: The effect is expected to occur once or infrequently throughout a relevant project phase. Probability: The effect is unlikely to occur.

4 Definitions are informed by EPA (2022) guidelines and interpreted in accordance with CIEEM (2018)

Magnitude	Criteria
	Consequence (Adverse): Very short term, recoverable effect on the behaviour and/or distribution in a very small proportion of the population. No potential for the any changes in the individual reproductive success or survival therefore no changes to the population size or trajectory.

Table 7-3: The duration term and the length of time to achieve reversibility

Duration	Definition of Reversibility[5]
Very short term	Effects lasting only a brief period (e.g. days to months); typically associated with temporary activities such as site access or minor maintenance.
Short term	Effects lasting less than one year; relevant to single breeding or wintering seasons, depending on species.
Medium term	Effects lasting beyond a single year, potentially affecting multiple seasonal cycles; assessed in relation to species' ecology (e.g., breeding maturity, site fidelity).
Long term	Effects persisting over multiple years, potentially spanning several generations or stages of habitat succession. May alter population dynamics or site use.
Permanent	Effects considered effectively irreversible within relevant ecological timescales; may result in loss of critical habitat or sustained population-level change.
Reversible	Recovery to baseline conditions is reasonably achievable, either through natural processes or effective mitigation (e.g., habitat enhancement or restoration).
Irreversible	Recovery is not achievable within a relevant ecological timescale, or no effective mitigation exists.

7.2.4.3 Significant Effects on Important Ornithological Features

For the purpose of this EIAR, specifically this Ornithology Chapter, a significant effect, in ornithological terms (whether beneficial or adverse), is an outcome to an IOF resulting from an impact that either supports or undermines conservation objectives for that feature. Conservation objectives may be specific (e.g. for an SPA designated for particular bird species) or broader (e.g. national conservation priorities for species listed as Red or Amber on Birds of Conservation Concern in Ireland). As such, significant effects can occur across a range of geographic scales, from International to Local, and are qualified with reference to the appropriate scale (CIEEM, 2018).

7.2.4.4 Mitigation Rationale and Design

Potential effects on IOFs are considered following the mitigation hierarchy (avoidance, mitigation, and compensation) as set out in CIEEM (2018). The aim is to ensure that potential ornithological effects are addressed at the earliest possible design stage and that positive measures, such as habitat enhancement or provision of alternative foraging areas, are incorporated where possible. Where significant adverse effects on IOFs are

5 Definitions are informed by EPA (2022) guidelines and interpreted in accordance with CIEEM (2018), which advises that duration and reversibility should be defined in relation to ecological context, such as species' lifespans, habitat resilience, and recovery potential.

predicted and avoidance is not possible, mitigation (e.g. timing restrictions to avoid disturbance during breeding, micro-siting of turbines away from high-sensitivity areas, or crop management to deter sensitive species) will be implemented. If mitigation alone is insufficient, compensation measures (e.g. habitat creation or management elsewhere within the wider landscape) will be considered. The level of response is proportionate to the sensitivity of the IOF and the scale of potential effect, applying the precautionary principle where significant uncertainties remain.

7.2.4.5 Residual Effects

After mitigation measures are applied, residual effects are assessed to determine whether significant effects on IOFs remain. This step ensures transparency in relation to any unavoidable ornithological impacts and informs the overall judgement on project acceptability.

7.2.4.6 Cumulative Effects

Cumulative effects on IOFs may result from individually minor but collectively significant pressures, particularly for wide-ranging species such as raptors, geese, and swans, which may be subject to disturbance, displacement, or collision risk across multiple developments. Cumulative effects can be:

- Additive/incremental – where multiple projects in proximity contribute to an overall significant effect on IOFs, for example increased collision risk across a cluster of wind farms; or
- Associated/connected – where development activities are linked, such as grid infrastructure associated with wind farms that may cause additional effects on IOFs.

Cumulative effects are assessed in the context of the IOFs' existing conservation pressures and thresholds, with reference to other plans and projects within the same ZoI (e.g. consented or proposed wind energy developments). This ensures that potential impacts on ornithological populations are fully considered at the relevant geographic scale.

7.2.5 Consultation

Consultation was undertaken through the Development Applications Unit (DAU) Consultation Request process on the 21 October 2024 and on 1 May 2025, see EIAR Appendix 1B for copies of the consultation correspondence. The initial engagement was for consultation during the Development scoping stage (Ref: G Pre00295/2024) and a generic response was received. The second engagement focused on a high-level summary of the Whooper Swan Management Plan (WSMP) (Appendix 7D), with the intention of inviting targeted feedback on the plan prior to finalisation. On 25 June 2025, a response to the latter consultation was received from the DAU. The response included a number of queries relating to visual disturbance, collision risk, and the potential population-level effects of the Development on regionally important whooper swan (*Cygnus cygnus*) populations associated with Lough Gur.

The WSMP was prepared by Dr Kerry Mackie, an established expert in whooper swan ecology with extensive ornithological experience. The WSMP provides a comprehensive suite of mitigation, enhancement, and monitoring measures, which address the queries from the DAU, summarised and responded to below. In addition, the WSMP includes provisions for follow-up monitoring to assess the efficacy of the proposed mitigation and enhancement measures, should permission be granted, thereby ensuring adaptive management and continued protection of whooper swan populations.

Visual Disturbance

Queries raised in relation to visual disturbance include:

- Part of the Development site supports a sensitive and regionally important population of Annex I-listed whooper swans associated with Lough Gur, within a Wildfowl Sanctuary and proposed Natural Heritage Area (pNHA).
- Whooper swans are vulnerable to disturbance, particularly from turbine proximity and visual stimuli, and require extensive undisturbed foraging habitat during winter.

In response to the concerns, a comprehensive programme of protection and habitat enhancement has been prepared and will be implemented to mitigate impacts on whooper swans associated with the Development. A central element of this strategy involves the enhancement of 14.3-ha of grazing land, strategically located adjacent to historically used foraging areas and positioned at a safe distance from the turbines. The fields located approximately 350 m southeast of T1 and 340 m north of T4 (**Figure 7-8**), will be improved through sowing of preferred high-quality forage species (such as Italian ryegrass), the installation of water retention features, and the application of low-intensity managed grazing to maintain optimal foraging conditions. To further reduce potential disturbance, no heavy construction activity will occur in the most sensitive areas, particularly around turbine T3, during the swan wintering period (October to March). Turbine operations will be closely monitored and will be adjusted during the early operational years to allow swans time to adapt.

While the DAU recommend applying a more precautionary upper buffer distance for displacement (typically up to 600 m from turbines), their response also includes the important caveat: "unless lower values have been shown not to result in disturbance." Several empirical studies suggest that whooper swans may tolerate infrastructure at closer distances, particularly when foraging in favoured habitats or where visual/noise disturbance is reduced by landscape features (e.g. Rees *et al*. 2005b; Colhoun *et al*. 2013; Liley *et al*. 2010). For instance, Rees *et al*. (2005b) found that foraging swans could occur within 250–300 m of human disturbance where suitable habitat was available, and Liley *et al*. (2010) reported similar tolerances in swans using agricultural fields.

More recent evidence supports these findings. Plonczkier & Simms (2012) observed continued usage of farmland by geese and swans in proximity to turbines when habitat quality remained high, while Kearney *et al*. (2021) reported whooper swans foraging within 300–400 m of wind energy infrastructure in Ireland under low-disturbance conditions. Heuck *et al*. (2023) further demonstrated that displacement distances can vary widely depending on habitat attractiveness and local landscape context, with swans often prioritising high-quality foraging areas over strict distance avoidance.

These findings have directly informed both the location of infrastructure and the design of mitigation for the Development. Specifically, the proposed enhancement fields were selected based on prior swan use, with baseline surveys confirming regular foraging activity by whooper swans in the area. The fields lie approximately 955 m from turbine T3, 340 m north of T4 and 350 m southeast of T1, distances within the documented tolerance range under low-disturbance conditions (Kearney *et al*., 2021). Its location also aligns with the southwest–northeast flight corridor (**Figure 7-7**) preserved through the turbine layout, including a 960 m gap between turbines, which was deliberately maintained to facilitate safe swan movement between Lough Gur and foraging areas. The location was chosen to avoid creating an ecological trap by enhancing fields already used by swans, rather than introducing a new or isolated site. Fields within the landholding[6] boundary of the development, within 300 m of turbines will be managed to discourage foraging, while the enhancement fields, situated beyond that threshold, will be actively improved. By aligning mitigation with both known usage and literature-based

[6] Landowner Legal agreements in place

disturbance thresholds, the WSMP adopts a precautionary, evidence-based approach aimed at maintaining habitat functionality within the local foraging landscape.

A long-term monitoring programme will track swan activity, feeding behaviour, and flight patterns, with findings used to guide any future changes in Development management. Monitoring will span multiple seasons and will inform adaptive management where required. These combined measures, underpinned by scientific literature and consistent with conservation best practice, aim to support safe foraging and minimise disturbance for the wider swan population using the area.

See Section 7.6 for the assessment of likely effects on whooper swan, Section 7.7 and Appendix 7D for proposed mitigation measures, and Section 7.9 for assessment of residual effects.

Collision Risk

Queries raised in relation to collision risk include:

- That the current proposal restricts swan usage to a limited field located between infrastructure, within close range of turbines.
- This undermines the whooper swans' adaptive use of multiple fields and risks displacement due to habitat degradation or disturbance.

Queries were raised that locating the enhancement field between turbines could create an "ecological trap," increasing collision risk and limiting the swans' ability to adaptively use multiple foraging areas. The DAU also highlighted a 600 m turbine sensitivity threshold for swans, referencing Irish Wetland Bird Survey (I-WeBS) guidance and known susceptibility to powerline collisions, especially during low-light movements.

In response, the proposed mitigation is designed to avoid creating ecological traps by enhancing, not isolating, several fields historically used by swans. Fields within 300 m of turbines will be managed to discourage foraging, while fields beyond this will be actively enhanced. A precautionary 300 m working buffer has been applied around turbines — this is not a physical barrier but a management threshold. Within this zone, foraging will be actively discouraged due to elevated risk of disturbance and collision, while fields beyond it are considered suitable for enhancement. This approach is supported by literature (e.g. Overgaard Andersen *et al*., 1998; McGuinness *et al*., 2015), which shows minimal displacement and low collision risk at this distance.

While the WSMP refers to five years of survey data, the present assessment strictly considers the three years of detailed site-specific surveys. These surveys confirm regular swan commuting flights from Lough Gur (the roost site) into and out of the Development to forage. Flight frequencies were low, and flight paths followed a regular route in a southwesterly-northeasterly direction between the roost and foraging area, which based on design considerations, avoids turbine rotor-swept zones. The first two years comprised dedicated whooper swan surveys, which also recorded swan activity in relation to the Development; these are referenced in the WSMP to provide additional context and ensure consistency across reporting. Collision risk modelling based on observed flight data indicates a low probability of collision. To support adaptation of whooper swans to the operational wind farm, turbines T1–T4 will be temporarily shut down during the first winter of operation as a precautionary approach and to allow habituation of the swans to the turbine structures.

Transient movements (e.g. towards Rathcannon Pond, approximately 2.5 km south), outside of the regular route mentioned above, were recorded infrequently. The local swan population is relatively small and concentrated within two consistently used foraging areas, Camas South and Ballycullane, with occasional use of a third site at Rathcannon Pond. The area within Camas South as outlined in the Whooper Swan Management Plan (Appendix 7D) will be protected, and managed specifically for whooper swan, located away from turbines at distances shown to be tolerated by the species, thereby reducing the potential for disturbance. There is no evidence of a larger, undetected roosting population.

The combined mitigation, targeted habitat enhancement, strategic turbine management, and long-term monitoring, offers a robust, evidence-based approach that balances collision risk and habitat availability while safeguarding the integrity of the local whooper swan population.

Integrity of the Lough Gur population

Queries raised in relation to the integrity of the Lough Gur population include:

- The Development supported ~10% of Limerick's whooper swan population in 2021/22, raising queries over collision risk, especially in low light and poor visibility.
- Flight paths between Lough Gur roost site and multiple foraging areas may intersect turbine locations, posing a risk of mortality and broader population-level effects.

In response to the queries raised by the DAU, the Development design has been refined to avoid the most important and sensitive areas used by wintering whooper swans. Key foraging areas have been protected and, where avoidance was not possible, relocated further from turbines to reduce potential disturbance. Access and construction routes will be carefully managed, particularly during the swan wintering season to minimise disruption.

To reduce potential risk of collision and displacement to the regional swan population which roost at Lough Gur, the Development incorporates a multi-year ornithological monitoring programme to be implemented in the early operational years to monitor swan behaviour across varying conditions. This data will inform a detailed adaptive curtailment protocol, which allows turbines, particularly those closest to high-use areas, namely T1 and T4, to be shut down or modified during high-risk periods (e.g. low-light, dawn or dusk, and in poor weather), as described in Section 7.7. Monitoring and mitigation are linked, with findings used to trigger targeted adaptive management where required.

The Development is predicted to result in no measurable impact on the whooper swan population at a national and flyway scale. Historical peak counts (e.g. 59 individuals out of 493 in 2020, representing ~12% of the Co. Limerick total) provide context, equating to ~0.3% of the national population (Republic of Ireland, 19,111 individuals in 2020) and ~0.03% of the Northwest European flyway population (c. 180,000 individuals), confirming that the Development's impact at both national and flyway levels is minimal. Recent site-specific surveys conducted over the assessment period corroborate these findings, and more recent national population estimates indicate continued growth, with Ireland's whooper swan population increasing by ~3,741 individuals, and regional counts in the Shannon & Fergus Estuary also rising (by +314 to +561 swans), acknowledging natural inter-annual variability. The WSMP implementation will result in a residual effect of slight to moderate adverse at local/county scale; not significant at population level.

Long-term monitoring results will be reviewed at Years 1, 2, 3, 5, 10, and 15 post-construction; ensuring that Development operations continue to align with mitigation measures set out in this chapter and avoid adverse effects on the Lough Gur roost population.

7.2.6 Data Requests

A data request was submitted to the National Parks and Wildlife Service (NPWS) for records of protected and threatened species and birds within the ZoI of the Development. The provision of these records does not constitute consultation with NPWS regarding the Development. The data request focused on species of conservation concern, including those listed under the EU Birds and Habitats Directives, the Wildlife Acts, the

Flora (Protection) Order 2015, and national Red Lists, in line with the NPWS Checklists of Protected and Threatened Species (NPWS, 2023).

7.2.7 Desk Study

A comprehensive desk study was undertaken to identify sensitive bird populations and evaluate potential ecological connectivity between the Development and nearby designated ornithological sites, including SPAs, NHAs, and pNHAs. A 10 km radius around the Development was used as the baseline search area, in line with established best practice for EIA and ornithological assessments, as this distance typically captures most designated sites potentially affected by construction or operational activities, while remaining proportionate and manageable for detailed assessment (e.g., NatureScot, 2016; CIEEM, 2018). This radius also provides a precautionary framework for considering indirect impacts on species with larger foraging ranges, functional linkages, or habitat connectivity beyond the immediate Development footprint. The assessment reviewed habitat availability within and around the Development and considered species-specific foraging ranges and sensitivities.

7.2.7.1 Existing Ornithological Records

Key data sources included the National Parks and Wildlife Service (NPWS) Designations Viewer, Environmental Protection Agency (EPA) hydrological maps, the I-WeBS, and the National Biodiversity Data Centre (NBDC) database[7]. Additional resources consulted included bird sensitivity mapping to wind energy (McGuinness *et al.,* 2015), national bird atlases (Balmer *et al*., 2013; Colhoun & Cummins, 2013), and peer-reviewed literature on the distribution and status of species such as hen harrier *Circus cyaneus* (NPWS Hen Harrier National Survey 2022), barn owl *Tyto alba (O'Neill et al., 2017)*, merlin *Falco columbarius* (Ruddock *et al*., 2022), and wintering waterbirds including whooper swan *Cygnus cygnus* (Crowe *et al*; Fitzgerald *et al*., 2021). This information informed an evaluation of the ornithological importance of the Development and its surrounding landscape.

The Study Area falls within two 10 km grid squares (R53 and R63) and six 2 km grid squares (R53Y, R63D, R53X, R63C, R53W and R63B).

7.2.7.2 Designated Sites

Designated sites referred to in this assessment are of national and/or international nature conservation importance and are afforded protection as set out in this section. Special Protection Areas (SPAs) are designated under the EU Birds Directive (2009/147/EEC) to protect bird species listed in Annex I of the Directive, regularly occurring populations of migratory species, and important wetland habitats for birds. Both the Birds Directive and the Habitats Directive (for Special Areas of Conservation, SACs) have been transposed into Irish law under the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011, as amended).

National Heritage Areas (NHAs) are designated under the Wildlife Acts to protect habitats, species, or geological features of national importance. Many NHAs overlap with European sites. Proposed NHAs (pNHAs) are sites not yet fully designated but are protected on a non-statutory basis by local authorities and are recognised as significant for wildlife and habitats.

The potential ecological connectivity between the Development and designated ornithological sites was assessed using a Source–Pathway–Receptor approach (OPR Practice Notes PN01 (2021) and PN02, 2021a), informed by

[7] https://maps.biodiversityireland.ie/

professional judgement and available datasets. Shapefiles of SACs, SPAs, NHAs, and pNHAs were obtained from NPWS and imported into GIS. Connectivity to a designated site can extend over considerable distances, for example via hydrological links, mobile species such as birds, or other functional pathways. In line with best practice (NatureScot, 2016; CIEEM, 2018), a 10 km radius was used as the baseline for desk-based assessment, with additional consideration of sites up to 20 km where pathways of potential effect were identified.

7.2.8 Ornithological Surveys

7.2.8.1 Field Surveys

Baseline ornithological surveys were conducted over a three-year period from October 2021 to September 2024, in accordance with NatureScot (2017) guidance, widely regarded as best practice in Ireland, although developed for Scotland.

Survey methods are detailed in the Baseline Ornithology Report (Appendix 7B) and summarised below. Surveys were completed within the Study Areas as set out in this section, which were determined by the 'Core Study Area' i.e. a 500 m buffer of the proposed turbine locations, and additional suitable buffers in line with NatureScot (2017) guidance applied. The core study area was defined as any land where turbines could potentially be located, surrounded by a 500 m buffer. Study Areas, as shown on Figure 7-2, were therefore as follows:

- Vantage Point (VP) Study Area – The core study area;
- Breeding Bird Survey Study Area – The core study area;
- Breeding Raptor Study Area – The core study area and a 2 km buffer;
- Barn Owl Study Area - The core study area and a 1 km buffer;
- Winter Walkover Study Area - The core study area;
- Wintering Waterbird Study Area - The core study area and a 5 km buffer;
- Hen Harrier Roost Study Area - The core study area and a 2 km buffer;
- Whooper Swan Study Area – The core study area and a 5 km buffer.

The ornithology Study Area exceeds the Deevelopment Boundary. See Figure 7-2 which illustrates each of the above Study Areas. While the final turbine layout and Deevelopment Boundary were confirmed only after survey completion, small areas containing access tracks, between the north and south sections of the Development, were not directly covered during some surveys. These areas are limited in extent, typically located at the periphery of the Development, and do not contain habitat likely to support species or activity levels materially different from those recorded in surveyed areas. As such, this is not considered a limitation to the assessment.

An overview of survey methodologies is provided below, and further details, including survey dates, durations, and weather conditions, are also presented in Appendix 7B.

7.2.8.1.1 Vantage Point (VP) watches

Vantage Point (VP) watches were conducted between October 2021 to September 2024 (inclusive), using a series of VPs to record flight activity of target bird species and inform the Collision Risk Modelling (CRM).

Initially, six VP locations were established to cover the core study area during Year 1 surveys, covering the 2021-22 non-breeding season and 2022 breeding season. This arrangement provided coverage of the turbine layout and a 500 m buffer zone, i.e. Core Study Area, in line with NatureScot (2017) guidance.

Prior to the Year 2 surveys, (2022-23 non-breeding and 2023 breeding season), a seventh VP was added to address a small coverage gap identified on the eastern side of the Core Study Area, where visibility was restricted by a spruce plantation. This expanded VP network of seven locations was retained for the Year 3 surveys (non-breeding season 2023-24 and breeding season 2024).

VP locations were selected using viewshed analysis undertaken using Geographic Information Systems (GIS) and were subsequently ground-truthed in the field to confirm visibility accuracy. The locations and associated viewsheds are illustrated in Figure 7-3 and Figure 7-4. Viewsheds represent the visible airspace at a height of 24 m above ground level, corresponding to the lowest extent of the rotor-swept height.

VP watches were conducted in accordance with NatureScot (2017) guidance, with 36 hours of VP survey effort completed per VP in each breeding and non-breeding season, except during Year 1 breeding season (2022), with 30 hours per VP completed.

Target species during VP watches included:

- All waterbird species;
- All raptor species;
- Any species listed on Annex I of the EU Birds Directive; and:
- Any species listed as Red or Amber of the BoCCI 2020-26 (Gilbert *et al*., 2021), where collision risk could lead to population level effects.

Each recorded flight path was numbered and cross-referenced, with the following data recorded:

- Time of detection;
- Bird species, age, and sex (where age and sex were determinable);
- Number of birds;
- Behaviour where applicable (e.g. foraging, commuting, display, etc,);
- Flight height range and duration.

Flight height estimation was conducted visually by experienced observers using known reference points in the landscape to aid accuracy. These reference points included turbine hub height, nearby structures (e.g. buildings, masts), trees, and topographic features such as hills or ridgelines. This approach enables consistent and reliable estimation of the vertical position of birds in flight, which is a key parameter in assessing potential collision risk. Observers were trained to ensure standardised assessment of height bands, particularly within and around the rotor-swept zone, enabling robust data to inform CRM.

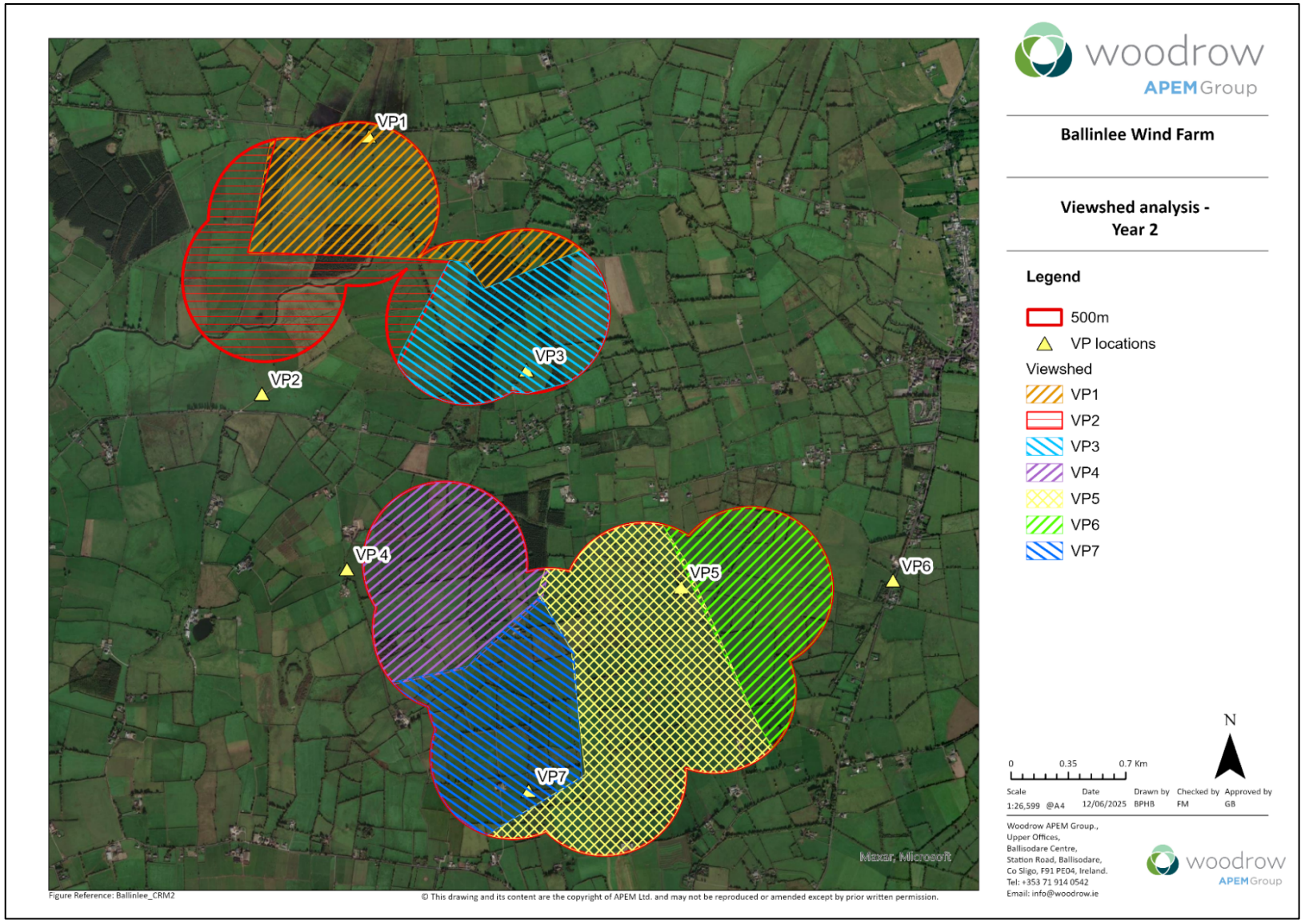

Figure 7-3: VP locations and associated viewsheds for Year 2

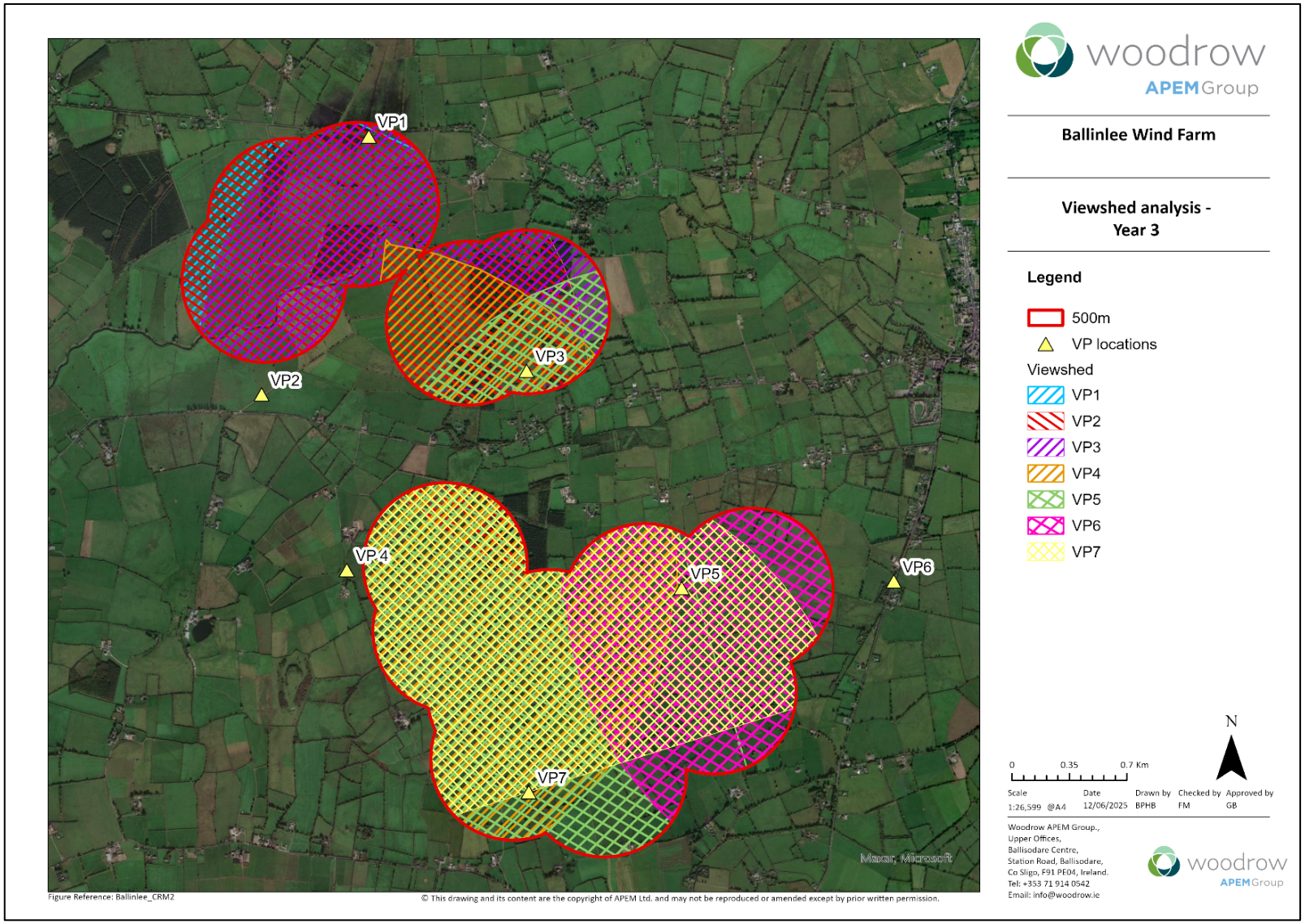

Figure 7-4: VP locations and associated viewsheds for Year 3

7.2.8.1.2 Breeding bird surveys

Breeding bird surveys were conducted within the core study area (**Figure 7-2**), during the 2022, 2023 and 2024 breeding seasons (Years 1 to 3) in accordance with SNH (2017) guidelines. These surveys were undertaken to determine the breeding bird assemblage, with routes selected to sample all key habitat types, including woodland, agricultural grassland, and treelines/hedgerows. The aim was to identify potential ecological constraints, such as breeding waders or raptors.

Survey methodology combined O'Brien and Smith (1992), developed for mapping lowland wader territories and other ground nesting species of conservation concern, and the common bird census (CBC) approach outlined in Gilbert *et al*. (2021b). The breeding bird surveys encompassed all suitable habitats within the core study area.

7.2.8.1.3 Crepuscular/Dusk surveys

To supplement breeding bird and breeding raptor surveys, additional dusk visits were undertaken between April and June 2023, and June and August 2024 (Years 2 and 3) to detect crepuscular or nocturnal species that standard daytime surveys may miss. The surveys covered woodland habitat within the core study area (**Figure 7-2**) to identify roding woodcock *Scolopax rusticola* (territorial males), breeding long-eared owl *Asio otus*, and breeding snipe *Gallinago gallinago* habitat. Surveys followed species-specific methods detailed in Gilbert *et al*. (2021b) for woodcock, long-eared owl, and snipe.

7.2.8.1.4 Breeding raptor surveys

Breeding raptor surveys were conducted between April and August during the 2022, 2023, and 2024 breeding seasons (Years 1, 2 and 3), targeting Annex I species and raptors listed on Birds of Conservation Concern Ireland (BoCCI). Surveys followed methods set out by Hardey *et al*. (2013), in line with NatureScot (2017) guidance. The study area included all accessible land within the core study area and a 2 km buffer (**Figure 7-2**). Any land which was not accessible was surveyed from suitable ad-hoc vantage points.

7.2.8.1.5 Barn owl surveys

Barn owl surveys were undertaken between June and August 2022, May and August 2023 (Years 1 and 2). Searches targeted old buildings and veteran trees within the core study area and a 1 km buffer (**Figure 7-2**), for potential usage by breeding barn owls. Techniques for surveying adhered to Transport Infrastructure Ireland (TII) guidelines on Survey and Mitigation Standards for Barn Owls to inform the Planning, Construction and Operation of National Road Projects (TII, 2021) and Hardey *et al*. (2013).

7.2.8.1.6 Winter walkover surveys

Winter walkover surveys were completed during Year 1 (October 2021 to March 2022), Year 2 (November 2022 to March 2023) and Year 3 (October 2023 to March 2024) to map the location of all species within the core study area (**Figure 7-2**). Survey methods followed the 'look-see' method (Bibby *et al.,* 2000) to record all species, although passerine were not considered target species, per NatureScot (2017).

7.2.8.1.7 Wintering waterbird surveys

Wintering waterbird surveys were undertaken during the non-breeding seasons in Year 2 (October 2022 to March 2023) and Year 3 (November 2023 to March 2024), with monthly surveys conducted throughout the defined periods. In accordance with NatureScot (2017) guidance, particular attention was given to identifying wildfowl foraging and roosting sites within 1 km of the Development, although the full study area was extended to the core study area and a 5 km buffer (**Figure 7-2**).

Surveys followed an adapted I-WeBS methodology, incorporating modifications for detailed recording of bird locations and behaviours, following Lewis & Tierney (2014). In Year 2, survey effort focused on Lough Gur, while in Year 3 the study area was expanded to include all suitable wetland, foraging, and roosting habitats within the 5 km buffer (Figure 7-2). All suitable waterbodies or habitats considered appropriate for foraging or roosting waterbirds was surveyed.

7.2.8.1.8 Hen harrier roost surveys

Hen harrier roost surveys were conducted during the 2023–24 non-breeding season, in line with NatureScot (2017) guidance. A total of five surveys were undertaken between November and February (inclusive), following best practice methods outlined by O'Donoghue (2019). Surveys were conducted within the core study area and a 2 km buffer (see Figure 7-2) following SNH guidance (2017). Additionally, potentially suitable roosting habitat within the wider 5 km buffer was surveyed.

7.2.8.1.9 Whooper swan surveys

Whooper swan surveys were undertaken during the non-breeding seasons of Year 1 (October to March 2021–22), Year 2 (October to April 2022–23), and Year 3 (October to March 2023–24) within the core study area (Figure 7-2). To ultimately track the whooper swan population and fully understand their movements between the roost site and foraging areas, surveys employed an adapted VP watch methodology at key locations.

VP locations were selected to provide comprehensive coverage of key foraging areas at the northern section of the core study area, encompassing the Camas South townland, and the floodplains of the Camoge River at Ballycullane, the latter located approximately 5.2 km north of the Development boundary. These surveys also incorporated a VP location at Lough Gur, the known roost site for whooper swan.

This methodology follows established best practice guidance for non-breeding waterbird monitoring, including CIEEM (2018) for ecological impact assessment and Wetlands International / I-WeBS (Eaton et al., 2020) for waterbird survey design.

In addition, during the non-breeding season of Year 3 (November 2023 to March 2024) information was collected on flight speed of whooper swan travelling between the roosting site at Lough Gur and key foraging areas located at the Camas South townland and at Ballycullane (Figure 7-5). The surveys involved coordinated observations by teams of two or more surveyors positioned simultaneously at the roosting and foraging sites, enabling accurate recording of departure and arrival times.

7.2.8.1.10 Whooper swans bioacoustic surveys

Bioacoustic monitoring was undertaken at Camas South over two consecutive non-breeding seasons (2022–23 and 2023–24) to record nocturnal activity of whooper swans. This method was used to supplement traditional daytime VP and walkover surveys, enabling detection of flight activity during hours of darkness when visual observations are not feasible.

Recording effort varied between the two seasons. In Year 2 (2022–23), detectors operated for approximately six hours daily, covering the three hours before and after both sunset and sunrise. In Year 3 (2023–24), the monitoring protocol was expanded to 24-hour continuous operation, capturing both diurnal and nocturnal activity. Spatial coverage was also enhanced in Year 3 through the deployment of an additional detector, increasing the likelihood of detecting whooper swan activity across the Study Area.

Bioacoustic monitoring follows established guidance for wintering waterbird surveys, including CIEEM (2018) and Eaton et al. (2020, I-WeBS Waterbird Survey Guidelines), which recommend the use of acoustic methods to detect species with nocturnal or crepuscular flight activity that may not be captured by visual surveys. This approach is particularly suitable for whooper swans, which exhibit regular nocturnal commuting between roost and foraging

areas. The method allows systematic, repeatable detection of activity patterns, providing spatial and temporal data that complement VP observations.

These bioacoustic data provided supplementary information on nocturnal swan movements but were not incorporated directly into the collision risk model (CRM), which relied on VP survey data. Instead, the acoustic surveys supported interpretation of movement patterns, peak activity periods, and spatial flight corridors.

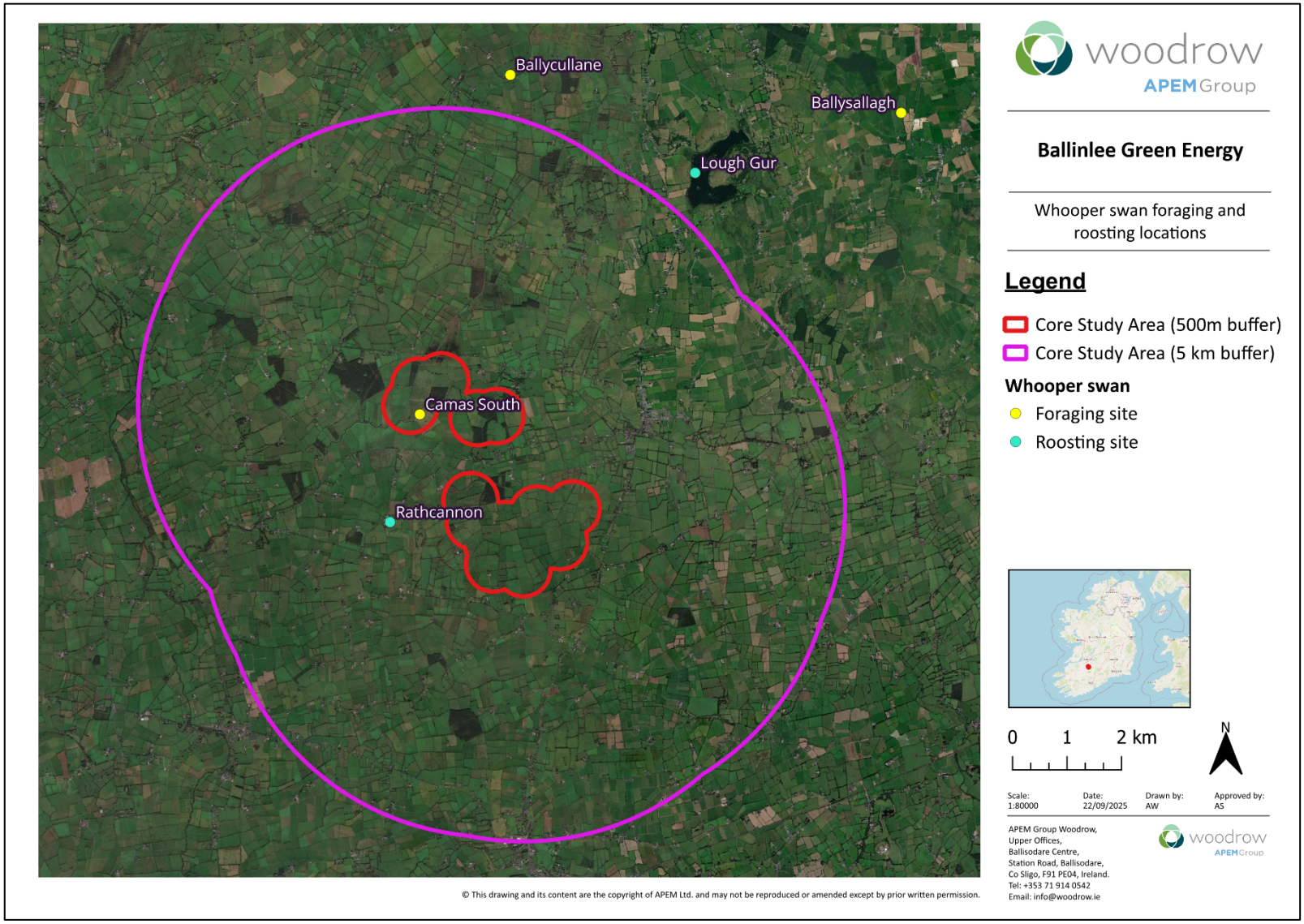

Figure 7-5: Whooper swan foraging locations and roost site

7.2.9 Collision Risk Model (CRM)

The Collision Risk Modelling (CRM) followed the methodology provided by NatureScot (Band, 2024). Bird usage data were obtained from VP watches conducted by experienced ornithological surveyors. Guidance from NatureScot, formerly Scottish Natural Heritage (SNH), (2007, 2014, 2024) also informed the assessment, promoting a standardised approach that increases transparency and stakeholder confidence.

Flightline data for selected target species were collected over a three-year period (October 2021 - September 2024). As per NatureScot guidance, the CRM analysis was undertaken for Years 2 and 3, the two most recent consecutive years.

One turbine model has been specified for use in the Development; the Vestas 136 (V136). CRM was conducted using this turbine specification. The Collision Risk Zone (CRZ) was defined as the height between the minimum and maximum rotor sweep (24–160 m) (except for T6, where the CRZ is between 14-150m, due to a hub height of 82m) within a surrounding 500 m buffer of turbines.

Based on professional judgement, CRM was run for target species that met the following criteria: Aggregate flight time > 300 seconds within the CRZ (at collision risk height and within the turbine envelope) in a given year; and more than three flight observations across the baseline survey period.

These thresholds are broadly consistent with standard practice in wind farm collision risk assessments, as outlined in guidance by NatureScot (2024) and other UK/EU sources (SNH, 2007; SNH, 2014; Scottish Renewables/SSN, 2016). The aggregate flight time threshold ensures that species with minimal exposure are not modelled, avoiding predictions based on very limited data that would have low statistical reliability. Similarly, requiring more than three flight observations over the baseline period prevents inclusion of species with sporadic or incidental flights, which could otherwise inflate or skew collision risk predictions. These criteria represent a precautionary but proportionate approach, focusing the CRM on species for which robust, representative flight data exist, while maintaining transparency and comparability with other assessments in the UK and Ireland.

Avoidance rates in CRM represent the proportion of birds assumed to detect and avoid turbines while flying through the rotor-swept zone (SNH 2024). Higher rates (i.e. 99.0-99.5%) are applied to species with strong avoidance behaviour, reducing predicted collision mortality. Lower rates (i.e. 95.0-98.0%) are used for more vulnerable or less responsive species, resulting in higher predicted impacts (SNH 2024).

Based on the criteria outlined above, for Year 2 the CRM was run for 12 species, including:

- Black-headed gull *Chroicocephalus ridibundus*
- Buzzard *Buteo buteo*
- Cormorant *Phalacrocorax carbo*
- Golden plover *Pluvialis apricaria*
- Kestrel *Falco tinnunculus*
- Lapwing *Vanellus vanellus*
- Lesser black-backed gull *Larus fuscus*
- Mallard *Anas platyrhynchos*
- Peregrine *Falco peregrinus*
- Snipe
- Sparrowhawk *Accipiter nisus*
- Whooper swan

For Year 3 the CRM was run for nine species, including:

- Buzzard

- Cormorant
- Golden plover
- Grey heron *Ardea cinerea*
- Kestrel
- Lapwing
- Mallard
- Sparrowhawk
- Whooper swan

All other target species were scoped out of CRM due to the absence of, or extremely low, levels of flight activity within the Collision Risk Zone (CRZ). The full CRM methodology, along with justification for species scoped into or out of the model, is presented in Appendix 7C Avian Collision Risk Modelling Report.

7.2.10 Statement of Limitations

This section outlines the limitations of ornithological surveys undertaken during the three-year study period. With minor constraints, such as restricted land access and variation in walkover routes between years, the data collected are considered sufficiently robust to inform the ornithological impact assessment.

Surveys were conducted where land access was granted or from public roads and rights of way. To ensure representative sampling across all key habitat types within the Development and the 2 km and 5 km buffers, survey routes and vantage points were strategically selected based on habitat mapping, previous species records, and expert knowledge. Indirect observations from accessible areas were used to infer use of less accessible locations. This approach ensured that all areas of ecological significance, as indicated by survey data and known species distributions, were adequately considered, providing a robust and representative dataset despite access and boundary constraints.

Surveys were designed around the core study area, which aligns with the turbine layout of the Development. As a result, a small number of discrete locations, comprising less than 0.1% of the core study area, where infrastructure such as access tracks and cable routes are proposed, were not directly surveyed in all seasons. These areas consist primarily of agricultural land and small patches of conifer plantation or improved grassland, all of which are habitat types well represented elsewhere within the surveyed area.

Given the extensive coverage of similar habitats in adjacent and nearby parts of the Development, and the fact that target species were recorded using such habitats during baseline surveys, it is considered unlikely that the limited un-surveyed areas represent functionally unique or higher-value habitats. While it cannot be categorically excluded that small patches may hold occasional value, the high degree of habitat continuity and the consistent patterns of species use observed during surveys support the conclusion that omission of these areas does not materially affect the assessment outcomes. This approach follows standard ecological practice, whereby representativeness of surveyed habitats and species use can be reasonably inferred across comparable un-surveyed areas (CIEEM, 2018).

To address a gap identified along the eastern boundary of the Core Study Area in Year 1, an additional vantage point (VP) was introduced in subsequent years, ensuring full coverage of the turbine area. Across Years 1, 2, and 3, a minimum of 36 hours of VP watches per season was achieved at each location, except in Year 1 (breeding season 2022), with 30 hours completed.

While survey routes varied between years, this is not considered a significant limitation. Habitat coverage across the Development and wider study areas remained representative. Variability was offset by increased observer effort in subsequent visits and the integration of complementary survey methods, ensuring comprehensive spatial

and temporal representation of bird activity. Key habitat types were consistently surveyed, and IOFs were effectively monitored.

Territories of key species were monitored consistently throughout the survey period. This was achieved through a combination of targeted walkover surveys, detailed territory mapping, and vantage point observations. Survey effort was strategically distributed to ensure that known or likely breeding areas were visited at ecologically appropriate times during the breeding season, enabling the detection of key behaviours such as territorial display, nesting activity, and chick-rearing. This approach ensured that interannual variation in survey routes did not compromise the robustness of the dataset or the reliability of ecological conclusions.

Surveys were undertaken under favourable weather conditions, with pauses during poor weather (i.e. wind speeds exceeding Beaufort scale F5 or low visibility). Weather conditions were monitored throughout, and surveys were resumed once suitable conditions returned, ensuring data reliability. Variation in conditions is considered to reflect a realistic baseline of bird activity.

In conclusion, notwithstanding minor limitations in access and methodology, the overall dataset is considered sufficient to identify all sensitive ornithological features and to support a robust and reliable assessment of potential significant effects arising from the Development.

7.2.11 Scientific Nomenclature Conventions

Bird species referenced in this chapter follow binomial nomenclature at the first mention of each species' common name, with the scientific name written in full and italicised. Subsequent references use only the common name. Irish (English language) common and scientific names of bird species referred to in this report follow those used by the British Ornithologists' Union (BOU)[8]. Where appropriate, geographic prefixes such as "common," "European," or "Eurasian" are not included.

7.3 Existing Receiving Environment

7.3.1 Desk Study

7.3.1.1 Existing Ornithological Records

A detailed description of the existing ornithological records within the Study Area and wider area can be found in the Baseline Ornithology Report (**Appendix 7B**), with a summary provided below.

A review of existing datasets indicates that the Development and surrounding study areas support a modest assemblage of non-breeding waterbirds, with key areas of interest including Lough Gur and, to a lesser extent, Charleville Lagoons (Site code: 0L003), located approximately 9.2 km to the south-west of the proposed development. I-WeBS count data for Lough Gur, the only site in the vicinity with nationally important waterbird numbers, confirms regular winter use by a range of species including whooper swan, greylag goose, wigeon, teal, lapwing, and tufted duck. Notably, peak counts of tufted duck exceeded the 1% national population threshold, indicating national importance for this species at this site.

8 - Bird nomenclature follows the British Ornithologists' Union (BOU) and the International Ornithological Congress (IOC) World Bird List, with English and scientific names aligned to the most recent BOU taxonomic recommendations (BOU, 2013; updated online).

The whooper swan flock associated with Lough Gur is one of the few recorded in the region, and suitable foraging habitat exists within the Development and 5 km buffer, primarily in low-lying agricultural grasslands. While the Development lies beyond the typical core foraging ranges of designated SCI species from nearby SPAs, including the River Shannon and River Fergus Estuaries SPA (18.2 km northwest) and Kilcolman Bog SPA (21.2 km south), the presence of migratory waterbird species such as whooper swan and greylag goose supports the need for careful consideration of potential indirect impacts, including disturbance and displacement.

I-WeBS count data show that non-breeding waders, such as lapwing, curlew, and golden plover, are recorded sporadically at Lough Gur, though well below national importance thresholds. Black-headed gull was the most regularly recorded gull species, while common gull and lesser black-backed gull occurred only occasionally, with count data suggesting a relatively mobile and sporadic use of the area by gulls in winter.

The Lough Gur pNHA, located approximately 5 km northeast of the Development, is the only nationally designated ornithological site nearby and is recognised for its wetland communities and associated birdlife, though it is not hydrologically connected to the Development.

Sensitivity mapping (McGuinness *et al.*, 2015) classifies the 2 km buffer as of low sensitivity to wind farm development, though the presence of several species of conservation concern, such as whooper swan, greylag goose, lapwing, and curlew, warrant consideration for appropriate mitigation and monitoring where relevant.

7.3.1.2 Designated Sites

The National Parks and Wildlife Services (NPWS) Designations Viewer[9] was also used to identify the location of sites designated for ornithological features that may have potential connectivity to the Development. The search applied the following criteria:

- Internationally important sites - Special Protection Areas (SPAs) and Ramsar sites within 20km of turbine locations. Special Areas of Conservation (SACs) are assessed in **Chapter 6** Biodiversity;
- Nationally important sites - Natural Heritage Areas (NHAs) and pNHAs within the same 20km radius.

A 20 km buffer was selected to align with the recognised zone of potential connectivity for sites designated for non-breeding swans and geese, in accordance with standard SNH (2016) guidance on assessing connectivity with SPAs. For other wildfowl and wader species, potential connectivity is typically limited to 15 km; however, the 20 km search area ensures a precautionary approach and comprehensive assessment of all relevant sites.

Three designated sites were identified within the defined search area. The locations of the relevant designated sites are shown in **Figure 7-6** with details of its proximity to the Development and their qualifying ornithological features provided in **Table 7-4** below.

The Grid Connection Route (GCR) and Turbine Delivery Route (TDR) were not included within the 10 km designated site search buffer. The GCR intersects several hydrologically connected watercourses, including the Morningstar River, which flows downstream to the River Shannon and Fergus Estuaries SPA. While this represents a potential pathway for ecological connectivity, no ornithological features are directly associated with the GCR or TDR, and these areas fall outside the core study area.

9 https://www.npws.ie/maps-and-data/designated-site-data (Accessed 15/04/25)

Table 7-4: Designated Sites within 20 km of the Development

Designated Site and Distance to Development	Qualifying Ornithological Features	Potential S-P-R connectivity considered (i.e. proximity of the feature[10] or hydrological connectivity[11])	S-P-R identified and considered further within this assessment? Yes/No
River Shannon and River Fergus SPA Site code: 004077 Approximately 18.2 km northwest	Cormorant (Phalacrocorax carbo) [A017] Whooper swan (*Cygnus cygnus*) [A038] Light-bellied Brent goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Wigeon (Mareca *penelope*) [A050] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (Spatula *clypeata*) [A056] Scaup (*Aythya marila*) [A062] Ringed Plover (*Charadrius hiaticula*) [A137] 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] Greenshank (*Tringa nebularis*) [A164] Black-headed gull (*Chroiccocephalus ridibundus*) [A179] Wetland and Waterbirds [A999]	A weak hydrological connection exists via the Morningstar River and other watercourses intersected by the GCR. However, the GCR is outside the main development footprint and no direct functional connectivity with qualifying species was identified. See Section 7.3.2. The Morningstar River flows downstream for c. 7.2 rkm until it joins with the River Maigue, which then flows further downstream for c. 27.2 rkm into this SPA. The GCR also intersects four hydrologically connected watercourses and extends to within 190 m of the River Groody at its point of termination, c. 12.6 km upstream of the SPA.	Yes
Lough Gur pNHA Site Code: 000437 Approximately 4.6 km northeast	No listed SCI bird species Supports nationally important numbers of shoveler, tufted duck and coot, in addition to other species including cormorant, mute swan, whooper swan, teal,	There is ecological connectivity between the Development and this pNHA. The Development is located within the foraging range of waterbird species for which the pNHA is designated. Notably the whooper swan population that roost at Lough Gur and can travel up to 5	Yes

10 Measured in a straight line between the site and closest point of European site boundary.

11 Hydrological connections indicated in river kilometres, 'rkm'.

Designated Site and Distance to Development	Qualifying Ornithological Features	Potential S-P-R connectivity considered (i.e. proximity of the feature[10] or hydrological connectivity[11])	S-P-R identified and considered further within this assessment? Yes/No
	gadwall, mallard, pochard, lapwing and curlew. Some of the habitats found at the Lough were recorded supporting the rare plant species golden dock.	km to foraging grounds [12] located c. 4.6 km northeast. The GCR also crosses a hydrologically connected watercourse that flows into Lough Gur, representing a potential pathway for connectivity between the Development and the pNHA.	
Herbertstown Fen pNHA (Site code: 000436) Approximately 8.3 km northeast	Nationally important wetland and calcareous fen habitat. Provides foraging opportunities for waders, but no ornithological features present.	No ornithological pathway; not included in I-WeBS network therefore not considered to be an important wetland site of wintering waterbirds.	No

12 SNH (2016) Assessing Connectivity with Special Protection Areas (SPAs) Guidance. Version 3 – June 2016

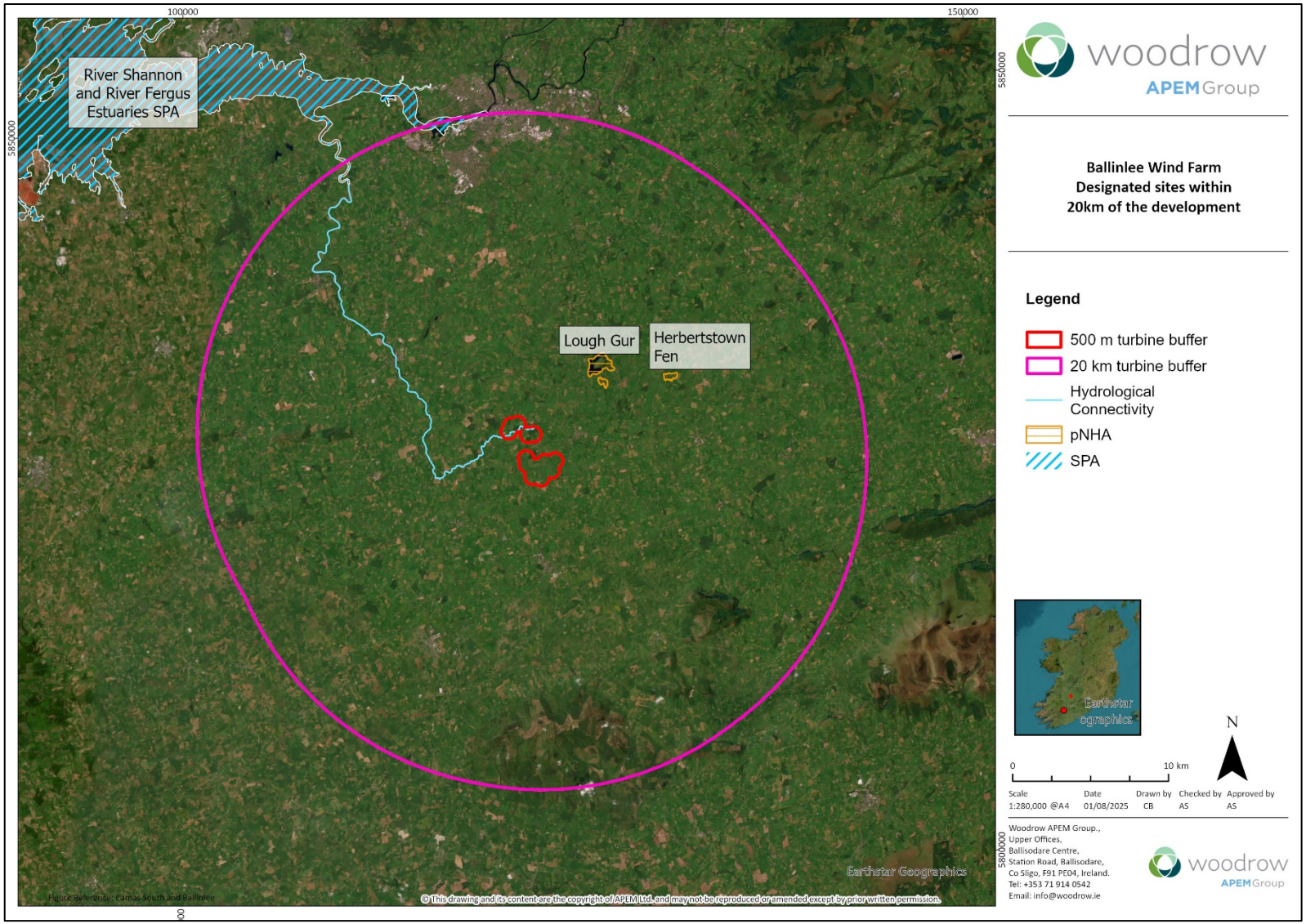

Figure 7-6: Designated Sites within 20 km of the Development

7.3.2 Ornithological Surveys

7.3.2.1 Ornithological baseline

The following section presents summarised ornithological findings from surveys undertaken between October 2021 and September 2024 inclusive. **Table 7-5** illustrates observations recorded within the core study area (**Figure 7-2**), defined as a 500 m buffer of turbines during VP watches. Results from all baseline surveys are then provided in the form of individual species accounts and include all target species as recommended NatureScot (2021).

Species names in **Table 7-5** and **Table 7-6** are presented with colour-coding corresponding to their conservation status as defined by *Birds of Conservation Concern in Ireland 2020–2026* (Gilbert *et al*., 2021):

- Red-list (high conservation concern),
- Amber-list (medium conservation concern),
- Green-list (low conservation concern).

Table 7-5: Ornithological activity recorded within 500 m of turbines during VP watches

Species *[13]	Activity – No. of observations						
	Year 1 Non-breeding	Year 1 Breeding	Year 2 Non-breeding	Year 2 Breeding	Year 3 Non-breeding	Year 3 Breeding	Total
Black-headed Gull	7	-	11	1	5	1	25
Buzzard	27	38	61	57	32	87	302
Common gull	3	-	-	-	-	-	3
Cormorant	1	11	23	20	7	25	87
Curlew	-	-	-	3	1	-	4
Dunlin *	-	-	1	-	-	-	1
Golden plover *	1	-	10	5	5	-	21
Great black-backed gull	-	-	1	-	3	-	4
Grey heron	4	7	7	21	8	16	63
Greylag goose	1	-	1	-	-	-	2
Herring gull	-	-	-	-	1	1	2
Jack snipe	-	-	1	-	-	-	1

[13] - Denotes species listed on Annex I of the Birds Directive

Species *[13]	Activity – No. of observations						
	Year 1 Non-breeding	Year 1 Breeding	Year 2 Non-breeding	Year 2 Breeding	Year 3 Non-breeding	Year 3 Breeding	Total
Kestrel	38	30	94	56	21	18	257
Lapwing	3	-	17	1	12	-	33
Lesser black-backed gull	2	12	26	32	3	-	75
Little egret *	7	3	4	6	2	-	22
Mallard	5	2	9	21	-	11	48
Merlin	-	-	2	-	-	-	2
Mute swan	5	-	7	6	9	1	28
Peregrine *	4	2	8	1	-	-	16
Raven	-	-	-	-	1	-	1
Snipe	5	2	26	7	6	1	47
Sparrowhawk	5	5	14	8	12	13	57
Teal	-	-	1	-	-	-	1
Whooper swan	9	-	25	-	16	-	50
Woodcock	-	-	-	-	1	-	1
Total	127	112	349	245	146	174	1153

7.3.2.2 Waterbirds

The following waterbird species were recorded during baseline surveys:

7.3.2.2.1 Mute swan

During VP watches, mute swan *Cygnus olor* flights were recorded on 28 occasions within the core study area, with numbers ranging from one to seven birds. The majority of flights occurred during the non-breeding seasons, which is consistent with slightly higher local abundance in winter. At least six observations involved no flights, with birds recorded foraging on the ground.

Supplementary VP watches and incidental surveys during the non-breeding seasons of 2022–23 and 2023–24 recorded small numbers of wintering mute swans (one to six birds) within the core study area and the 2 km buffer.

Breeding season records were limited to six observations (up to seven birds) during Year 2 VP watches, and six records during Year 3 breeding bird surveys, with Year 3 survey including the area of the Morningstar River in

which the mute swan nesting was confirmed, involving a single pair that successfully bred and raised four cygnets. It is possible that all six birds were involved in a flight through the core study area in early September 2024.

Mute swan numbers within the 5 km buffer during the non-breeding season were based on peak counts of up to 11 individuals recorded during dedicated wintering waterbird surveys, and a maximum of 38 individuals recorded at Lough Gur during I-WeBS counts in the 2022–2023 winter period. While mute swans were observed at Lough Gur, no evidence of connectivity between these individuals and the Development was identified through baseline survey data.

The mute swan is BoCCI Amber-listed, primarily due to its localised breeding distribution and congregatory behaviour, but is otherwise considered to have a stable population and favourable conservation status in Ireland, with an estimated breeding population of 2,500 – 3,000 pairs and a wintering population potentially exceeding 10,000 individuals.

7.3.2.2.2 Whooper swan

Whooper swan presence and behaviour within the core study area and at Ballycullane (Figure 7-5) over three non-breeding seasons (2021-22, 2022-23, and 2023-24) displayed fluctuating numbers and varying patterns of use. Swans were observed in all years during the core non-breeding period, typically from October through March, with peak numbers occurring between December and February. Observations confirmed regular movements between the Lough Gur roost and key foraging areas, demonstrating strong functional connectivity.

In Year 1 (2021–22), swans were recorded from late October through late February, absent in March. Most observations were concentrated at Camas South early in the season, with no presence at Ballycullane until late January. Peak counts occurred on 27 January 2022, with a total of 67 birds (51 at Camas South and 16 at Ballycullane). Flock sizes at Ballycullane ranged from one to 55 birds, and at Camas South from two to 51 birds, based on available counts.

In Year 2 (2022–23), swans were recorded from early November through March, with no observations in October. Moderate numbers were observed, with a peak of 33 swans recorded at Camas South on 14 December 2022. Several behavioural observations indicated active movement between sites. Ballycullane counts ranged up to 20 birds, and Camas South peaked at 33. Flock sizes ranged from two to 33 birds at Camas South and up to 20 at Ballycullane. Bioacoustics monitoring undertaken during this season operated within a standard ±3-hour window before and after sunrise and sunset, recording 406 nocturnal detections. Peak hourly activity occurred in the early evening, around 17:00, with most detections concentrated between approximately 16:45 and 17:45, corresponding with visual observations of commuting behaviour. Activity outside these monitoring windows was not recorded.

In Year 3 (2023–24), swans were consistently present from October through March at both sites. Peak counts were recorded on 17 January 2024 with 71 birds (59 at Camas South and 12 at Ballycullane). Flock sizes at Ballycullane ranged from one to 59 birds, and at Camas South from two to 39 birds, demonstrating substantial usage of both sites throughout the winter. Bioacoustics monitoring during this season recorded 1,904 nocturnal detections across 24-hour continuous monitoring. When analysed within the same ±3-hour windows used in Year 2, detections increased from 385 to 822, a 113% rise, confirming that the observed increase in activity reflects genuine changes in seasonal site use rather than solely extended monitoring effort. The majority of detections occurred in December, which accounted for 87.5% of the seasonal total. Notably, detections were spatially concentrated at Camas South, particularly near T3, and temporally peaked between 00:00 and 01:00, indicating concentrated nocturnal flight activity between foraging and roosting areas. In contrast, February monitoring indicated a shift in peak activity to the early evening, with most detections occurring between roughly 16:45 and 17:45, corresponding with visual observations of commuting behaviour. March activity was lower and concentrated in the morning around 07:00, highlighting a seasonal shift in swan movement patterns.

Based on peak daily counts, the average flock sizes recorded at Ballycullane and Camas South were approximately 10 and 12 birds, respectively, with Ballycullane showing a range of one to 59 birds across years, and Camas South ranging from two to 51 birds. Combining data from both sites over the three non-breeding seasons, the overall mean flock size was about 12 birds.

Overall, Camas South supported more consistent whooper swan presence throughout the non-breeding season, while Ballycullane showed increasing usage in the latter half, likely reflecting seasonal changes in food availability and its closer proximity to the Lough Gur roost. Observations confirmed the importance of both sites for foraging, with frequent movements between them and the roost location at Lough Gur, indicating strong functional connectivity between the core study area and this designated site. The combined results of daytime visual VP surveys and nocturnal bioacoustics monitoring confirm that Camas South in particular functions as a key part of a nocturnal foraging and flight corridor system associated with the Lough Gur roost.

In addition to general observations, roost surveys were conducted between November 2023 and March 2024 to assess the movements of whooper swans between their roosting and foraging sites. A total of 18 individual flights were recorded, with the highest combined count of 69 swans being recorded in February 2024, which also coincided with the peak flight speeds of the season. These findings suggest that whooper swans demonstrate regular and efficient commuting behaviour between roosting and foraging sites, with external factors such as weather and wind influencing flight speed and duration. Bioacoustics data further corroborated this commuting behaviour, with concentrated detections aligning with known roosting and foraging times, thereby enhancing understanding of swan activity patterns beyond the limits of daytime surveys.

The whooper swan is a BoCCI Amber-listed species and listed on Annex I of the EU Birds Directive, reflecting its status as a species of conservation concern in Ireland. Although it does not breed in the country, Ireland supports an internationally important wintering population, estimated at ~19,112 individuals (NPWS, 2020), with approximately 493 individuals recorded in Co. Limerick during the 2020 International Swan Census (Crowe *et al*., 2020). The species is also listed as an SCI for the River Shannon and River Fergus Estuaries SPA, located 18.2 km northwest of the Study Area; however, the flocks observed within the core study area are associated with the regularly used roost location at Lough Gur rather than the SPA population. Whooper swan surveys undertaken for the Development have confirmed there is no interaction between the Lough Gur population and the River Shannon and River Fergus Estuaries SPA. Peak counts at Camas South represent up to ~9% of the Co. Limerick total. Regular wintering flocks were recorded within the core study area and surrounding landscape, with movement patterns indicating a functional link to Lough Gur and nearby wet grasslands. While Lough Gur does not support nationally important numbers, it provides habitat for a locally significant portion of the Co. Limerick population, with consistent seasonal use and ecological connectivity to a designated pNHA. Baseline surveys over three non-breeding seasons (2021–2024) recorded swans foraging at distances of approximately ~200–600 m from proposed turbine locations, with foraging within 200 m observed primarily near turbine T3. The primary functional foraging areas comprise Camas South (within the core study area) and Ballycullane (~5.2 to north of the core study area), which are used interchangeably across the non-breeding season, highlighting their functional importance for swan foraging during winter.

7.3.2.2.3 Brent goose

Just two observations of Brent Goose *Branta bernicla* were made during non-breeding waterbird surveys in Year 3, involving a single bird and a flock of ten individuals flying in a northeasterly direction over the core study area in November 2023.

The light-bellied brent goose *Branta bernicla hrota* is BoCCI Amber-listed and is an SCI species for the River Shannon and River Fergus Estuaries SPA, reflecting its national and international importance as a wintering species in Ireland. However, given the extremely low frequency of observations within the Development, there is no connectivity to the SPA identified or population of ecological significance present.

7.3.2.2.4 Greylag goose

During VP watches, three observations of greylag goose *Anser anser* were recorded, including a single flight of eight birds occurring within the Collision Risk Zone (CRZ). Additionally, a flock of 16 individuals was noted as an incidental record in November 2021, travelling south at 100 m altitude between Manus and Fedamore, passing over Ballycullane. A further flock of six was observed foraging within the core study area throughout a VP watch in February 2022. No regular flight paths between foraging and roosting locations were identified.

The only breeding season record involved a group of five birds seen in the 2 km buffer during a raptor survey in April 2022, and there was no evidence of any breeding behaviour recorded.

The desk study indicated variable wintering numbers at Lough Gur, with I-WeBS counts ranging from five to approximately 44 birds during the winter months between 2017-18 to 2020-2021 (Burke *et al.,* 2022). Year 2 and Year 3 non-breeding waterbird surveys confirmed that wintering greylag geese occur in small numbers at Lough Gur, occasionally foraging in agricultural fields to the south. Peak counts included 37 birds in December 2023, with smaller groups of five and six in February and March 2024, respectively. Although the species was recorded using Lough Gur, limited evidence of connectivity to the Development was identified based on the results of baseline surveys.

Greylag goose was recorded only occasionally and in low numbers within the core study area, with no indication of regular usage, roosting, or breeding activity. Importantly, the individuals observed are assessed to belong to the widespread, naturalised feral population rather than the migratory Icelandic population, which is of higher conservation concern. Greylag goose is not a qualifying feature of any designated site within the identified 20 km ZoI.

7.3.2.2.5 Pink-footed goose

A single record of four pink-footed geese *Anser brachyrhynchus* was recorded during a survey in January 2024. The birds were seen leaving Lough Gur with eight whooper swans and subsequently foraging with them in the northern section of the core study area.

While not a major wintering species in Ireland, the pink-footed goose is BoCCI Amber-listed due to its restricted occurrence and the international importance of its migratory populations. A single record within the wider study areas highlight the dynamic and occasionally unpredictable nature of the wider migratory landscape. However, this was an isolated observation over a three-year period, with no evidence of regular or sustained use of the Development.

7.3.2.2.6 Mallard

During VP watches a total of 48 flight observations were recorded within the core study area, with numbers recorded ranging from one to eight birds.

Supplementary VP watches conducted between October 2023 and March 2024 recorded up to eight birds within the core study area.

Nesting was suspected during each breeding season within the core study area, particularly along the Morningstar River, and breeding was confirmed in 2024 when nest-building was observed.

Mallard was regularly recorded in small numbers (one to four individuals) during winter walkover, wintering waterbird, and breeding bird surveys across all three survey years. The species was widespread and dispersed in winter, typically occurring in small to moderate numbers across a range of freshwater and agricultural habitats

within the 5 km buffer. Occasional larger aggregations may occur at favourable locations, such as Lough Gur, where a peak count of 66 individuals was recorded in December 2022.

Although mallard was frequently recorded within the Development and surrounding area, the usage was low-density, and the species is common and broadly distributed in the wider landscape. It is BoCCI Amber-listed due to moderate declines in breeding and wintering populations and partial reliance on wetland habitats of conservation concern. No evidence of significant functional connectivity between Lough Gur and the Development was identified during baseline surveys.

7.3.2.2.7 Teal

Teal *Anas crecca* were recorded six times during structured surveys over the three-year monitoring period. Three birds were initially seen on the ground during a VP survey in December 2022; the group later flew off at a low altitude (approximately 2 m) and did not enter the CRZ.

During a breeding bird survey in March 2024, a group of six teal was flushed from a section of the Morningstar River within the core study area. There was no evidence of breeding activity recorded, and this sighting involved birds still on passage.

A further four records were documented during Year 3 winter waterbird surveys, with small numbers (ranging from 2 – 12 individuals) recorded at Lough Gur, and a peak count of 51 in January 2024. Lough Gur is a known wintering location for teal, with historical I-WeBS counts including 381 individuals in winter 2011-12 and 140 in winter 2020-21. More recent peaks include 78 in February 2023 and 63 in January 2024. The 2011-12 count exceeds the importance threshold of 1% of the national population (1% threshold: 360 birds), confirming Lough Gur's potential importance for the species in some winters.

Although teal was recorded regularly at Lough Gur during the winter months, baseline survey results showed only irregular and small numbers within the Development, with no evidence of functional connectivity between the two locations. Teal is a widespread wintering species in Ireland, typically favouring shallow freshwater wetlands, flooded fields, and lowland lakes. While teal were observed at both Lough Gur and within the core study area, the limited spatial scope of the baseline surveys (restricted to a 500 m buffer) and the absence of consistent directional flight observations or repeated use of specific foraging areas mean that regular functional connectivity between the two areas cannot be confirmed. However, given these survey limitations, such connectivity cannot be definitively ruled out either.

7.3.2.2.8 Common sandpiper

A single record of common sandpiper involved two birds observed during a wintering waterbird survey in November 2023, flying in association with a flock of lapwing over an area of temporary standing water at the northern edge of the core study area. This is an atypical observation, as the species is primarily a summer migrant to Ireland, typically occurring on autumn passage between July to September. It is most frequently associated with estuaries, lakes and coastal wetlands rather than inland farmland or artificial habitats.

Its breeding population in Ireland is small, scarce and localised, with confirmed breeding largely restricted to upland areas in the west and north-west (Fitzgerald *et al.*, 2021). Overwintering is exceptionally rare, and the November sighting likely represents either late migrants or transient individuals displaced by weather conditions or habitat disturbance elsewhere.

Given the species' status in Ireland as a scarce summer visitor, the absence of suitable breeding or regular foraging habitat, and the extremely low frequency of observations, there is no population of ecological significance associated with the Development.

7.3.2.2.9 Curlew

During VP watches, four observations of curlew *Numenius Arquata* were recorded, with three flights involving a single bird recorded in August 2023. The other sighting was of a flock of ten birds recorded in October 2023 but that did not fly through the CRZ.

Non-breeding season records were limited to Years 2 and 3 and were primarily associated with an area of temporary standing water at the northern edge of the core study area, with two small flocks (12 – 14 individuals) observed feeding or roosting. In the non-breeding season 2022-23, two birds were recorded during winter walkover surveys in November, and a flock of 24 was noted near a stud farm pond approximately 900 m west of the 2 km buffer during a raptor survey in February 2023. Additional flocks of 10 and 24 birds were recorded at the northern edge of the core study area as incidental observations in February and October 2023 respectively. In the non-breeding season 2023-24, eight birds were seen during a supplementary VP watch in October, and further flocks of 8–28 individuals were recorded on three occasions between December 2023 and February 2024 during waterbird surveys. The maximum number of birds recorded within the core study area was just 24 with a mean of eight reported from just 10 sighting over the three years of survey.

Curlew is one of Ireland's most threatened bird species, BoCCI Red-listed due to severe breeding population declines, it is also included on Annex II of the EU Birds Directive and is listed as an SCI of the River Shannon and River Fergus Estuaries. In Ireland, it is of critical conservation concern as a breeding species and is also an important component of the wintering waterbird assemblage, particularly in lowland wet grasslands and estuarine habitats.

While curlew was occasionally recorded in winter using parts of the core study area and wider 5 km buffer, these records were intermittent and limited to small flocks (maximum 24) using temporary wetland features, suggesting only opportunistic and low-intensity use of the Development. No functional connectivity with Lough Gur was established based on observed movement patterns.

Although curlew was also detected during VP watches in the breeding season**,** no breeding behaviour (e.g. displaying, territorial calling, or nesting) was observed, and no breeding birds were recorded within the 2 km and 5 km buffers during targeted breeding surveys.

Curlew are sensitive to disturbance, particularly at non-breeding foraging and roosting sites. Recommended buffer distances for non-breeding curlew typically extend to 400 m (Mason *et al*., 2018), while guidance for wind farm development in Ireland and the UK notes that displacement effects can occur up to 250–500 m from active works depending on activity type, topography, and habitat context (NPWS, 2019; SNH, 2017).

Breeding Eurasian curlew have undergone a severe national decline, with Ireland's population decreasing by over 97% since the late 1980s. In Co. Limerick, curlew formerly bred in suitable lowland grassland and bog habitats, as evidenced by historical records (Sharrock, 1976), but recent surveys indicate the species is now likely extirpated as a breeder in the county. No breeding activity was recorded during the baseline surveys, aligning with broader national patterns of range contraction and local loss.

7.3.2.2.10 Dunlin

A single observation of two dunlin *Calidris alpina* was recorded during a VP watch in November 2022. No additional sightings were made during any other survey period across the three years of baseline data collection.

Dunlin is a BoCCI Red-listed species due to significant long-term declines, especially among the Irish breeding population. It is also listed as an SCI species for the River Shannon and River Fergus Estuaries SPA, where it contributes to the SPA's internationally important wintering waterbird assemblage.

However, the birds recorded during the survey were presumed wintering individuals, and no functional connectivity between the Development and the SPA was established. Moreover, the habitat within the Development is of limited suitability, and no suitable foraging or roosting features of relevance to dunlin were identified.

Given the extremely low frequency of observations**,** lack of suitable habitat, and absence of any evidence of regular or significant usage, dunlin is not considered to form a population of ecological significance within the Development**.**

7.3.2.2.11 Golden plover

During VP watches, 21 golden plover flights were recorded within the core study area, with flock sizes ranging from nine to 130 birds. Sixteen of these flights occurred during non-breeding season surveys between October and January, as expected given the higher wintering numbers in the area. Peak counts of 80 and 100 occurred during October 2022 and January 2023, respectively. Only five flights were recorded during the breeding season (early April 2022 and 2023, with up to 130 birds) and these are considered to be non-breeding flocks on passage migration. Of all VP observations, only one involved birds landing within the core study area: 80 individuals in October 2022.

Additionally wintering records from waterbird surveys include two occasions where golden plover where observed on the ground: 40 birds in the northern section of the core study area in November 2023 and 62 birds near the southwest boundary of the 5 km buffer in March 2024. A significantly larger flying flock of 750 birds were observed just outside the southeastern boundary of the core study area in December 2023. While the 750-bird count represents the maximum single observation, it was not typical.

Across three winters (2021–2024), 20 observations yielded an average of 96 individuals, with mean counts of 65 in 2021–22, 70 in 2022–23, and 43 in 2023–24.

While the peak count of 750 is notable, it falls just below the 1% national threshold (~850–1000 individuals) used to define site-level importance for non-breeding waterbirds in Ireland. This context indicates that although the Development may occasionally support significant numbers of golden plover, overall usage is intermittent and generally below thresholds considered to confer conservation significance at the national level.

Golden plover is BoCCI Red-listed in Ireland due to declines in its European breeding population and changes in overwintering distribution. It is also an SCI species of the River Shannon and River Fergus Estuaries SPA, where it forms part of the internationally important wintering wader assemblage. While golden plover is a qualifying interest of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code 004161), this site lies over 30 km from the Development, well beyond the species' typical non-breeding foraging range of 10–11 km (NatureScot 2022; Natural England 2010).

7.3.2.2.12 Jack snipe

A single record of two Jack snipe *Lymnocryptes minimus* was seen flying through the core study area in February 2023. The birds were recorded at an estimated height of 10 m and therefore did not enter the CRZ.

Jack snipe typically flies at low altitudes, often below 10 m, during both routine movements and migration. This low flight behaviour is well documented (e.g. Cramp & Simmons, 1983) and has been consistently observed in field studies. Combined with the extremely low frequency of observations and the absence of evidence for regular or sustained use of the core study area, there is no population of ecological significance associated with the Development.

7.3.2.2.13 Lapwing

During VP watches, 33 lapwing flights were recorded within the core study area, with flock sizes ranging from four to 190 birds. All recorded flights, except one, occurred during the non-breeding season surveys, as expected given the higher wintering numbers in the area. Lapwings were recorded flying through the core study area in most months during non-breeding VP surveys, with peak counts occurring in November (70) in Year 1, December (190) in Year 2 and January (138) in Year 3.

These flocks were frequently seen moving through the Development, with a notable preference for the vicinity of Camas North, located at the northern border of the core study area, and the area around a farm pond at Rathcannon, approximately 900 m to the west. Further observations were made during winter walkover and wintering waterbird surveys, as well as several incidental observations during Year 2 and 3, with a peak count of 88 birds in October 2023.

No records were made between April and August, and no evidence of lapwing breeding within the core study area. A single record of four birds foraging during a September 2023 VP watch likely relates to post-breeding or early autumn movement rather than local nesting. Lapwing was historically a breeding species in this part of Co. Limerick, with records from the 10 km grid squares R53 and R63 (Sharrock, 1976; Gibbons *et al*., 1993). However, consistent with national declines in the lowland breeding population, it is no longer considered a regular breeder in the area.

Peak counts within the core study area represent approximately 0.14–0.16% of the national non-breeding population (100,000 individuals; Crowe *et al*., 2021), indicating that while locally important, the population using the Development does not approach national threshold levels of significance.

Lapwing is BoCCI Red-listed due to sustained declines in both breeding and wintering populations. Ireland holds internationally important numbers of wintering lapwing, and the species is listed on Annex II of the EU Birds Directive, under which hunting must be compatible with sustainable population levels.

7.3.2.2.14 Snipe

During VP watches, 47 snipe flights were recorded within the core study area, with flock sizes ranging from one to 23 birds. The majority of these flights (37) occurred during non-breeding season surveys, as expected given the higher wintering densities of snipe across Ireland during this period. Peak monthly counts occurred in Year 2, including 12 birds in November, 13 in December, 12 in January, and a high of 23 in February. By March the peak count had dropped to three individuals, consistent with the expected departure of wintering birds to northern breeding grounds. All other VP observations during the non-breeding season involved counts of just one or two birds.

Snipe were also occasionally encountered during breeding season VP watches, though at consistently low densities, typically just one or two birds. A single higher count of nine birds was recorded in September 2023, interpreted as early winter arrivals or late passage birds. Similarly, incidental sightings of 1–9 birds were noted during late March, April, and September across the three survey years, further supporting their classification as non-breeding season visitors.

The only breeding season records came during Year 3, when up to three birds were recorded as flushed on nine occasions during breeding bird surveys between mid-March and mid-April, from varied locations across the core study area. However, no evidence of territorial behaviour, drumming, or nesting was observed, and the absence of any further detections in May–July strongly suggests these birds were wintering or passage individuals, rather than part of a breeding population.

Winter walkover and wintering waterbird surveys generated 37 and 12 records respectively, involving small counts of one to six birds. Additionally, five incidental records of one to seven birds were recorded during non-breeding season surveys during Years 2 and 3.

Snipe are a BoCCI Red-listed species, reflecting sustained short- and long-term declines in the Irish breeding population and contraction of suitable breeding habitats such as damp grassland, cutover bog, and wet heaths (Gilbert *et al*., 2021). However, they remain a relatively common wintering species across Ireland, particularly in areas with damp, soft soils that allow probing for invertebrate prey.

Records confirm regular winter use of the Development by small numbers of non-breeding snipe in low densities, and no breeding evidence was recorded.

7.3.2.2.15 Woodcock

Over the three-year survey period, there were only three records of the species: a single individual flying through the core study area in October 2023, at an estimated height of 2 m, and therefore outside the CRZ, and two individuals recorded during a breeding bird survey in July 2023, which may suggest the possibility of local breeding, although no roding displays, territorial behaviour, or further breeding evidence was observed.

Woodcock is BoCCI Amber-listed due to significant declines in its breeding population in Ireland. Breeding is now largely restricted to suitable woodland in upland and western regions, and populations are considered to be highly localised. During the winter months, woodcock is more widespread, with large numbers of migrants from northern Europe arriving to overwinter in damp woodlands, bogs, and field edges. However, wintering birds are also difficult to detect, and no regular observations were made within the study areas across three winters of baseline surveys.

Given the extremely low frequency of observations, absence of roding activity, and lack of confirmed breeding or wintering behaviour, it is concluded that no population of ecological significance is using the Development.

7.3.2.2.16 Whimbrel

The only record of whimbrel *Numenius phaeopus* during the three-year survey period was of a single individual flying over the core study area, at an estimated height of 100 m, during early-May 2023. This is consistent with the species' known status as a passage migrant through Ireland, with peak spring movements typically occurring in late April to early May, as birds migrate northwards from African wintering grounds to breeding areas in Iceland and northern Europe.

Whimbrel is currently Green-listed in Ireland under BoCCI, reflecting its low conservation concern at a national level. The species does not breed or overwinter in Ireland in significant numbers and is not listed as a Special Conservation Interest (SCI) for any relevant Natura 2000 site in the vicinity, including the River Shannon and River Fergus Estuaries SPA.

Given the extremely low frequency of observations and the absence of suitable habitat or sustained usage within the Development or surrounding lands, there is no population of ecological significance present.

7.3.2.2.17 Coot

Two coots *Fulica atra* were observed on a temporary waterbody in the northern section of the core study area during a supplementary VP watch in late October 2023.

Additional records were made on Lough Gur during a winter waterbird survey in November 2023, where four individuals were recorded, with two still present in February 2024. Further I-WeBS counts at Lough Gur recorded low numbers, with between one and six birds per month from October 2022 to January 2023, increasing slightly

to 16 in February 2023 and 18 in March 2023. In contrast, numbers declined again in winter 2023–24, with only four in November 2023 and two in February 2024.

Although the species was recorded using Lough Gur, no evidence of functional connectivity with the Development was identified based on the results of baseline surveys. Records within the core study area were limited to a single supplementary VP observation, and there were no repeat sightings suggesting regular use or reliance on the Development by coot.

Coot is BoCCI Green-listed, reflecting its stable and secure national status. Furthermore, coot is generally reluctant to fly during daylight hours, typically remaining on water or in dense emergent vegetation, and is thus considered to present a low collision risk in the context of wind energy infrastructure.

Given the low frequency of observations, lack of connectivity to the Development, and stable national conservation status, there is no population of ecological significance using the Development.

7.3.2.2.18 Cormorant

During VP watches, 87 cormorant observations involved flights recorded within the core study area, with flock sizes ranging from one to two birds. Additionally, eight records during supplementary VP watches involved up to four birds in February 2023 and singles in October 2022, March 2023, January 2024, and during the breeding season in May 2023.

Monthly I-WeBS counts at Lough Gur during October 2022 to March 2023 recorded between five to 13 individuals regularly using the site. Wintering waterbird surveys across the 5 km buffer, including Lough Gur, between December 2023 and March 2024 documented five records of up to six individuals on three separate dates.

Although breeding bird surveys during Years 2 and 3 recorded between one and five individuals on nine occasions within the core study area, most observations related to birds flying through the Development or perched/swimming along the Morningstar River.

Given the regular flight paths observed of cormorants moving through the Development, likely transitioning between waterbodies, and the occasional use of the Morningstar River within the core study area for feeding, functional connectivity between Lough Gur and the Development can be assumed.

Cormorant is a qualifying species for SCI designation of the River Shannon and River Fergus SPA. It is BoCCI Amber-listed indicating a species of moderate conservation concern. However, the SPA is located over 20 km west of the Development, and the cormorants observed are more likely associated with local inland waterbodies such as Lough Gur and the Morningstar River. Cormorants typically forage within 10–15 km of their roost or colony during inland movements (Dirksen *et al*. 1995; Wernham *et al*. 2002). Given this species' relatively limited overland foraging range and the absence of direct flight paths between the Development and the SPA, there is no evidence to suggest that the individuals observed are functionally linked to the SPA population.

7.3.2.2.19 Grey heron

During VP watches, 63 grey heron observations involved flights within the core study area, with records ranging from one to two birds. Additionally, six further records during supplementary VP watches in the non-breeding season of Year 3 each recorded one or two individuals.

Other records of grey heron within the core study area, but excluded from the VP dataset, documented higher counts. These included an incidental observation of four individuals in a flooded field north of the Convent Road in late-October 2023. A winter waterbird survey recorded nine birds at the same location the following day, with six still present in early-November 2023.

Breeding bird surveys during Year 1 recorded single individuals in April and July, whilst in Year 3, eight individuals were recorded between April and July within the core study area.

Monthly I-WeBS counts at Lough Gur between October 2022 and March 2023 recorded between one and four individuals, while wintering waterbird surveys across the 5 km buffer, including Lough Gur, documented up to three individuals between January and March 2024.

The species is currently BoCCI Green-listed, indicating a stable and secure population in Ireland.

7.3.2.2.20 Little egret

During VP watches, 22 little egret *Egretta garzetta* observations involved flights recorded within the core study area, with flock sizes ranging from one to two birds.

In addition to the standard VP watches, supplementary watches between December and February in the non-breeding season of Year 2 recorded three single birds. A further two single birds were observed during December and January during non-breeding season of Year 3.

Most records consisted of transitory birds, moving between other roosting and feeding sites rather than remaining locally. A single bird was seen roosting within the core study area during a breeding bird survey in mid-July 2023 and two records during wintering waterbird surveys in Year 3 involved a single bird roosting in trees in the northwestern section of the 5 km buffer in February 2024 and a flock of six flying over Lough Gur in March 2024.

Little egret is a widespread species in Ireland and is currently BoCCI Green-listed, indicating a stable and secure population. Although it is a regular feature within the wider landscape surrounding the Development, the low numbers recorded and lack of evidence of breeding suggest the Development itself is of limited importance for the species.

7.3.2.2.21 Little grebe

Two little *grebes Tachybaptus ruficollis* were observed foraging on a temporary area of standing water during a supplementary VP watch in late October 2023, located just within the northern section of the core study area.

Monthly I-WeBS counts at Lough Gur between October 2022 and March 2023 recorded a peak count of 10 individuals in December 2022. In contrast, wintering waterbird surveys across the 5 km buffer, including Lough Gur, documented just three individuals in November 2023 and a single in February 2024. Although the species was recorded using Lough Gur, no evidence of connectivity to the Development was identified based on the results of baseline surveys.

Given the little grebe's typical reluctance to fly during daylight hours, preferring to remain on water or in dense vegetation, the species is considered to have a low collision risk with turbines. Additionally, due to its stable national population, absence from conservation concern lists (BoCCI), and the extremely low frequency of observations within the core study area, there is no population of ecological significance utilising the Development.

7.3.2.2.22 Moorhen

A single moorhen *Gallinula chloropus* was observed on a temporary area of standing water during a supplementary VP watch in October 2023, located just within the northern section of the core study area.

Monthly I-WeBS counts at Lough Gur between October 2022 and March 2023 recorded a peak of 11 individuals in March 2023. In contrast, wintering waterbird surveys across the 5 km buffer, including Lough Gur I-WeBS

counts, recorded six individuals in early-November 2023 and further singles in January and March 2024. Although the species was recorded using Lough Gur, no evidence of connectivity to the Development was identified based on the results of baseline surveys.

Given the moorhen's typical reluctance to fly during daylight hours, preferring to remain on water or in dense vegetation, the species is considered to have a low collision risk with turbines. Additionally, due to its stable national population, absence from conservation concern lists (BoCCI), and the extremely low frequency of observations within the core study area, there is no population of ecological significance utilising the Development.

7.3.2.3 Gulls

7.3.2.3.1 Black-headed gull

During VP watches, 25 black-headed gull flights were recorded within the core study area, with flock sizes ranging from one to 100 birds.

Twenty-three of these flights occurred during non-breeding season surveys, as expected given the higher wintering numbers present in the general area. Peak monthly counts were recorded in October (100 individuals) of Year 3, November (51 individuals) of Year 2 and December and January (25 individuals) of Year 1. Only two observations occurred during breeding season VP watches with a single seen in April 2023 and five in March 2024. The species does not breed within the 5 km buffer and the absence of records between May and September further supports this conclusion.

Winter walkover surveys in November 2022 and January 2023 recorded three observations of up to 27 birds. Additionally, 16 incidental records, mostly from October 2023, documented up to 210 that were associated with feeding in temporary flooded fields within the core study area. This indicates that the Development provides occasional foraging opportunities during the non-breeding season, although use is dispersed and opportunistic.

Black-headed gulls are common and widespread in Ireland but have experienced moderate population declines or range contraction, leading to their BoCCI Amber-listed status. The species is listed as an SCI for the River Shannon and River Fergus Estuaries SPA. However, the SPA is located over 20 km west of the Development, and there is no evidence that the birds observed within the Development form part of the SPA population. Black-headed gulls are highly mobile and opportunistic foragers, often ranging across agricultural land, rivers, lakes, and built environments. Foraging movements are typically localised during the non-breeding season and centred around inland food sources such as pasture and ploughed land (Balmer *et al.*, 2013).

Given the availability of suitable foraging habitat in the wider landscape and the lack of direct connectivity or observed movements between the SPA and the Development, a functional link to the SPA population is not supported. Despite the moderate number of records and absence of breeding activity within the Development and wider study areas, the species is a regular component of the local avifauna.

7.3.2.3.2 Common gull

During VP watches, three observations of common gull *Larus canus* were recorded during Year 1 surveys, with a single bird flying through the core study area in November 2021 and two birds on two dates in February 2022.

The only other record was of two birds recorded flying through the core study area, among a flock of lapwing, in January 2024 during a supplementary VP watch.

Common gull is currently listed as a BoCCI Green-listed species in Ireland, indicating it is not of immediate conservation concern.

Given the extremely low frequency of observations there is no population of ecological significance using the Development.

7.3.2.3.3 Great black-backed gull

During VP watches, four observations of great black-backed gull *Larus marinus* were recorded: a single bird was observed flying through the CRZ at a height of between 50 -100 m in November 2022. Three additional observations involved birds flying through the core study area but not entering the CRZ: a single and a flock of 15 in October 2023, and three birds in January 2024.

Great black-backed gull is currently listed as a BoCCI Green-listed species in Ireland, indicating it is not of immediate conservation concern.

Given the extremely low frequency of observations there is no population of ecological significance using the Development.

7.3.2.3.4 Herring gull

During VP watches, just two observations of herring gull were recorded: a single bird feeding in flooded fields in October 2023 and three birds that flew through the CRZ in April 2024.

Additionally, a single herring gull was recorded flying over the core study area during a breeding bird survey, in April 2024.

Given the extremely low frequency of observations and the species being BoCCI Amber-listed in Ireland, indicating some conservation concern but no immediate threat, there is no population of ecological significance using the Development.

7.3.2.3.5 Lesser black-backed gull

During VP watches, 75 lesser black-backed gull flights were recorded within the core study area, with flock sizes ranging from one to 384 birds. Two incidental records involved flocks of 27 and ten individuals seen feeding in temporary flooded fields during two VP watches in late-October 2023.

Winter walkover surveys recorded a single bird in November 2022 and five in January 2023. During breeding bird surveys between April and July 2024, between one and three birds were seen flying over on four occasions. Additionally, 15 observations were documented during supplementary VP watches during the non-breeding season in Years 2 and 3, with eight records of between 1 - 16 birds during November and December 2022, and seven records of between 8 – 45 birds in October 2023. These records indicate opportunistic, dispersed use of the Development for foraging and passage rather than reliance on specific sites.

Lesser black-backed gull is a BoCCI Amber-listed species, reflecting moderate population declines nationally. They may exhibit temporary avoidance within ~300 m of construction activity, but their mobility and generalist behaviour reduce the likelihood of sustained displacement. Despite relatively frequent observations, the use of the Development and wider study areas appear to be predominantly for passage and opportunistic foraging, with no evidence of breeding.

7.3.2.4 Raptors

7.3.2.4.1 Barn owl

Targeted barn owl surveys were undertaken during the breeding seasons of Year 1 (2022) and Year 2 (2023) to assess the presence and breeding activity of the species within and adjacent to the core study area and the 1 km and 2 km buffers.

No barn owls were recorded within the 1 km buffer during any of the surveys conducted in either year. However, confirmed breeding was recorded in June 2022 at Ballygrennan Castle, a known historical nesting site located approximately 900 m east of the boundary of the 2 km buffer. A follow-up visit on 20 August 2022 recorded an adult Barn Owl emerging from a cavity at 21:16 hrs. While no vocalisations were heard, it was considered likely that any young would have fledged by the time of the visit.

In 2023, further signs of barn owl presence were recorded at Ballygrennan Castle, although no breeding was confirmed. A building inspection in May 2023 identified fresh signs of occupation, including eight pellets and whitewash beneath a known nest cavity in the internal northwest corner of the main tower. Later in the month a single Barn Owl was observed emerging from the structure, although no additional evidence of breeding was recorded. A final survey in August 2023 again recorded a single adult emerging from the castle at 22:49 hrs, but the absence of vocalisations or other signs of breeding led to the conclusion that nesting did not occur at the site during the 2023 season.

Contemporary records confirm Barn Owl breeding in the wider area (Balmer *et al.,* 2013), including a nest box approximately 5.5 km southwest of the core study area that successfully fledged four owlets in 2020[14]. The core breeding home range in Ireland typically spans 4–5 km from the nest, with a maximum range of up to 9 km (Lusby & Cleary, 2014; TII, 2021; Lusby *et al.,* 2021). The core study area and 1 km buffer comprise a mix of woodland, rough grassland, and treelines/hedgerows, offering suitable foraging habitat. However, the availability of nesting cavities was assessed as limited. Of the buildings assessed, only one was considered suitable for nesting Barn Owl, but breeding season dusk surveys found no signs of activity or vocalisations.

Barn Owl is BoCCI Red-listed, reflecting its high sensitivity and conservation concern in Ireland.

While Barn Owls are confirmed to breed in the wider area surrounding the Development, no evidence of breeding or significant use was recorded within the core study area and 1 km buffer during the survey period. Suitable foraging habitat is present, but limited nesting opportunities and the absence of breeding activity suggest that the Development itself is of ecological importance to the local barn owl population.

Given the proximity of known breeding sites just outside the 2 km buffer, individuals may occasionally forage within the Development, but this use appears opportunistic and limited.

Consequently, the Development does not support a population of barn owl.

7.3.2.4.2 Buzzard

During VP watches, 302 buzzard observations involved flights recorded within the core study area, with counts ranging from one to five birds.

In addition, supplementary VP watches between November 2022 and March 2023 recorded up to five birds within the core study area on 26 occasions.

Buzzards were recorded frequently during both breeding and non-breeding seasons across the whole survey period, indicating consistent, year-round use of the 2 km buffer. In 2022, three observations were made during breeding raptor surveys, though no breeding activity was noted at that time. By 2023, buzzards were observed displaying clear breeding behaviour within the 2 km buffer, including the presence of juvenile birds making food-begging calls to adults in July in the southern section of the core study area, confirming an active nest.

In 2024, breeding was again confirmed, with a nest located approximately 430 m east of the northern boundary of the core study area. During both the 2023 and 2024 breeding seasons, breeding bird surveys recorded birds

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hunting, calling, mobbing, circling, and emitting alarm and flight calls, with multiple sightings of paired birds and breeding/territorial activity strongly suggesting two or even three breeding territories may exist within or immediately adjacent to the Development. Buzzards were also recorded during the 2023–24 non-breeding season, with birds observed feeding, flying, and calling within the 2 km buffer.

Buzzard is BoCCI Green-listed, indicating a species of low conservation concern and the Irish buzzard population has grown significantly over the last 25 years (Lusby, 2011; Balmer *et al*., 2013). Buzzards show moderate sensitivity to wind farm developments, with recommended precautionary buffers of approximately 300 m around breeding territories to minimise disturbance (Madden *et al*., 2015; SNH, 2016b).

Up to three breeding territories of buzzard occupy the Development site.

7.3.2.4.3 Hen harrier

During surveys conducted over the three years hen harriers were only recorded twice, with single males seen flying through the core study area during breeding bird surveys in late August 2022 and again in May 2023. It is considered that these records relate to transitory individuals, and no evidence of breeding was suspected within the 2 km buffer.

Hen harriers are an important Annex I species and must be carefully considered in relation to wind farm developments. The desk study assessment determined the habitat within the 2 km buffer as largely unsuitable for breeding hen harrier, a conclusion supported by the species' reported breeding distribution in Ireland (NPWS, 2022, Ruddock *et al.,* 2024). The nearest SPA for the species (Slievefelim to Silvermines Mountains SPA) lies ~24 km northeast, beyond the species' core foraging range (~10 km; SNH, 2016). Ballyhoura Mountains SAC, ~20 km south, supports a nationally important hen harrier population (c. 17–19 pairs, ~12 % of the national population) and provides regional context for the species' distribution. According to NPWS (2022) there are no known hen harrier roosts within the 2 km buffer.

Given national estimates of 106 breeding pairs (Ruddock *et al.,* 2024) and 311 wintering birds (NPWS, 2019), the 1% threshold of international importance (≥2 breeding or ≥3 wintering birds) are not met. The baseline survey supports desk study findings confirming that the Development is not important for breeding or wintering hen harriers, and there is no population of ecological significance utilising the Development.

7.3.2.4.4 Kestrel

During VP watches, 257 kestrel observations involved flights recorded within the core study area, with counts ranging from one to two birds.

In addition, supplementary VP watches between November 2022 and March 2023 recorded up to two birds within the core study area on 20 occasions.

Kestrel was recorded in all three breeding seasons (2022–2024) within the 2 km buffer, typically with one to two individuals observed per season. In 2022, signs of possible breeding were noted within the core study area, including pellets, moulted feathers, and whitewash found in a metal-roofed barn in June, suggesting potential nesting activity. In 2023, kestrels were again regularly observed, though no direct evidence of breeding was recorded within the 2 km buffer; the nearest known nest site was at Rockstown Castle, approximately 9 km from the Development. In 2024, kestrels continued to be observed in small numbers, and although breeding was not confirmed, behavioural cues in late May indicated possible territorial or nesting activity within the wider study areas.

Outside the breeding season, kestrels were regularly recorded across all three non-breeding seasons (2021–2024). Individuals were observed during incidental, wintering waterbird, winter walkover, and raptor surveys between November and March. Most non-breeding records involved single birds hunting or flying, with repeated

detections between January and March indicating wintering or regular foraging use of the area. A higher count of up to four kestrels was noted during a raptor survey in February 2023, though this was an isolated observation.

Kestrel is BoCCI Red-listed, reflecting severe long-term declines in the Irish breeding population. A population of kestrel is considered to use the lands within the Development for foraging.

7.3.2.4.5 Long-eared owl

The only record during the three-year survey period was of a long-eared owl fledgling heard calling from conifer woodland approximately 300 m west of the northern section of the core study area during a barn owl survey in May 2023. This observation confirms breeding within the 1 km buffer. While no adults were seen or heard, the presence of a fledgling is definitive evidence of a successful nesting attempt.

Long-eared owl is BoCCI Green-listed and are not of conservation concern.

7.3.2.4.6 Merlin

During VP watches, just two observations of merlin were recorded: a single bird flying 12 sec at 20-50 m -in/out of core study area (VP1) in November 2022 and another also seen from VP1 flying/perched 15 sec at 0-20 m -in/out.

During the three-year survey period, the only other merlin record was a single individual observed during a breeding bird survey in early-April 2024. However, this bird was considered a passage individual, and no breeding activity was recorded within the 2 km buffer.

Merlin is an important Annex I species and must be carefully considered in relation to wind farm developments. The desk study assessment concluded that the habitat within the 2 km buffer is largely unsuitable for breeding merlin. Furthermore, within the 10 km Irish national grid squares [R53 and R63], encompassing the Development, there are no historical records of probable breeding merlin (Balmer *et al.,* 2013). The nearest SPA designated for merlin, the Slieve Aughty Mountains SPA is located over 46 km to the north of the Development. This distance places the Development well beyond the species' core foraging range of 2 km and maximum breeding season foraging range of 5 km (SNH, 2016; Lusby *et al.,* 2017).

Merlin is BoCCI Amber-listed and there is no population of ecological significance utilising the Development site.

7.3.2.4.7 Peregrine

During VP watches, 16 peregrine observations involved flights recorded within the core study area, with counts of just single individuals. In addition, supplementary VP watches recorded a single individual within the core study area during November 2022.

The species was recorded intermittently within the 2 km buffer during the 2022 and 2023 breeding seasons, but no confirmed breeding activity was found. A single bird was observed as an incidental record during the non-breeding season in November 2023, but there were no records within the 2 km buffer during breeding season 2024.

Confirmed breeding of peregrines occurred outside the 5 km buffer at Kilballyowen Quarry (5.1 km to the east) and Ballyneety Castle (13.2 km to the north) during both 2023 and 2024, indicating that peregrines were active in the wider region. The core foraging range for breeding peregrines is approximately 2 km (SNH, 2016), although foraging distances of up to 18 km have been recorded (Enderson & Craig, 1997).

Peregrine is BoCCI Green-listed. Use of the Development site is likely limited to occasional passage flights and not core breeding territory.

7.3.2.4.8 Sparrowhawk

During VP watches, 57 sparrowhawk observations involved flights recorded within the core study area, with flock sizes ranging from one to two birds. In addition, supplementary VP watches between November 2022 and March 2023 recorded three singles, and a further two singles were observed between October 2023 and February 2024.

Sparrowhawks were also recorded during several other survey types. Winter walkover surveys in Year 3 documented two records during the non-breeding and five during the breeding season surveys. Raptor surveys in the breeding season of Year 3 recorded two birds displaying and being mobbed by corvids during May within the 2 km buffer, with a nest located in a large oak earlier that month. Additionally, three incidental records were noted during waterbird surveys, with single birds in December 2023, January, and March 2024. Birds were observed regularly hunting along hedgerows and in woodland edges.

Sparrowhawk is BoCCI Green-listed and is not of conservation concern.

7.3.2.4.9 White-tailed eagle

There was a single observation of one white-tailed eagle *Haliaeetus albicilla* flying over the core study area during the three-year survey period, at an estimated height of 300 - 400 m, during early-November 2023.

Although the species is BoCCI Red-listed, the extremely low frequency of observations, i.e. a single observation, combined with the lack of suitable breeding or foraging habitat within the surrounding landscape, suggests that this was a transitory individual and the record represents a chance encounter. Accordingly, there is no population of ecological significance using the Development site.

7.3.2.5 Additional species of conservation concern

Over the baseline study, two other non-passerine species with unfavourable (Red-listed) conservation status in Ireland (Gilbert *et al*. 2021b) were recorded and these species do not fall within the wetland birds or raptor categories.

7.3.2.5.1 Swift

Two records of up to three individuals seen during breeding bird surveys in July and September 2023 are likely to have involved birds foraging or passing over the core study area on passage.

While swift *Apus apus* forage over the Development site during the summer, nesting is primarily associated with nearby towns and villages, with the closest reported nests in Bruff, approximately 1.9 km northwest (Birdwatch Ireland, 2023). Although the swift is a BoCCI Red-listed species, given the extremely low frequency of observations there is no population of ecological significance using the Development site.

7.3.2.5.2 Stock dove

Over the three-year study period there was only one record of an individual bird flying over the southern section of the core study area in January 2024. Additionally, a moulted stock dove feather was recorded at Ballygrennan Castle during a barn owl building survey in August 2023.

Although the stock dove *Columba oenas* is a BoCCI Red-listed species, given the extremely low frequency of observations there is no population of ecological significance using the Development site.

7.3.2.5.3 Red-listed passerines

Three passerine species with unfavourable BoCCI Red-listed conservation status in Ireland, as reported by Gilbert *et al*. (2021b), were recorded during the baseline study period: redwing *Turdus iliacus*, meadow pipit *Anthus pratensis* and grey wagtail *Motacilla cinerea*. While NatureScot (2017) notes that passerine species are generally

not considered vulnerable to significant effects from wind farms, the status of these species has been acknowledged in the following assessments.

Baseline observations also recorded ten Amber-listed passerines (Gilbert *et al*., 2021b), discussed further below.

7.3.2.5.4 Redwing

Redwing is a common and widespread winter visitors to Ireland. Its national conservation status was upgraded from Green to Red (BoCCI) following its classification as a European species of global conservation concern (SPEC 1). The species does not breed in Ireland, with individuals arriving from Icelandic and Fennoscandian breeding grounds during the autumn.

Flocks of two to 450 birds were frequently recorded within the core study area across the three non-breeding seasons, with the greatest numbers recorded during November, indicating passage through the Development. Most observations were associated with transient flock movements or opportunistic foraging in flooded or rough grassland fields. No evidence of prolonged roosting, localised wintering concentrations, or use of key habitats was identified.

Given the lack of habitat specialisation, the highly mobile and dispersed nature of redwing flocks, and the absence of localised key habitats or concentrations within the core study area, the species is considered to be present at a frequency and density that does not constitute a population of ecological significance in the context of the Development.

7.3.2.5.5 Meadow pipit

Meadow pipit was the most abundant and widespread passerine recorded during the breeding bird surveys, with up to 40 individuals observed. Breeding was confirmed within the core study area in all three survey years, primarily in semi-improved and rough grassland with low grazing pressure, tussocky swards, and scattered rushes, providing suitable nesting and foraging habitat. These areas are located across the mid- to western sections of the Development.

Meadow Pipit was also regularly recorded during winter surveys (up to 27 individuals), indicating year-round use of the Development and surrounding landscape. Despite its BoCCI Red-listed conservation status in Ireland due to long-term breeding population declines, meadow pipit remains one of the most widespread upland and farmland passerines in the country (Colhoun & Cummins, 2013; Balmer *et al*., 2013).

No evidence of concentrations or habitats supporting nationally important numbers was identified within the Development site. Given the confirmed breeding locations and densities, a local population of meadow pipit utilise the lands within the Development site.

7.3.2.5.6 Grey wagtail

There is a single record of one flying in a northeasterly direction over the core study area during a winter walkover survey in January 2024.

Although grey wagtails have a Red-listed (BoCCI) status, the extremely low frequency of observations and absence of breeding or key habitat within the Development site indicate no population of ecological significance.

7.3.2.5.7 Amber-listed passerines

Ten Amber-listed passerines (Gilbert *et al.,* 2021b) were recorded during survey the period including: goldcrest* *Regulus regulus*, greenfinch *Chloris chloris*, house martin *Delichon urbicum*, house sparrow* *Passer domesticus*, linnet* *Linaria cannabina*, sand martin *Riparia riparia*, skylark* *Alauda arvensis*, starling *Sturnus vulgaris*, swallow *Hirundo rustica* and willow warbler* *Phylloscopus trochilus* (* indicates breeding within the core study area).

Most of the breeding species nest in scrub and woodland habitats and may be affected by vegetation clearance during the breeding season. Skylarks, the only ground-nesting species, breed in open grasslands, favouring less intensively managed areas similar to meadow pipits. Observations confirm breeding activity within the Development for goldcrest, house sparrow, linnet, skylark, starling, swallow, and willow warbler. Greenfinch, house martin, and sand martin were recorded but not confirmed breeding.

Given their breeding status and densities, local populations of these species are considered utilise suitable lands within the Development site.

7.3.3 Collision Risk Modelling

Direct operational phase effects on birds may arise through mortality caused by collision with the turbines. As all grid connection cabling and associated infrastructure will be placed underground, they do not represent a collision risk to avifauna.

A Collision Risk Model (CRM), following NatureScot guidance (Band, 2024), was applied. This model uses site-specific data, including bird flight activity and flight height distribution within 500 m of turbines at collision height (the Collision Risk Zone, CRZ), to estimate potential collision rates. The baseline survey strategy for this Development was specifically designed to facilitate robust input into the CRM, with a focus on time spent by target species within the collision risk zone (Table 7-6).

Table 7-6: Target species flight activity within the Collision Risk Zone

Species *[15]	Number of flights		Total Flights	No. of Birds per Flight
	Year 2	Year 3		
Black-headed gull	7	0	7	3 - 51
Buzzard	86	45	131	1 - 5
Cormorant	19	14	33	1 - 2
Golden Plover*	1	6	7	10 - 78
Grey Heron	10	3	13	1 - 2
Kestrel	23	32	55	1 - 2
Lapwing	3	7	10	1 - 116
Lesser Black-backed Gull	34	0	34	1 - 23
Mallard	7	7	14	1 - 7
Peregrine*	3	0	3	1
Snipe	6	10	16	1 - 3

15 *Denotes species listed on Annex I of the Birds Directive

Species *[15]	Number of flights		Total Flights	No. of Birds per Flight
	Year 2	Year 3		
Sparrowhawk	10	10	20	1 - 2
Whooper swan*	3	9	12	3 - 25
† - incl. inferred flights (Year 3 only)	-	+ 8 inferred	16	3 - 42
Total (observed flights only)	187	168	355	

For this assessment, the SNH collision risk assessment model was used with data from VP watches conducted over a two-year period (October 2022 to March 2024). Seven VP locations provided complete coverage of the proposed turbine locations and 500 m buffer, generating data on bird density and flight height distribution across breeding and non-breeding seasons. The methodology and assumptions used in the CRM are detailed in **Appendix 7C**, which outlines the parameters input into the model. **Appendix 7C** also provides a summary of the predicted collision risk, presenting weighted values that account for overlapping viewsheds, turbine downtime (15% unavailability), and seasonal variation in bird activity. Appropriate species-specific avoidance rates have been applied throughout (NatureScot, 2024).

Flight activity and CRM outputs indicate that mean bird densities in flight were generally low across all species and seasons. Most species showed reduced densities in Year 3 compared to Year 2. The highest non-breeding season collision estimate was for golden plover in Year 2 (6.18 collisions), reducing markedly to 0.32 in Year 3. No breeding golden plover were recorded. A proportion of observed flights for each species occurred within the rotor-swept height of the proposed V136 turbines (24–160 m), with several species, including golden plover, whooper swan, grey heron, and cormorant, recorded at 100% rotor risk height in Year 3.

Predicted annual collisions after applying avoidance rates were low across all species.

- Golden plover had the highest predicted annual collision rate at 3.25 birds/year (Year 2), reducing to 0.32 birds/year in Year 3, with a cumulative total of 113.75 individuals over 35 years.
- Buzzard was next highest, with predicted annual collision rates of 1.48 birds/year (Year 2) and 1.27 birds/year (Year 3), and a cumulative total of 51.45 individuals.
- Kestrel and lapwing had annual collision rates of 0.82 and 0.77 birds/year respectively, with cumulative totals of 28.80 and 26.95 individuals.
- Black-headed gull had a predicted annual collision rate of 0.47 birds/year and a cumulative total of 16.45 individuals.
- Lesser black-backed gull had a predicted annual collision rate of 0.35 birds/year and a cumulative total of 12.25 individuals.
- Mallard and cormorant had lower predicted annual collision rates, at 0.13 and 0.21 birds/year respectively, with cumulative totals of 4.55 and 7.35 individuals.
- Grey heron had a predicted annual collision rate of 0.14 birds/year (Year 3) and a cumulative total of 4.90 individuals.
- Sparrowhawk, peregrine, and snipe all had predicted annual collision rates below 0.12 birds/year, with cumulative totals of 3.85, 2.80, and 2.10 individuals, respectively.

Whooper swan had a predicted annual collision rate of 0.22 birds/year (Year 2) and 0.02 birds/year (Year 3), with cumulative totals of **7.7** and **0.66** individuals, respectively. An alternative, more precautionary scenario for whooper swan using "inferred flight" data for Year 3 predicted a higher annual collision rate of **0.55 birds/year** and a cumulative total of **19.2** individuals over 35 years.

Over the full 35-year operational lifespan of the development, golden plover is predicted to incur the highest cumulative collision risk (113.75 collisions), followed by buzzard (51.45), kestrel (28.80), lapwing (26.95), and black-headed gull (16.45). Whooper swan and snipe, though recorded in lower flight numbers, have relatively high per-transit collision probabilities of 7.54% (whooper swan) and 3.98% (snipe), respectively.

A supplementary collision risk analysis using Year 3 data has been undertaken to refine the assessment for whooper swan. This estimate is based on several conservative assumptions, including that flocks observed foraging during VP surveys had commuted into and out of the Development under cover of darkness, and thus were not directly observed in flight. This assumption is supported by bioacoustics data collected during Year 3, which detected consistent nocturnal use of the area by whooper swans. The analysis also incorporated flock size data, inferred flight speeds, and known flight corridor usage. Under this scenario, the updated cumulative collision estimates increase to 19.2 individuals over 35 years. These Year 3-derived figures are presented in addition to the original CRM outputs and represent a precautionary upper bound that accounts for elevated site use recorded in the most recent non-breeding season.

Following application of appropriate species-specific avoidance rates, adjusted collision estimates fall well below thresholds likely to trigger significant population-level impacts for all species assessed (**Table 7-7**). Within the table, the collisions for each species following application of avoidance rates proposed for each species within NatureScot (2024) and Furness (2019) guidance has been highlighted in bold.

Table 7-7: Collision rate estimated by the non-breeding (NB) and the breeding seasons (B) and year-round, applying different avoidance rates

Turbine	Target species *[16]	Collision rate after 0.95 avoidance			Collision rate after 0.98 avoidance			Collision rate after 0.99 avoidance			Collision rate after 0.995 avoidance			Per decade	Per 35 years
		NB	B	Year	NB	B	Year	NB	B	Year	NB	B	Year		
Year 2	**Black-headed gull**	4.62	0.05	4.67	1.85	0.02	1.87	0.92	0.01	0.93	0.47	-	0.47	4.70	16.45
	Buzzard	2.97	1.23	4.2	1.19	0.49	1.68	0.59	0.25	0.84	0.3	0.12	0.42	16.80	58.80
	Cormorant	0.16	0.21	0.37	0.06	0.08	0.14	0.03	0.04	0.07	0.02	0.02	0.04	1.40	4.90
	Golden plover *	15.44	-	15.44	6.18	-	6.18	3.09	-	3.09	1.54	-	1.54	61.80	216.21
	Kestrel	0.78	0.47	1.25	0.31	0.19	0.50	0.16	0.09	0.25	0.08	0.05	0.13	12.50	43.52
	Lapwing	3.15	-	3.15	1.26	-	1.26	0.63	-	0.63	0.32	-	0.32	12.60	44.16
	Lesser black-backed gull	1.04	5.42	6.46	0.42	2.17	2.59	0.21	1.08	1.29	0.1	0.54	0.64	6.40	22.63
	Mallard	0.11	0.33	0.44	0.04	0.13	0.17	0.02	0.07	0.09	0.01	0.03	0.04	1.70	6.14
	Peregrine *	0.02	0.16	0.18	0.01	0.07	0.08	-	0.03	0.03	-	0.02	0.02	0.80	2.62
	Snipe	0.07	0.07	0.14	0.03	0.03	0.06	0.01	0.01	0.02	0.01	0.01	0.02	0.60	1.95
	Sparrowhawk	0.12	0.15	0.27	0.05	0.06	0.11	0.02	0.03	0.05	0.01	0.01	0.02	1.10	3.77

16 - * Denotes species listed on Annex I of the Birds Directive

Turbine	Target species *[16]	Collision rate after 0.95 avoidance			Collision rate after 0.98 avoidance			Collision rate after 0.99 avoidance			Collision rate after 0.995 avoidance			Per decade	Per 35 years
		NB	B	Year	NB	B	Year	NB	B	Year	NB	B	Year		
Year 3	**Whooper swan ***	2.2	-	2.2	0.88	-	0.88	0.44	-	0.44	0.22	-	0.22	2.20	7.71
	Buzzard	0.12	3.05	3.17	0.05	1.22	1.27	0.02	0.61	0.63	0.01	0.3	0.31	12.70	44.40
	Cormorant	0.03	0.66	0.69	0.01	0.26	0.27	0.01	0.13	0.14	-	0.07	0.07	2.70	9.59
	Golden plover *	0.8	-	0.8	0.32	-	0.32	0.16	-	0.16	0.08	-	0.08	3.20	11.23
	Grey heron	0.02	0.32	0.34	0.01	0.13	0.14	-	0.06	0.06	-	0.03	0.03	1.40	4.75
	Kestrel	0.1	0.29	0.39	0.04	0.11	0.15	0.02	0.06	0.08	0.01	0.03	0.04	3.90	13.54
	Lapwing	0.7	-	0.7	0.28	-	0.28	0.14	-	0.14	0.07	-	0.07	2.80	9.78
	Mallard	-	0.46	0.46	-	0.19	0.19	-	0.09	0.09	-	0.05	0.05	1.90	6.49
	Sparrowhawk	0.02	0.15	0.17	0.01	0.06	0.07	-	0.03	0.03	-	0.02	0.02	0.70	2.36
	Whooper swan *	0.19	-	0.19	0.08	-	0.08	0.04	-	0.04	0.02	-	0.02	0.20	0.66
	Whooper swan* (inferred flights)[17]	5.49	-	5.49	2.20	-	2.20	1.10	-	1.10	**0.55**	-	**0.55**	5.5	19.2

17 - Inferred flights' refers to additional whooper swan flight activity estimated from behavioural observations, flight speed measurements, and bioacoustics data, to account for movements not directly observed during standard vantage point watches (e.g., nocturnal flights).

7.4 Identification and Evaluation of Important Ornithological Features

The identification and evaluation of IOFs within the Development has been undertaken in accordance with the *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal, and Marine* (CIEEM, 2018). This guidance provides a systematic and widely accepted framework for assessing the significance of potential adverse effects from development on ecological features, including avifauna. While the CIEEM (2018) guidance predates the Nature Restoration Regulation (NRR), the broad definition of IOFs is sufficiently flexible to encompass the ecological considerations highlighted under the NRR, including protection of Annexed species, ecological connectivity, and habitat restoration priorities.

An IOF is defined as any bird species, population, assemblage, habitat, or designated ornithological site considered to be of ecological value and potentially subject to significant effects arising from the Development. IOFs have been identified through desk-based review (10 km study radius), and detailed baseline field surveys (Figure 7-2). The 10 km radius reflects an ecologically meaningful scale, consistent with the national 10 km grid system used for statutory and atlas datasets (e.g. NPWS, NBDC), and accounts for the spatially coarse nature of many bird records.

A species or feature has been considered an IOF where baseline evidence demonstrates direct observations, confirmed habitat use (breeding, foraging, commuting, roosting), or the presence of suitable habitat capable of supporting a functionally important population.

Following identification, ornithological features has been evaluated against a geographic hierarchy of importance (International, National, County, Local), Birds of Conservation Concern in Ireland (BoCCI), empirical survey results, and professional judgement. Features assessed as being of less than *Local Importance (Higher value)* are considered of negligible ornithological importance and are scoped out of further assessment.

In addition, designated ornithological sites (SPAs, pNHAs) with potential hydrological, biological, or functional connectivity to the Development are considered in line with CIEEM guidance.

A summary of all IOFs, including those scoped in and out of assessment are presented in Table 7-8.

7.4.1 Designated Conservation Sites

7.4.1.1 Sites of International Importance

The River Shannon and River Fergus Estuaries SPA qualifies under Article 4 of the EU Birds Directive as a wetland of international importance, supporting internationally important populations of migratory waterbirds, including several Annex I species such as whooper swan and golden plover. Of the 19 additional species that are qualifying features of the SPA, nine were recorded during baseline surveys; however, based on the very low activity observed and the limited pathway for potential effects, the connectivity between the Development and the SPA for these features is considered limited.

A direct hydrological connection exists between the Development and the SPA via the Morningstar and Maigue Rivers. Consequently, in the absence of mitigation, there is potential for water quality impacts during the construction, operational and decommissioning phases that could adversely affect sensitive qualifying features of the SPA. Therefore, in line with the conclusions of the Natura Impact Statement (NIS, APEM 2025), the River Shannon and River Fergus Estuaries SPA is considered an IOF of International Importance within this assessment.

Accordingly, the River Shannon and River Fergus Estuaries SPA is retained as an IOF of International Importance within this assessment (Table 7-8).

7.4.1.2 Sites of National Importance

The only nationally important site in the vicinity of the Development with an ornithological interest is Lough Gur pNHA, which encompasses Lake Bog (east, between Loughgur cross and Knockadoon Hill), and Red Bog (south). The main ecological features of interest pertain to the floristic communities associated with wetland habitats and associated waterbirds. The catchment is not hydrologically connected to the Development. The pNHA is monitored for non-breeding waterbirds via I-WeBS and supports a diverse assemblage, including wintering whooper swan, resident mute swan and greylag goose. Other wildfowl include mallard, wigeon, teal, and gadwall *Mareca strepera*, whilst the area also supports wader species such as lapwing, golden plover, curlew, and snipe.

Herbertstown Fen pNHA (~8 km northeast) is nationally designated for botanical and hydrological interest, supporting species-rich calcareous fen habitat. It is not designated for ornithological features and is not included within the I-WeBS monitoring network. It holds no ornithological value and is excluded from further assessment in this chapter.

Therefore, Lough Gur pNHA is identified as an IOF of National Importance (Table 7-8).

Designated sites beyond 20 km are scoped out of the assessment in line with NatureScot (2016) connectivity guidance.

7.4.2 Summary of Important Ornithological Features

Table 7-8 summarises all Important Ornithological Features (IOFs) identified through baseline surveys and desk-based review. The table combines species accounts (Section 7.3), conservation status, ecological notes, and assigned highest geographical importance (International, National, County, Local) following Table 7-1 criteria. Only species and sites of Local Importance (Higher value) or greater are retained for assessment.

7.4.2.1 Summary of Ornithological Features Scoped Out of Assessment

Table 7-8 also summarises ornithological features that have been scoped out of further assessment, including designated sites and bird species. These features were scoped-out because baseline surveys and desk-based assessments indicate no likely significant effects, based on factors such as absence of functional connectivity, low sensitivity, or infrequent occurrence. The scoping approach follows NatureScot (2016, 2024) guidance. Table 7-8 provides rationale and supporting evidence for each scoped-out feature, ensuring transparency in the assessment process.

Table 7-8: Ornithological features scoped in or out of further impact assessment

Category / Feature Type	Feature / Species	Scoped In/Out	Conservation / Status	Ornithological Evaluation	Connectivity Pathway	Reason for Scoping Out / Notes	IOF
Designated Sites	River Shannon & River Fergus Estuaries SPA	In	SPA	International	Hydrological via Morningstar → Maigue → estuary; no direct functional link	Scoped in due to downstream hydrological connectivity	Yes
	Lough Gur pNHA	In	pNHA	National	Functional link (wintering whooper swan and waterbirds); ~5 km	Key local supporting site	Yes
	Herbertstown Fen pNHA	Out	pNHA	—	No ornithological pathway	No IOF features; botanical/hydrological focus; not part of I-WeBS	No
Waterfowl	mute swan	In	BoCCI Amber	Local (Higher)	Local habitat use (Morningstar/ag fields)	Breeding confirmed; regular presence	Yes
	whooper swan	In	Annex I; BoCCI Amber	County/Regional	Functional link to Lough Gur roost (visual & acoustic evidence)	Consistent seasonal use	Yes
	mallard	In	BoCCI Amber	Local (Higher)	Local habitat use; no confirmed Lough Gur link	Regular low density; breeding confirmed	Yes
	teal	In	BoCCI Amber	Local (Higher)	Intermittent local use; no confirmed connectivity	Infrequent, low density	Yes
	brent goose, greylag goose, pink-footed goose	Out	BoCCI Amber; Annex II	—	Very infrequent / passage	Low sensitivity and no regular occurrence (2021–2024 surveys)	No
Waders	curlew	In	BoCCI Red	Local (Higher)	Local wet field use; no SPA link	Red-listed; low-density winter use	Yes
	golden plover	In	Annex I; BoCCI Red	Local (Higher)	Winter flocks in farmland	Intermittent local use	Yes
	lapwing	In	BoCCI Red	Local (Higher)	Winter flocks in farmland mosaic	Flocks up to 190	Yes
	snipe	In	BoCCI Red	Local (Higher)	Foraging in damp/temporary wetlands	Regular winter use	Yes
	dunlin, jack snipe, woodcock, whimbrel, common sandpiper	Out	BoCCI Green/Amber/Red	—	Infrequent passage / low density	Not regular; no functional link; no significant effects	No
Other waterbirds	cormorant	In	BoCCI Amber	Local (Higher)	Foraging connectivity with Lough Gur	Regular, all seasons	Yes

Category / Feature Type	Feature / Species	Scoped In/Out	Conservation / Status	Ornithological Evaluation	Connectivity Pathway	Reason for Scoping Out / Notes	IOF
	grey heron	In	BoCCI Green	Local (Higher)	Local watercourses/flooded fields	Frequent, esp. winter	Yes
	little egret	In	Annex I; BoCCI Green	Local (Higher)	Local foraging; occasional Lough Gur link	Regular at low density	Yes
	coot, moorhen	Out	BoCCI Green	—	No strong linkage	Very low density; no functional link	No
Gulls	black-headed gull	In	BoCCI Amber	Local (Higher)	Opportunistic in flooded fields	Non-breeding only	Yes
	lesser black-backed gull	In	BoCCI Amber	Local (Higher)	Passage / farmland foraging	Regular flocks	Yes
	common gull, great black-backed gull, herring gull	Out	BoCCI Amber/Green	—	Opportunistic / infrequent	Low frequency; no SPA link	No
Raptors & owls	buzzard	In	BoCCI Green	Local (Higher)	Local breeding and foraging	Territories within/near site	Yes
	kestrel	In	BoCCI Red	Local (Higher)	Local foraging; possible nesting	Regular; no confirmed breeding	Yes
	long-eared owl	In	BoCCI Green	Local (Higher)	Breeding confirmed within 1 km	Green-listed	Yes
	peregrine	In	Annex I; BoCCI Green	Local (Higher)	Occasional wide-ranging foraging	Breeds regionally	Yes
	sparrowhawk	In	BoCCI Green	Local (Higher)	Local breeding/foraging	Confirmed within 2 km	Yes
	barn owl, hen harrier, merlin, white-tailed eagle	Out	Annex I; BoCCI Red/Amber	—	Very infrequent / wide-ranging	Rare / incidental records; no site-level importance	No
Passerines	meadow pipit	In	BoCCI Red	Local (Higher)	Abundant, breeding confirmed	Core local breeding species	Yes
	amber-listed passerines (goldcrest, house sparrow, linnet, skylark, willow warbler)	In	BoCCI Amber	Local (Higher)	Local breeding in scrub, woodland, grassland	Confirmed breeding	Yes
	non-breeding passerines	Out	—	—	No pathway of significance	Below Local (Higher) importance (NatureScot, 2024 guidance)	No
	swift, stock dove, grey wagtail	Out	BoCCI Red/Amber	—	Occasional records only	Low frequency; no significance	No

7.5 Do-Nothing Scenario

The Development encompasses agricultural land and commercial forestry plantation that are currently managed through a combination of intensively managed pasture and agroforestry practices. Under the do-nothing scenario, it is likely that the baseline conditions of the Development would continue, and the ecological value of the area for birds would be expected to remain broadly comparable with current conditions in the short term. However, this scenario does not account for the longer-term implications of failing to transition to renewable energy. Without the implementation of low-carbon infrastructure, Ireland's progress toward national and EU climate targets would be impeded, contributing to cumulative global emissions and exacerbating the impacts of climate change. Over time, climate change is expected to exert increasing pressure on biodiversity, particularly on wetland systems and migratory bird populations that are sensitive to changing hydrology, temperature regimes, and seasonal cycles. As such, the do-nothing scenario carries an implicit risk of long-term ecological degradation at a broader scale.

7.6 Likely Significant Effects

Potential effects on each IOF are assessed below. The assessment considers the significance of potential impacts following implementation of the embedded mitigation proposed.

7.6.1 Construction Phase

During the construction phase, potential effects on avian assemblages will arise from vegetation removal, habitat loss and disturbance. These effects are primarily associated with turbine foundations, access tracks, hardstands, temporary infrastructure, borrow pits, deposition areas, and associated works.

The assessment considers both direct and indirect effects on IOFs, as well as other bird species of Local (Higher) value or greater recorded during baseline surveys.

Direct effects include:

- Permanent habitat loss through vegetation clearance, including 1.9 km of hedgerows, 922 m of treelines, 1.1 ha of mixed woodland, and 1.8 ha of immature woodland;
- Loss of drainage features, including drainage ditches (1.3 km) and depositing/lowland river features (4.1 km);
- Loss of nesting, roosting, or resting sites due to habitat removal;
- Temporary habitat loss for construction compounds, blade set-down areas, crane pads and spoil deposition areas, including 230 m of hedgerows, 246 m of treelines, and 51.4 m of lowland river features;
- Excavation for turbine foundations, access tracks, and cable ducting, which may result in localised fragmentation of foraging habitat;
- Construction of the clear-span bridge over the Morningstar River, with associated abutments and access works, leading to localised habitat alteration and potential loss of riparian vegetation; and
- Drainage of wetland areas reducing the value of foraging habitat.

Indirect Effects include:

- Noise disturbance from construction activities, including blasting limited to turbine foundation works;
- Dust emissions and temporary lighting effects from construction compounds;
- Surface water run-off containing sediments, accidental pollution spills or wastewater;
- Bridge construction works across the Morningstar River, creating risks of sediment run-off, accidental pollution, and temporary disturbance to riparian and aquatic fauna;
- Temporary lighting from compounds and night works;
- Spread of non-native plant species; and
- Disturbance and displacement of fauna due to construction activity.

Disturbance during construction is expected to be largely confined to the construction footprint and adjacent areas, including temporary storage areas and borrow pits. Activities along the Grid Connection Route (GCR) will be restricted to existing road networks Activities along the Turbine Delivery Route (TDR) which may involve vegetation trimming are accounted for as a direct effect. This is also relevant for the temporary access track at Tullovin required for turbine delivery. The construction phase is anticipated to last ~24 months, followed by a six-month commissioning period. Seasonal sensitivities of bird species have been considered in the timing of works and mitigation measures, as outlined in (Section 7.7 and CEMP (Appendix 2A).

7.6.1.1 Designated Sites

Potential source-pathway-receptor (SPR) linkages between the Development and designated sites were evaluated. Only sites within 20 km with ornithological qualifying interests were considered relevant. Potential construction-related effects include hydrological impacts and disturbance affecting foraging, nesting, or roosting areas. Assessments are summarised below, with full evaluations provided in the NIS (APEM, 2025).

7.6.1.1.1 River Shannon and River Fergus Estuaries SPA

No functional connectivity between the Development and the SPA populations were established, see Section 7.3.2. As such no direct effects have been identified with the qualifying interest species of the SPA, nor has disturbance been identified as a potential effect.

Water quality effects arising from surface water run-off and/or pollution event

The River Shannon and River Fergus Estuaries SPA is located *c*. 36.9 rkm downstream of the Development and *c*. 12.6 rkm downstream of the GCR at its nearest point (i.e. near the point of termination at Killonan substation). The hydrological connection between the Development and the SPA is weak, and with all works along the GCR option confined to the existing road network, significant water quality impacts are unlikely.

Any potential effects on the SCIs of the River Shannon and River Fergus Estuaries SPA, would arise from an extreme pollution event or extreme adverse weather event which could result in significant suspended solids entering the downstream environment and would be indirect, primarily linked to water quality impacts within the estuaries. These impacts could alter foraging and roosting ranges by affecting prey abundance (e.g. benthic invertebrates) and habitat extent or quality. While some SCIs have been recorded within the Development Boundary and its surroundings, the Development lies outside any reported core or maximum foraging ranges for these species (SNH, 2016)[18]. Therefore, there will be no direct effects on SPA-linked SCIs.

[18] SNH (2016). Assessing Connectivity with Special Protection Areas (SPAs) – Guidance, version 3. NatureScot (formerly Scottish Natural Heritage).

While eelgrass (*Zostera* spp.) is somewhat limited in the Shannon Estuary, it remains an important food resource for SCI species light-bellied brent goose (*Branta bernicla hrota*). The formation of extensive algal mats over intertidal flats could alter macroinvertebrate communities, which serve as a critical food resource for wintering SCI birds. Furthermore, hydrocarbon contamination from accidental spillages could also reduce invertebrate prey availability. Several waders, such as dunlin, exhibit high site fidelity, meaning any decline in food resources could have knock-on effects on their foraging distribution. Additionally, the ingestion of prey items contaminated with PAHs may promote toxicity to SCI species and give rise to sub-lethal effects.

Significance of effect: While the likelihood of a pollution event or volumes of suspended sediment arising from the Development of significant magnitude are unlikely to reach the SPA, in the absence of mitigation, there is potential for indirect water quality effects to reach the River Shannon and River Fergus Estuaries SPA and result in a temporary to short-term (i.e., during the period of suspended solids/pollutants in the surface water run-off), adverse, likely significant effects of minor magnitude on the hydrology of the River Shannon and River Fergus Estuaries SPA.

7.6.1.1.2 Lough Gur pNHA

This pNHA is not hydrologically connected with the Development; however, ecological connectivity exists via the foraging range of waterbird species for which it is designated. Notably, whooper swans are known to roost at Lough Gur during the winter and regularly travel up to 5 km to forage within the proposed Wind Farm area. Although Lough Gur is not designated for whooper swan under EU or Ramsar frameworks, it is recognised nationally as a Wildfowl Sanctuary and supports regular wintering use by the species. Baseline surveys and behavioural observations indicate consistent usage patterns between the roost at Lough Gur and the foraging areas within the Development, confirming a functional linkage.

No direct effects are anticipated on the roost at Lough Gur. The Development will not result in the loss of area or supporting habitat at the roost location.

During the construction phase, in the absence of mitigation, disturbance arising from noise, the presence of machinery, and human activity has the potential to cause temporary displacement of whooper swans from foraging areas within the Development. Such effects are likely to occur intermittently over up to two winters, potentially altering foraging patterns within the wider area.

A weak hydrological connection exists between the Development and the River Shannon and River Fergus SPA via the Morningstar River and other watercourses intersected by the GCR. However, the GCR lies outside the main Development footprint, and no direct functional connectivity between qualifying ornithological species and the Development has been identified (see Section 7.3.2). Accordingly, hydrological pathways are not predicted to give rise to significant indirect ornithological effects.

Significance of effect: Taking account of the above, construction phase activities are assessed as giving rise to a temporary, moderate, adverse effect at the local scale on whooper swans using the foraging areas within the Development. No significant direct effects on the roost at Lough Gur are predicted.

7.6.1.2 Bird Species

7.6.1.2.1 Waterfowl - Mute swan, mallard and teal

Mute swans and mallards are regularly present within the core study area, with mute swans confirmed breeding along the Morningstar River. Teal are present only sporadically.

During the construction phase, waterfowl may be subject to temporary disturbance from noise, human activity, and habitat modification, including from borrow pit operations. Disturbance could lead to short-term

displacement, reducing breeding success or altered behaviour, particularly for mute swans and mallards breeding in riparian habitats. Disturbance may also occur in association with the Morningstar River crossing, although the use of a clear span bridge will avoid direct loss of instream or riparian habitat, and any disturbance is expected to be temporary and confined to the construction period. In addition, drainage ditch habitat loss is calculated at approximately 1.3 km, representing a permanent loss of marginal foraging and nesting habitat for waterfowl, although this habitat is of low ecological value at the site level and alternative habitat is available in the wider landscape. Given the low numbers and limited use by teal, disturbance effects on this species are considered negligible. The clear span bridge design will avoid direct habitat loss at the Morningstar River crossing, and best-practice construction methods will be implemented to minimise temporary disturbance.

Significance of effect: Overall, construction-phase disturbance to waterfowl is assessed as minor and localised, adverse, with impacts reversible post-construction. The permanent loss of drainage ditch habitat is considered a low-level effect given the availability of alternative habitats and the low numbers of waterfowl using these features.

7.6.1.2.2 Whooper swan

Baseline surveys conducted across three non-breeding seasons (2021-22 to 2023-24) confirm regular use of Camas South by whooper swans, with peak counts of up to 50 individuals. Camas South and Ballycullane, are functional connected to the Lough Gur roost and together support a locally important overwintering population.

Whooper swans are sensitive to disturbance within 400–600 m of foraging or roosting sites (Kirby & Owen, 2002; NatureScot, 2022), with general tolerance distances beyond 200 m (Larsen & Madsen, 2000; Fijn *et al.*, 2012).

Construction activities, particularly turbine foundation works (T1, T3, T4), borrow pit excavation, spoil storage, and heavy vehicle movements, fall within this sensitivity threshold. Visual and acoustic disturbance from these activities has the potential to cause short-term disruption to feeding swans at Camas South, representing a direct disturbance effect during the construction period.

Displacement from the grasslands along the Morningstar River (Camas South) is also likely during construction. Such displacement may increase energetic costs due to longer commuting flights to alternative foraging areas, including Ballycullane and Rathcannon Pond, particularly under prevailing southerly winds, which were frequently recorded during January of the 2022/23 and 2023/24 seasons. While suitable temporary displacement habitats are available within the wider area, construction-related disturbance could reduce feeding efficiency and alter local site use patterns over up to two non-breeding seasons.

Significance of effect: During construction, direct disturbance effects on whooper swan foraging at Camas South are anticipated, in combination with indirect displacement to alternative foraging grounds. Taking into account the functional linkage to Lough Gur and the importance of Camas South within the local foraging network, construction-phase disturbance is assessed as a moderate adverse effect at a County/Regional scale in the absence of mitigation.

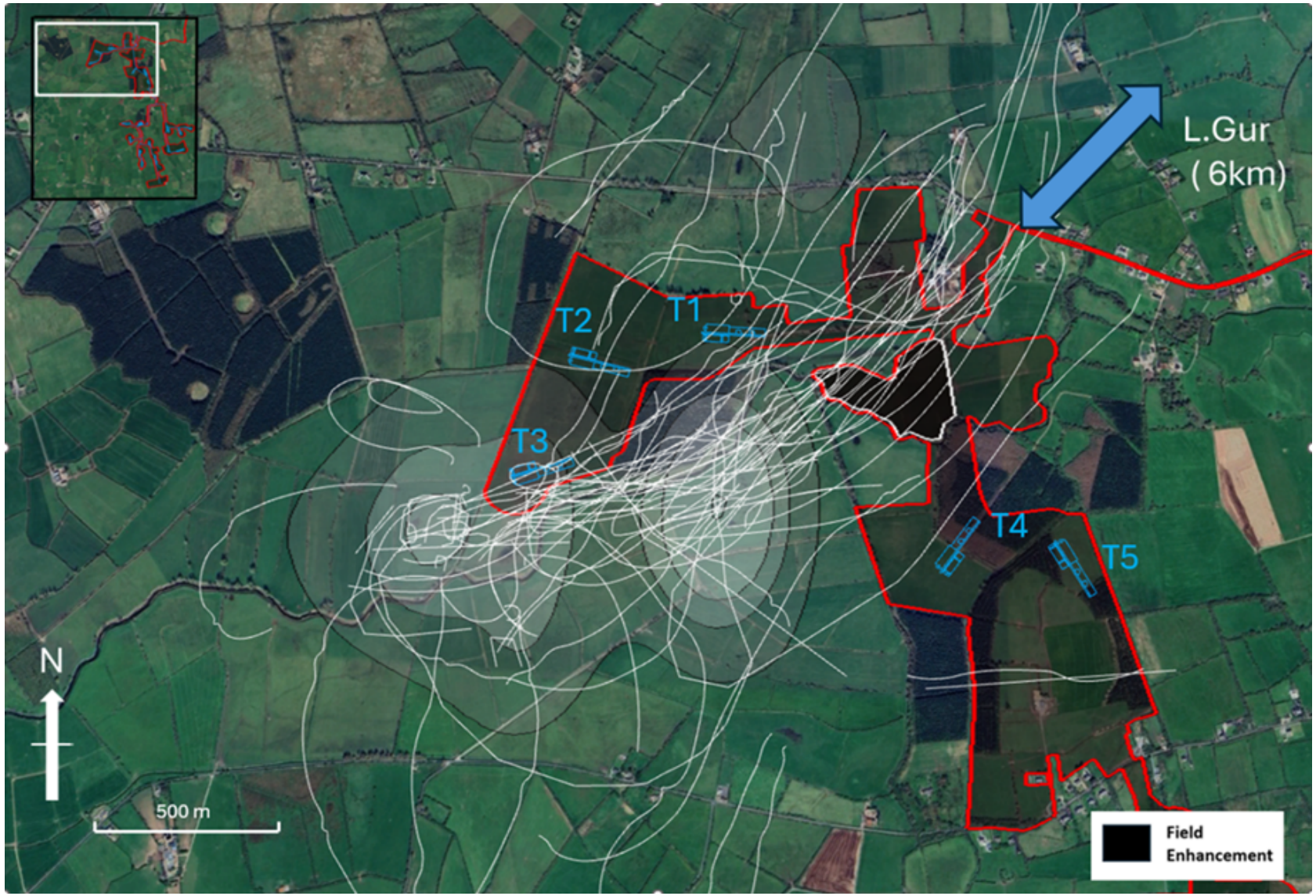

Figure 7-7: Projected flight lines from VP surveys illustrating SW-NE trend. Reproduced from the WSMP (Appendix 7D)

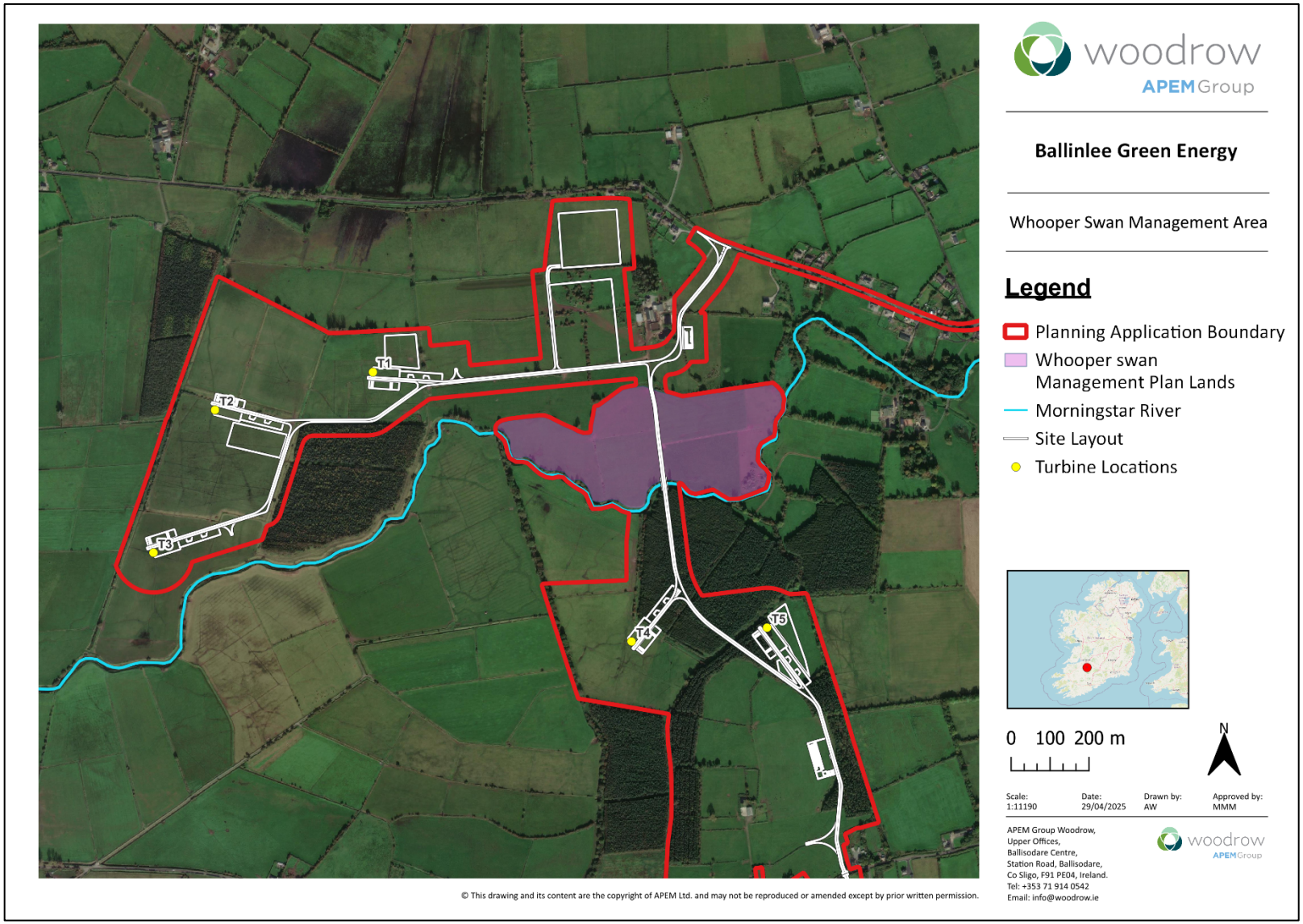

Figure 7-8: Proposed whooper swan management plan lands

7.6.1.2.3 Waders

7.6.1.2.3.1 Curlew

Curlew are vulnerable to disturbance during the non-breeding season, particularly at foraging and roosting sites (Mason *et al*., 2018). Construction-phase activities have the potential to cause displacement at distances of 250–500 m, with recommended buffers of up to 400 m for non-breeding birds (Mason *et al*., 2018; SNH, 2017; NPWS, 2019). Sources of disturbance include vegetation clearance, vehicle movement, and increased human presence, all of which may temporarily reduce habitat availability and displace birds into less favourable areas, with potential consequences for foraging efficiency and energy budgets (Franks *et al*., 2007).

A precautionary assessment assumes that up to 24 curlew (the maximum flock recorded within the core study area) could be displaced during construction, equivalent to 0.06% of the national non-breeding population (Fitzgerald *et al*., 2021).

Significance of effect: Given the low numbers recorded, the localised and temporary nature of site use, and the availability of suitable alternative habitats in the wider landscape, any displacement is expected to be short-term and reversible and is therefore assessed as minor adverse at the local scale.

7.6.1.2.3.2 Golden plover

During the non-breeding season, golden plover forage and commute across the Development, with peak flocks recorded at up to 750 individuals, observed just outside the southeastern boundary of the core study area. Within the core study area, the highest count from VP watches was 130 birds, representing a flying flock. Only two counts involved birds actually landing within the core study area: 80 birds in October 2022 and 40 birds in November 2023. A precautionary worst-case displacement scenario assumes up to 130 individuals could be affected, representing approximately 0.14% of the national non-breeding population (92,060 birds; Fitzgerald *et al*., 2021).

Golden plover use improved grassland habitats for foraging and roosting and exhibit high site fidelity to traditional feeding grounds. However, with only two flocks recorded landing within the core study area over three years of survey, the Development is rarely used for actual foraging or roosting. The species is sensitive to disturbance during non-breeding activity, with recommended maximum disturbance buffers of 500 m (Goodship & Furness, 2022; Pearce-Higgins *et al*., 2012). Construction activity, including vegetation clearance, human activity, or vehicle movement, within or immediately adjacent to occupied foraging areas may cause temporary behavioural disruption or displacement.

While agricultural grasslands are widespread in the surrounding landscape, not all farmland is functionally equivalent. Golden plover show habitat selectivity and often return to the same wintering sites annually, meaning that even temporary displacement could have functional consequences for foraging efficiency and energy budgets (Pearce-Higgins *et al.,* 2012).

Significance of effect: Given the low proportion of the national population potentially affected, the limited use of the Development for actual foraging or roosting, and the availability of suitable alternative habitat, any displacement is expected to be short-term and reversible and is therefore assessed as minor adverse at the local scale.

7.6.1.2.3.3 Lapwing

During the non-breeding season, lapwing regularly commute across the Development, with peak flock sizes recorded at up to 190 birds. Within the core study area, peak counts represent approximately 0.14–0.16% of the national non-breeding population (100,000 individuals; Crowe *et al*., 2021). Use of the Development for actual

foraging or roosting is limited, with only occasional observations of birds on the ground. No evidence of breeding was recorded within the core study area.

Lapwing are sensitive to disturbance during the non-breeding season, with recommended maximum disturbance buffer of approximately 500 m (Goodship & Furness, 2022; Pearce-Higgins *et al*., 2012). Construction activities, including vegetation clearance, vehicle movement or increased human presence within or immediately adjacent to occupied foraging and commuting areas, may cause temporary behavioural disruption or displacement, although literature indicates no significant adverse effects of wind farms on lapwing during construction (Pearce-Higgins *et al*., 2012).

Significance of effect: Given the low numbers involved, the limited use of the Development for actual foraging or roosting, and the availability of suitable alternative habitat in the surrounding landscape, any displacement is expected to be short-term and reversible and is therefore assessed as minor adverse at the local scale.

7.6.1.2.3.4 Snipe

Snipe occur locally during the non-breeding season, with peak counts of up to 23 individuals recorded. Most records involved one to a few birds, with usage dispersed across suitable grassland habitats in close proximity to the Morningstar. Occasional records during spring surveys were interpreted as passage birds, and no evidence of breeding was recorded within the Development.

Snipe are a BoCCI Red-listed species in Ireland, reflecting sustained short- and long-term declines in the national breeding population (Gilbert *et al*., 2021). They are considered sensitive to disturbance during the non-breeding season, with a precautionary 500 m buffer commonly applied to wader species, although actual behavioural disruption typically occurs within c. 100 m of human activity or construction (SNH, 2016; NatureScot, 2020; Cutts *et al*., 2013).

Construction activity, including vegetation clearance, human presence, and vehicle movement, may result in temporary behavioural disruption or displacement. However, given the low numbers involved, the dispersed use of the Development, and the availability of adjacent suitable habitat, displaced individuals are expected to relocate locally.

Significance of effect: Given the low numbers involved, the dispersed use of the Development, and the availability of adjacent suitable habitat, any displaced individuals are expected to relocate locally. The effect is therefore considered short-term, reversible, and minor adverse at the local scale.

7.6.1.2.3.5 Other waterbirds

Three widespread fish-eating waterbird species, cormorant, grey heron, and little egret, were recorded in low numbers within the core study area and 5 km buffer, primarily during the non-breeding season.

Observations indicate that use of the Development site is largely transitory, with no evidence of reliance on specific locations for foraging, roosting, or nesting. Birds were most frequently observed commuting along the Morningstar River and River Maigue corridors, with limited use of adjacent grassland or wetland areas.

- Cormorants were typically recorded as individuals or small groups (1–4 birds) moving along watercourses or between nearby waterbodies.
- Grey herons were observed singly or in pairs, with occasional small aggregations in wetland features outside the Development.
- Little egrets occurred infrequently, usually as single birds or small flocks, with most records representing passage through the area rather than localised use.

Fish-eating waterbirds are generally tolerant of moderate human activity but may be disturbed within 100–200 m of the disturbance source, particularly when foraging or roosting (Rodgers & Schwikert, 2002; Colhoun & Worden, 2013). Construction activities, including vegetation clearance, vehicle movement, and increased human presence within this threshold, may cause temporary behavioural disruption or displacement.

In addition, potential effects on water quality and hydrology could indirectly affect fish-eating waterbirds. Construction-related sediment runoff, nutrient enrichment, or accidental pollution could reduce prey availability, while loss or modification of ditches, ponds, or wetland features could reduce foraging opportunities.

Significance of effect:

Cormorant: Given the low numbers, dispersed use of the Development site, and availability of alternative habitat in the surrounding landscape, any displacement is expected to be short-term and reversible and is therefore assessed as minor adverse at the local scale.

Grey heron: Given the low numbers, dispersed use of the Development site, and the availability of alternative habitat nearby, any displacement is expected to be short-term and reversible and is therefore assessed as minor adverse at the local scale.

Little egret: Given the low numbers, largely transitory use of the Development site, and availability of alternative foraging habitats, any effects are expected to be short-term and reversible and are therefore assessed as minor adverse at the local scale.

7.6.1.2.4 Gulls

Two gull species, black-headed gull and lesser black-backed gull, were recorded within the core study area, primarily during the non-breeding season (Sections 7.3.3.3.1 and 7.3.3.3.5). Both are generalist, wide-ranging species that forage opportunistically across agricultural and wetland habitats. Use of the study area is primarily for passage and opportunistic foraging, with no evidence of reliance on specific locations for nesting or roosting, and neither species breeds within the Development or the 5 km buffer.

Gulls are generally tolerant of human activity and construction noise, however, temporary avoidance behaviour may occur within approximately 300 m of disturbance, particularly when alternative foraging sites are available (Cutts *et al.*, 2009; Colhoun & Worden, 2013). Given the species' mobility, generalist behaviour, and low dependency on the Development site, any construction-phase disturbance is expected to be temporary and reversible.

Significance of effect:

Black-headed gull: Minor adverse at the local scale.

Lesser black-backed gull: Minor adverse at the local scale.

7.6.1.2.5 Raptors

Raptors are generally sensitive to disturbance during both breeding and non-breeding seasons, with noise, human presence, and machinery potentially causing temporary displacement, reduced foraging efficiency, or nest abandonment (Madden *et al.*, 2015; SNH, 2016a). Baseline surveys indicate that raptor activity within the core study area and 2 km buffer is generally low to moderate. Only probable breeding of kestrel was suspected, while breeding within or adjacent to the Development was confirmed for buzzard, kestrel, long-eared owl, and sparrowhawk. No nesting by barn owl, peregrine, hen harrier, merlin, or white-tailed eagle was confirmed within or adjacent to the Development site.

Buzzard

Buzzards were regularly observed soaring and foraging within the 2 km buffer with breeding activity confirmed

through observations of territorial display and juvenile calls. Nesting was recorded within proximity to the Development site: buzzard territories were located within the core study area in Years 2 and 3, closest to turbines T9 and T13, while a further nest site was identified within the 2 km study area in Year 2. Breeding buzzards are known to exhibit sensitivity to disturbance within approximately 300 m of nests (Ruddock & Whitfield, 2007).

Where construction activities overlap with these buffers, there is potential for temporary displacement of breeding pairs from up to two territories across the 24-month construction period. However, given the widespread availability of similar habitats in the surrounding landscape and the species' adaptability, any effects are expected to be temporary and reversible once construction is complete.

Significance of effect: The potential loss of these territories is considered temporary and reversible, with reoccupation anticipated post-construction given the continued availability of extensive suitable foraging and nesting habitat in the surrounding landscape. Potential displacement of up to two breeding territories is therefore assessed as a minor adverse at the local scale.

Kestrel

Observed consistently across breeding and non-breeding seasons, with low-level territorial activity suggesting possible breeding within the core study area. Breeding raptors are typically sensitive to disturbance within approximately 200–300 m of nests, providing context for assessing potential construction-phase effects. Construction activities may temporarily alter hunting or territorial behaviour, but no lasting effects are anticipated.

Significance of effect: Temporary displacement and potential disruption of hunting or territorial behaviour is assessed as a minor adverse at the local scale.

Long-eared Owl

Confirmed breeding in May 2023 approximately 300 m west of the core study area. A 300 m buffer will be applied around known roosting and foraging areas during construction. Temporary disturbance may result in short-term avoidance of adjacent habitat, but no significant long-term effects are anticipated. The breeding site is located 1,090 m from T3 and 1,110 m from T2.

Significance of effect: Temporary avoidance of roosting and adjacent foraging habitat within and near the 1 km buffer is assessed as a minor adverse impact at the local scale, reflecting confirmed breeding activity within this area.

Peregrine

Observed only intermittently in high-altitude passage or hunting, with no confirmed use of the core study area. The nearest breeding site was located 5.1 km from the Development.

Significance of effect: Given the absence of nearby nests, no construction related disturbance or potential effects are expected.

7.6.1.2.6 Passerines

Meadow pipit was the most abundant and widespread passerine recorded during breeding bird surveys and was also regularly observed in winter. Breeding was confirmed within the core study area across all survey years, primarily in less intensively managed grassland with tussocky swards, scattered rushes, and low grazing pressure, offering suitable nesting and foraging habitat. Total grassland habitat loss to facilitate the development infrastructure is 33.4 ha, representing the extent of potential permanent habitat reduction within the core study area

Ten amber-listed passerines were recorded during surveys, including goldcrest, greenfinch, house martin, house sparrow, linnet, sand martin, skylark, starling, swallow, and willow warbler. Of these, goldcrest, house sparrow,

linnet, skylark, starling, swallow, and willow warbler were confirmed breeding within the core study area, while greenfinch, house martin, and sand martin were recorded but not confirmed breeding.

Most breeding amber-listed species nest in scrub, woodland and hedgerow habitats, and may be vulnerable to disturbance and habitat loss due to vegetation clearance during the breeding season. Skylarks, as the only ground-nesting species, breeds in open grassland similar to meadow pipit habitats and is therefore particularly sensitive to construction activities.

Permanent habitat loss within the Development Boundary includes:

- Hedgerows (WL1): 1.9 km
- Treelines (WL2): 922.3 m
- Drainage ditches (FW4): 1.3 km
- Mixed broadleaved/conifer woodland (WD2): 1.1 ha
- Immature woodland (WS2): 1.8 ha

These losses represent the removal or permanent alteration of habitats used by breeding amber-listed passerines for nesting, foraging, and commuting within the core study area. Open grassland and tussocky swards used by skylark and other ground-nesting species will also be affected, contributing to potential temporary or permanent displacement from affected areas.

Construction activities including vegetation clearance, machinery operation and noise generation, have the potential to cause temporary displacement, reduced breeding success, or nest abandonment in sensitive passerines, particularly during the breeding season (April-July) (Gilbert *et al.*, 2021b; Eaton *et al.*, 2015). Disturbance thresholds vary by species, nest exposure, and habitat type. For ground-nesting species such as meadow pipit, potential behavioural disruption is generally limited to within tens of metres of active nests, rather than a uniform 100 m radius. The scale of potential disturbance is therefore influenced by local habitat structure and proximity to construction activities.

Significance of effect: Given the presence of breeding populations of Amber-listed passerines and Red-listed meadow pipit of Local (Higher) ecological importance, temporary disturbance is anticipated to be minor and localised. Populations are likely to recover fully post-construction and overall, the Development is unlikely to result in significant long-term effects on breeding passerine populations within the core study area.

7.6.1.3 Water quality

All phases of the Development, particularly the construction phase, have the potential to affect local water quality through sediment mobilisation, vegetation clearance, drainage modification, and accidental pollution. Key sensitive features include watercourse crossings over the Morningstar River and the network of drainage ditches within the Development (Chapter 6 Biodiversity and Chapter 9 Hydrology and Hydrogeology).

While the Morningstar River lies largely outside the main construction footprint, it remains hydrologically connected. Drainage ditches, grassland habitats in close proximity to the Morningstar, and intermittent flooded areas within the Development site provide foraging and roosting habitat for water-dependent species, particularly during wetter periods. Potential impacts on these birds include:

- Direct contact with pollutants or hydrocarbons via runoff or accidental spillage.
- Degradation or temporary loss of roosting and foraging habitat through sediment deposition or vegetation clearance.

- Reduced prey availability resulting from short-term changes in water quality or sedimentation.

Assessments in Chapter 9 Hydrology and Hydrogeology and the Surface Water Management Plan (SWMP) indicate that significant changes to hydrology or drainage features are unlikely, and the risk of widespread water quality impacts is low. Localised, temporary effects may result in short-term behavioural changes, reduced foraging efficiency, or minor displacement of water-dependent birds from affected areas.

Significance of effect: Any temporary displacement or reduced foraging efficiency for birds using the Morningstar River and associated habitats is expected to be adverse, minor and reversible. Populations are unlikely to experience long-term impacts due to the availability of alternative foraging and roosting sites within the surrounding landscape and the temporary nature of potential water quality changes.

7.6.2 Operational Phase

Operational adverse effects are considered as those resulting from the operation of the Development, including operational turbines, and turning blades, maintenance of built infrastructure, and operation of the proposed Ballinlee substation. The proposed operational lifespan for the wind farm is 35 years.

Therefore, for ornithological features, the temporal magnitude of effects arising during the operational phase of the Development is assessed as long-term, meaning effects lasting between 15 to 60 years (EPA, 2022).

Potential effects during the operational phase of the Development encompass both direct and indirect effects on ornithological features, which are summarised below.

- Disturbance and displacement to avifauna due to operational maintenance works, including noise and human activity that may disrupt feeding, nesting, and roosting behaviours;
- Displacement or attraction of nocturnal species (e.g., waterfowl or passage migrants) from operational lighting at the proposed Ballinlee substation, is expected to be minor and no greater than that associated with a domestic dwelling;
- Displacement effect of operating turbines, including potential barrier to movements and affecting flight paths particularly for migratory species and those that utilise the area for foraging or roosting;
- Collision risk from rotating turbine blades, particularly for species with high flight activity in the rotor-swept zone, such as migratory waterbirds or raptors;
- Surface water run-off containing sediments, accidental pollution spills or wastewater.

7.6.2.1 European and National Designated Sites

Potential source–pathway–receptor (SPR) linkages between the Development and designated sites were evaluated for the operational phase. Only sites within 20 km with ornithological qualifying interests were considered relevant. The application of a 20 km buffer is consistent with guidance for Environmental Impact Assessment and Appropriate Assessment (NPWS, 2021; NatureScot, 2017; CIEEM, 2018), which recommend precautionary zones of up to 20 km for highly mobile bird species and for screening designated sites with ornithological qualifying interests.

This differs from the 10–15 km buffers applied for baseline survey design, which were proportionate to survey practicality and the ranging behaviour of the species targeted for field data collection. For assessment purposes, however, the 20 km buffer ensures that potential operational-phase effects on designated conservation sites are not underestimated, in line with best practice for EIARs.

Potential operational effects include disturbance, displacement, and collision risk for species using or passing through the Development. Assessments are provided below:

7.6.2.1.1 River Shannon and River Fergus Estuaries SPA

Water quality deterioration arising from surface water run-off from hardstanding areas and/or accidental pollution events

The Development is upstream of and has weak hydrological connectivity with the River Shannon and River Fergus Estuaries SPA. The SPA is located c. 36.9 rkm downstream of the Development and c. 12.6 rkm downstream of the GCR at its nearest point (i.e., near the point of termination at Killonan substation).

Potential sources of water quality impact during the operational phase include increased suspended sediments from hardstanding areas, accidental release of hazardous materials (e.g., hydrocarbons), or wastewater generated at the substation welfare facilities, which could infiltrate to the underlying groundwater or migrate off-site via surface water drainage, ultimately reaching the Morningstar River. Surface water runoff from the Development is expected to remain broadly consistent with pre-development conditions. Hydrocarbons on site are limited to small volumes of lubricating and cooling oils, and wastewater will be collected in a contained holding tank. While there is a theoretical risk of material reaching the Morningstar River or downstream environment, including the SPA, this is considered highly unlikely.

Baseline observations and connectivity: During baseline surveys (Section 7.3.3), SCI bird species including cormorant, whooper swan, lapwing, golden plover, curlew, and black-headed gull were recorded within or near the Development. Linkage to the SPA is considered highly unlikely due to the distance (~18 km) between the Development and the SPA, which is well beyond the foraging ranges of these species. No source–pathway–receptor (SPR) linkages have been identified, and observed individuals are considered incidental or transient. Consequently, operational-phase water quality effects are not expected to result in measurable impacts on SPA bird populations.

Significance of effect: Without mitigation, any temporary, localised changes in water quality could potentially cause minor behavioural disturbance or reduced foraging efficiency for water-dependent birds within the Development. However, these effects are expected to be minor and reversible at the local scale, with no long-term population-level impacts on SCI bird species or SPA populations.

7.6.2.1.2 Lough Gur pNHA

Lough Gur pNHA, located c. 5 km northeast of the Development, maintains a functional ecological connection with the site through a local whooper swan population. These swans roost at Lough Gur but forage within agricultural lands adjacent to the Morningstar River in the northern section of the Study Area, including Camas South and Ballycullane, demonstrating regular commuting behaviour over distances of 200–600 m from proposed turbine locations (Section 7.3.3.2.2). Observations over three non-breeding seasons (2021–2024) confirm that Camas South functions as a key foraging area and nocturnal flight corridor associated with the Lough Gur roost, while Ballycullane is used interchangeably, particularly in the latter half of the non-breeding season. Peak counts at Camas South represent up to ~12% of the Co. Limerick whooper swan population, indicating local significance within the broader Lough Gur population.

During the operational phase, minimal long-term disturbance is anticipated once construction is complete. Collision risk from operational structures is considered low, and no hydrological changes are expected that would affect habitat quality at Lough Gur. Observed swans are highly mobile, and the availability of multiple functional foraging areas further reduces the likelihood of measurable adverse effects on local populations.

Significance of effect: Any temporary operational-phase disturbance is assessed as minor at the local scale. Temporary displacement or reduced foraging efficiency is unlikely to affect the overall whooper swan population connected to Lough Gur, and functional connectivity between the Development and Lough Gur pNHA is expected to be maintained.

7.6.2.2 Bird species

7.6.2.2.1 Waterfowl - Mute swan, mallard and teal

Disturbance and displacement

Evidence indicates that mute swan, mallard, and teal demonstrate some capacity to habituate to operational infrastructure, particularly in agricultural landscapes (Pearce-Higgins *et al.*, 2012; Larsen & Madsen, 2000). During the operational phase, potential impacts are primarily associated with disturbance and temporary displacement arising from turbine presence and blade rotation. Human presence and routine maintenance (vehicle access, minor infrastructure works) are negligible in comparison to existing farming and land management activity.

Initial disturbance may occur as waterfowl adjust to moving turbine blades, particularly near wetland features or during occasional traffic across the Morningstar River crossing. However, baseline surveys indicate that the majority of functionally used habitats lie outside the turbine footprint, including the Morningstar catchment, associated ditches, and other nearby waterbodies such as Lough Gur. As a result, sustained displacement is not anticipated.

Mute swan has been observed to tolerate turbines at relatively close distances provided suitable nesting and foraging conditions are maintained (Scott & Rose, 1996; Cramp & Simmons, 1977). Turbines are not located directly adjacent to confirmed breeding sites, and core riverine habitat remains accessible; therefore, the risk of disturbance-related breeding failure is low, and long-term displacement is considered unlikely. Mallard and teal may exhibit local avoidance during the initial operational period, but operational evidence indicates moderate habituation, with continued use of suitable foraging habitats.

Significance of effect: In the absence of mitigation, operational-phase activities may cause temporary displacement of local populations of mute swan, mallard, and teal. As such, there is an indirect, adverse, and minor effect at a local geographical scale, with functionally important habitat remaining accessible.

Collision Risk

Collision Risk Modelling was undertaken for mallard due to flight frequency and potential interactions with the rotor-swept zone. The modelling predicted a collision rate of 0.17 mallard per annum, which equates to 6.14 individuals over the 35-year operational life of the Development. This level of mortality is negligible at both local and county scales. CRM was not conducted for mute swan or teal due to low flight frequency and minimal interaction with the turbine envelope; observed flights were largely confined to vegetated margins or the Morningstar River corridor.

Significance of effect: In the absence of mitigation, potential direct impacts from collision with turbine blades are predicted to be extremely low for local populations of mallard, mute swan, and teal. As such, there is an indirect, adverse, and negligible effect at the local scale.

7.6.2.2.2 Whooper swan

Disturbance and displacement

During the operational phase, disturbance may arise from moving rotor blades and occasional maintenance visits. Human presence associated with turbine operation is considered negligible compared to routine

agricultural activity. Displacement is expected to be spatially limited, primarily affecting fields near turbine T3, with broader use of the floodplain, including the western end of Camas South, likely to continue.

Displacement may vary seasonally depending on swan abundance and prevailing weather conditions. Observations from the 2022/23 and 2023/24 non-breeding seasons indicate that swans adjust site use in response to wind direction and commuting efficiency, favouring Ballycullane during periods of strong southerlies. Although operational turbine noise can elicit short-term behavioural responses, predicted levels are below thresholds associated with sustained avoidance (Kirby & Owen, 2002; NatureScot, 2022; Larsen & Madsen, 2000), and suitable alternative foraging habitat remains available.

Significance of effect: In the absence of mitigation, disturbance and displacement effects are considered moderate adverse at a local scale, due to partial loss of foraging opportunity within the turbine envelope and potential energetic costs associated with altered site use.

Collision Risk

Collision Risk Modelling (**Appendix 7C**; **Table 7-7** and **Table 7-9**), based on VP survey data from the non-breeding seasons of 2022-23 and 2023-24 predicted:

- 0.22 collisions per annum (7.7 individuals over 35 years) using standard CRM.
- 0.55 collisions per annum (19.2 individuals over 35 years) using behaviourally adjusted CRM[19] incorporating flight speed and crepuscular activity.

Both estimates exceed the commonly used "low risk" threshold of 0.05 birds/year (e.g., NatureScot, 2024) but remain low relative to national and regional populations. CRM assumptions prioritise observed use patterns over macro-avoidance (~99.5%; Band, 2024), which would otherwise imply substantial habitat loss. Micro-avoidance remains less well quantified (Mackie, 2025), introducing some uncertainty in close-range turbine interactions.

Operational-phase monitoring at comparable wind farms, including Carrownagowan Wind Farm (Ireland) and Thanet Offshore Wind Farm (UK), indicates that birds generally exhibit high avoidance rates of turbines post-construction, and that behavioural responses often result in temporary, short-term displacement rather than population-level impacts (JNCC, 2021; Carrownagowan Ornithology Report, 2020). This supports the assumption that actual collision risk may be lower than predicted by conservative CRM outputs.

Significance of effect: In the absence of mitigation, collision risk is considered low and not significant at a local scale, based on predicted mortality rates, observed avoidance behaviour, and evidence from operational-phase monitoring at comparable wind farms.

7.6.2.3 Waders

7.6.2.3.1.1 Curlew

Disturbance and displacement

Curlew are sensitive to visual and noise disturbance, particularly in open landscapes, and may exhibit behavioural avoidance at distances of up to 250–500 m (Pearce-Higgins *et al.*, 2012; Drewitt & Langston, 2006). Breeding birds were absent from the Development and surrounding area. During the operational phase, routine turbine operation, including blade rotation, low-level noise, and lighting, is the primary potential disturbance pathway, while human maintenance activity is considered negligible.

19 - Inferred flights' refers to additional whooper swan flight activity estimated from behavioural observations, flight speed measurements, and bioacoustics data, to account for movements not directly observed during standard vantage point watches (e.g., nocturnal flights).

Operational disturbance may be longer-term compared with construction, but baseline surveys indicate that most potential foraging habitat lies outside the immediate turbine envelope, and displacement is therefore expected to be spatially limited.

Significance of effect: In the absence of mitigation, operational-phase activities, including turbine rotation, noise, and lighting, may cause temporary behavioural avoidance of local non-breeding curlew. As such, there is an indirect, adverse, and minor effect at a local scale.

Collision risk

Flight activity within the Development is typically at low altitude, with few observations at collision-risk height. No Collision Risk Modelling was required, and collision risk is considered negligible (SNH, 2016).

Significance of effect: In the absence of mitigation, operational-phase activities may cause temporary behavioural avoidance of turbines. As such, there is an indirect, adverse, and minor effect on non-breeding curlew at a local geographical scale.

7.6.2.3.1.2 Golden plover

Disturbance and displacement

Golden plover are sensitive to visual and noise disturbance and may avoid areas within 300–500 m of turbines (Pearce-Higgins *et al*., 2012; Drewitt & Langston, 2006). During the operational phase, potential effects primarily relate to temporary displacement due to turbine rotation, low-level noise and associated maintenance activity, which is minor compared with routine agricultural activity. Baseline surveys indicate that most potential foraging habitat lies outside the immediate turbine envelope, and displacement is therefore expected to be spatially limited.

Significance of effect: In the absence of mitigation, operational-phase activities may cause temporary behavioural avoidance of turbines while habituating to their presence. As such, there is an indirect, adverse, and minor effect on local golden plover.

Collision risk

Collision Risk Modelling predicts approximately 3.25 collisions per year for golden plover (**Table 7-9**), representing just 0.0035% of the national population (Fitzgerald *et al*., 2021). Most observed flights occur outside the rotor-swept zone, and potential interactions are low.

Significance of effect: In the absence of mitigation, operational-phase collision risk for local golden plover is extremely low. As such, there is an indirect, adverse, and negligible effect at a local scale.

7.6.2.3.1.3 Lapwing

Disturbance and displacement

Potential operational-phase effects on lapwing primarily relate to disturbance and temporary displacement from moving turbine blades, low-level noise and maintenance activity. Such disturbance is considered minor compared with routine agricultural activity in the area. Lapwing are sensitive to disturbance during the non-breeding season and may avoid areas within 300–500 m of turbines (Pearce-Higgins *et al*., 2012; Drewitt & Langston, 2006). Most suitable lapwing foraging areas lie outside the turbine envelope, and displacement is therefore expected to be spatially limited.

Significance of effect: In the absence of mitigation, operational-phase activities may result in temporary behavioural avoidance and minor displacement of lapwing. As such, there is an indirect, adverse, and minor effect at a local geographical scale.

Collision risk

Collision Risk Modelling predicts approximately 0.77 collisions per year for lapwing, equating to 27 individuals over the 35-year operational lifespan. This represents approximately 0.00077% of the national population (Fitzgerald *et al*., 2021). Mortality at this level is negligible at local and national scales.

Significance of effect: In the absence of mitigation, potential collision with turbines is predicted to result in an indirect, adverse, and minor effect at a local geographical scale.

7.6.2.3.1.4 Snipe

Disturbance and displacement

Operational-phase effects on snipe primarily relate to disturbance and temporary displacement from moving turbines and occasional low-level maintenance activity. Human presence associated with operation is minimal relative to routine agricultural activity. Some localised displacement may occur near operational turbines, but most potential foraging habitat lies outside the turbine envelope, and the extensive availability of suitable wet grassland and bog habitats within the surrounding 5 km buffer provides sufficient capacity to accommodate displaced individuals.

Significance of effect: In the absence of mitigation, temporary behavioural avoidance and displacement of snipe is assessed as negligible and not significant at the local geographical scale.

Collision risk

Collision Risk Modelling predicts approximately 0.06 collisions per year, or ~1.95 collisions over the 35-year operational lifespan. This represents 0.0004% of the estimated national non-breeding population (15,300 individuals; Fitzgerald *et al*., 2019). Given low, erratic flight behaviour and preference for low-lying wet habitats, collision risk is considered negligible.

Significance of effect: In the absence of mitigation, collision-related mortality is negligible and not significant at the local geographical scale.

Habitat loss

Permanent habitat loss within the Development comprises 33.4 ha of grassland and 1.3 km of drainage ditches, along with a temporary habitat loss of 51.4 m of lowland river features. While this represents a measurable loss within the core study area, it is minor in the context of the wider landscape, where extensive wet grassland, and drainage habitats are available within a 5 km buffer.

Significance of effect: In the absence of mitigation, the effect of permanent habitat loss on snipe is minor and not significant at the local geographical scale.

7.6.2.3.2 Other Waterbirds

Disturbance and displacement

Potential operational-phase effects on cormorant, grey heron, and little egret primarily relate to disturbance and temporary displacement arising from turbine rotation and occasional low-level maintenance activity. Human presence within the Development will be minor relative to routine agricultural activity. Observed flight paths indicate that these species primarily commute along the Morningstar River and River Maigue, which remain largely unaffected by operational activity, preserving key foraging and roosting connectivity. Flush responses to operational activity are typically within 100–200 m (Rodgers & Schwikert, 2002; Colhoun & Worden, 2013), but the low densities and dispersed distribution of these species, coupled with the availability of functional habitat, mean any displacement is expected to be temporary.

Significance of effect: In the absence of mitigation, temporary behavioural avoidance and displacement are assessed as adverse, minor and not significant at the local geographical scale.

Collision risk

Collision Risk Modelling predicts low annual collision rates:

- Cormorant: 0.27 collisions per year, or 9.6 individuals over 35 years, representing a negligible fraction of the national population (Percival, 2005; Drewitt & Langston, 2006).
- Grey heron: 0.14 collisions per year, or 4.8 individuals over 35 years, based on a 0.98 avoidance rate; low flight heights further reduce risk.
- Little egret: Not modelled due to low flight activity but expected to share similar behavioural tolerance to turbines as grey heron.

Significance of effect: In the absence of mitigation, collision-related mortality is negligible and not significant at the local geographical scale.

Water quality

Cormorant, grey heron, and little egret are sensitive to water quality changes, particularly turbidity and sedimentation, which can affect prey availability. No permanent alteration to water flow or clarity is anticipated, and watercourses within the Development will remain functional.

Significance of effect: In the absence of mitigation, operational-phase effects on prey availability due to water quality changes are negligible and not significant at the local geographical scale.

7.6.2.3.3 Gulls

Disturbance and displacement

Both black-headed gull and lesser black-backed gull are moderately sensitive to disturbance but are highly mobile, behaviourally flexible, and capable of habituating to operational infrastructure (Drewitt & Langston, 2006; Furness *et al*., 2013; Cutts *et al*., 2009; Colhoun & Worden, 2013). Baseline surveys recorded opportunistic foraging or in-flight activity across the Development, with no evidence of breeding, loafing colonies, or persistent displacement patterns. Operational activities, including turbine rotation and low-level maintenance, may cause temporary behavioural avoidance, typically within approximately 300 m of turbines. Most potential foraging habitat lies outside the turbine envelope, and alternative habitat is abundant in the surrounding landscape.

Significance of effect: In the absence of mitigation, operational-phase disturbance may cause temporary behavioural avoidance. As such, there is an indirect, adverse, and negligible effect on black-headed gull and lesser black-backed gull at the local geographical scale.

Collision risk

Collision Risk Modelling, using a precautionary 0.98 avoidance rate, predicts very low mortality: 1.87 black-headed gulls per year (16.45 birds over 35 years, ~0.014% of the national non-breeding population) and 2.59 lesser black-backed gulls per year (12.25 birds over 35 years, ~0.055% of the national population). Observed flight behaviour indicates that the majority of movements occur outside the rotor-swept envelope, and both species are expected to habituate to turbine presence.

Significance of effect: In the absence of mitigation, collision risk is predicted to be minimal. As such, there is a direct, adverse, and negligible effect on black-headed gull and lesser black-backed gull at the local geographical scale.

Water quality

Operational-phase activities have the potential to alter local water quality through runoff or accidental pollution, which could temporarily reduce prey availability for foraging waterbirds. However, the Development is designed to retain functional hydrological connectivity and aquatic habitat quality, and the volume and frequency of any potential disturbance are minimal.

Significance of effect: In the absence of mitigation, there is potential for short-term, localised changes in water quality. As such, there is an indirect, adverse, and negligible effect on local waterbird populations at the local geographical scale.

7.6.2.3.4 Raptors

Disturbance and displacement

Raptor species vary in their sensitivity to disturbance. Buzzard and kestrel are generally tolerant of moderate human activity, while peregrine, long-eared owl, and barn owl are more sensitive, particularly during the breeding season. Sparrowhawk is moderately sensitive to disturbance near nests. Many raptors, especially buzzard and kestrel, have demonstrated the capacity to habituate to operational wind farms over time (Drewitt & Langston, 2006; Pearce-Higgins *et al*., 2012). Breeding activity of buzzard, kestrel, and sparrowhawk occurs within or near the core study area, but no nests are located at turbine or infrastructure sites, and the majority of core nesting and foraging habitat remains accessible. Long-eared owl is present locally, with breeding likely just outside the core study area. Barn owl and peregrine breeding sites occur outside the 2–5 km buffer, limiting exposure to operational disturbance. Other raptors recorded outside the breeding season are highly mobile and utilise habitats across the wider landscape. Temporary behavioural changes or minor avoidance may occur near turbines, but functional habitat use is largely retained.

Significance of effect: In the absence of mitigation, temporary behavioural changes or minor avoidance may occur, but these are reversible. As such, there is an indirect, adverse, and minor effect on raptors, including long-eared owl, at the local geographical scale.

Collision risk

Collision Risk Modelling was undertaken for buzzard, kestrel, sparrowhawk, and peregrine. Predicted annual collision rates are low, representing less than 0.1% of national breeding populations, and are therefore considered negligible. CRM was not undertaken for long-eared owl due to low encounter rates and limited use of the Development. Collision risk for these species is considered minimal given flight behaviour, low flight heights (long-eared owl, merlin), and high-altitude passage (peregrine, white-tailed eagle).

Significance of effect: In the absence of mitigation, collision risk is extremely low, resulting in an indirect, adverse, and negligible effect on raptors at the local geographical scale.

Lighting effects

Operational lighting at turbines and the substation is limited, primarily motion-activated or low-intensity. Raptors observed within the Development, including barn owl, long-eared owl, peregrine, and buzzard, are highly mobile and able to avoid illuminated areas. No breeding nests are located immediately adjacent to lit infrastructure, and alternative hunting and commuting routes remain available. Therefore, operational lighting is not expected to result in measurable behavioural changes or displacement.

Significance of effect: In the absence of mitigation, operational-phase lighting may cause minor, temporary behavioural avoidance by raptors at a local scale. This is assessed as an indirect, adverse, and minor effect, reversible once birds habituate or avoid illuminated areas.

Noise effects

Operational turbine noise is continuous but of low amplitude and frequency. Raptors within the Development,

including buzzard, kestrel, peregrine, barn owl, and long-eared owl, are unlikely to be displaced from core foraging or commuting routes. Breeding sites are located outside or away from high noise exposure areas. Any localised behavioural responses are expected to be temporary, with birds habituating to the presence of turbines over time.

Significance of effect: In the absence of mitigation, operational-phase noise may cause minor, temporary behavioural avoidance at a local scale. This is assessed as an indirect, adverse, and minor effect, reversible once birds adjust to turbine operation.

7.6.2.3.5 Passerines

Disturbance and displacement

Operational turbines and routine maintenance within the Development may cause minor, localised behavioural responses in passerines. Most species fly below rotor height, and the majority of breeding territories and foraging habitats lie outside the immediate turbine envelope. Observed use of hedgerows, field margins, and scrub habitats indicates that structural and nesting resources remain largely accessible. Any temporary displacement or minor disruption of movement corridors is expected to be limited (Drewitt & Langston, 2006).

Significance of effect: In the absence of mitigation, operational-phase disturbance and temporary displacement may occur in passerines. This is assessed as an indirect, adverse, and negligible effect at a local geographical scale.

Collision risk

Passerines generally fly below rotor height and show low susceptibility to collision with turbines. No species-specific collision modelling was required, and the potential for collision mortality is negligible (Drewitt & Langston, 2006).

Significance of effect: In the absence of mitigation, the potential for collision-related mortality in passerines during operation is considered negligible at a local geographical scale.

7.6.2.4 Water Quality

During the operational phase, the Development is not expected to result in significant changes to local water quality. Key sensitive features, including the Morningstar River and the network of drainage ditches, will continue to provide foraging and roosting habitat for water-dependent species **(Chapter 6**: Biodiversity and **Chapter 9**: Hydrology and Hydrogeology). Routine operation may involve minor maintenance of access tracks or drainage features, but these activities are unlikely to cause measurable changes in hydrology or water quality.

Significance of effect: In the absence of mitigation, operational-phase activities are expected to have a direct, negligible effect on water quality at a local geographical scale.

7.6.2.5 Collision effects

Table 7-9: Mean predicted collision rates using species-specific avoidance rates recommended by NatureScot (2024) guidance

Species	Collisions per year	Collisions per decade	Development operational lifespan (35 years)
Black-headed gull	0.47	4.40	16.45

Species	Collisions per year	Collisions per decade	Development operational lifespan (35 years)
Buzzard	1.47	14.70	51.45
Cormorant	0.21	2.10	7.35
Golden plover	3.25	32.50	113.75
Grey heron	0.14	1.40	4.90
Kestrel	0.82	8.20	28.70
Lapwing	0.77	7.70	26.95
Lesser black-backed gull	0.35	3.50	12.25
Mallard	0.13	1.30	4.55
Peregrine	0.08	0.80	2.80
Snipe	0.06	0.60	2.10
Sparrowhawk	0.11	1.10	3.85
Whooper swan (original)	0.22	2.20	7.70
Whooper Swan (revised Year 3)	0.55	5.50	19.25

Collision Risk Modelling was undertaken using the Vestas V136 turbine model, following standard methodologies (Band, 2024) and applying species-specific avoidance rates. Flight activity rates were derived from vantage point surveys across Years 2 and 3. Methodology and assumptions are detailed in **Appendices 7B** (Baseline Ornithology Report) and **7C** (Collision Risk Modelling Report).

Thirteen species were included in the CRM based on their recorded flight activity within the core study area. These included waterbirds (golden plover, lapwing, snipe, whooper swan, mallard, grey heron, cormorant, black-headed gull and lesser black-backed gull) and raptors including kestrel, buzzard, peregrine and sparrowhawk. Predicted collision rates are summarised in **Table 7-9**.

To assess significance, mean annual collision rates were compared with national population estimates using a 1% annual mortality threshold (NatureScot, 2018). Even for species with the highest predicted rates, such as golden plover (0.0035% of ~92,000), buzzard (~0.25% of ~6,000 pairs), and whooper swan (0.0015–0.0037% of ~15,000),

predicted mortality is well below the threshold. All other species were substantially lower again, representing negligible proportions of their national populations.

Significance of effect: Based on the mean predicted CRM results (Table 7-9) and national population estimates, predicted turbine-related mortality is low for all species. No measurable population-level effects are anticipated over the 35-year lifespan of the Development, and collision effects are therefore considered not significant.

7.6.2.5.1 Barrier Effects

Barrier effects are considered only for the operational phase, as construction activities do not create permanent physical obstacles. During operation, turbines may cause minor, localised displacement for river-associated species; however, baseline surveys indicate infrequent use of the Development site, and the turbine layout avoids key flight corridors. Any barrier effects are expected to be negligible and reversible. Operational disturbance to whooper swan and golden plover is discussed in detail in Section 7.7.2 and addressed through the WSMP (Appendix 7D).

7.6.3 Decommissioning Phase

Potential effects on ornithological features during the decommissioning phase are anticipated to be broadly similar in nature to those experienced during the construction phase, albeit generally of reduced magnitude and duration. Activities such as turbine dismantling, infrastructure removal, and restoration of disturbed areas (as outlined in Chapter 2: Description of the Development) will result in temporary increases in human activity, noise, and ground disturbance.

Decommissioning is expected to occur more than 35 years after the original baseline surveys. Accordingly, the effects identified at this stage are indicative only and will require reassessment against updated baseline conditions nearer the time of decommissioning.

Significance of effect:

- Disturbance and displacement: Temporary disturbance from human activity, noise, and machinery may occur during decommissioning, but effects are expected to be localised and of short duration.
- Habitat alteration: Habitat reinstatement is expected to offset any temporary losses arising from infrastructure removal.
- Collision risk: No collision risk will apply once turbines are non-operational.

Although reduced in scale compared to construction, decommissioning effects could still be significant if they coincide with sensitive ecological periods (e.g. breeding or wintering). However, given the long timescale, current assessments cannot meaningfully predict effects on Important Ornithological Features (IOFs). A detailed reassessment will be undertaken prior to decommissioning.

Table 7-10: Summary of effects on key ornithological and habitat receptors

Receptor	Construction Phase – Key Effects	Operational Phase – Key Effects	Significance of effects
River Shannon & River Fergus Estuaries SPA	No source–pathway–receptor linkage; hydrological connection only via Morningstar–Maigue; no direct use by SCI species.	No functional linkage; no SPA population interaction confirmed.	Negligible – no adverse effect on integrity (both phases)
Lough Gur pNHA	Temporary disturbance risk to foraging whooper swan; construction timed to avoid peak use; no hydrological connectivity.	Functional linkage for swan foraging; low risk of disturbance/collision; WSMP mitigation in place.	Negligible to minor (construction & operation) – no adverse effect on integrity
Waterfowl (mute swan, mallard, teal)	Temporary loss of drainage features and grassland; disturbance near Morningstar River; breeding mute swan confirmed.	Local disturbance/displacement; mallard CRM ≤6 over 35 yrs; swan breeding sites unaffected.	Negligible to minor – not significant (both phases)
Whooper swan	Displacement from Camas South during works; temporary foraging loss; construction timed to avoid peak use.	Displacement risk from turbines; CRM ≤19 over 35 yrs. WSMP mitigation and monitoring in place	Moderate, locally significant without mitigation (both phases) → Not significant with WSMP
Waders (curlew, golden plover, lapwing, snipe)	Temporary disturbance and displacement; limited ground use confirmed for golden plover and lapwing.	Ongoing displacement risk within 300–500 m; very low collision risk. No breeding recorded	Curlew Minor local; Golden plover Minor-moderate local; Lapwing Minor local; Snipe Minor local.
Other waterbirds (cormorant, grey heron, little egret)	Temporary displacement from wet features and watercourses; no nesting confirmed.	Low disturbance; CRM very low; transitory use only.	Minor – not significant (both phases)
Gulls (black-headed, lesser black-backed)	Temporary disturbance from construction compounds and traffic; opportunistic foraging.	Low disturbance; CRM <0.06% of national populations; no breeding	Negligible – not significant (both phases)
Raptors (buzzard, kestrel, sparrowhawk, peregrine, long-eared owl, barn owl)	Temporary disturbance near nests if present; buffered by layout; no nesting within turbine envelope.	Minor disturbance; CRM <0.1% of national populations; no significant displacement.	Negligible – not significant (both phases)

Receptor	Construction Phase – Key Effects	Operational Phase – Key Effects	Significance of effects
Passerines	Temporary habitat loss (hedgerows, treelines, scrub); replacement planting proposed	Minimal disturbance; very low collision risk; hedgerows retained.	Negligible – not significant (both phases)
Water quality (Morningstar River, ditches, grassland)	Risk of sedimentation/runoff during works, controlled by SWMP and CEMP.	No hydrological change; water quality safeguarded by SWMP.	Negligible – not significant (both phases)

7.6.4 Cumulative Effects

The potential cumulative effects on IOFs arising from the Development in conjunction with other developments within 20 km were assessed to determine whether overlapping effects could arise. A 20 km study radius was used, consistent with guidance provided in the Wind Energy Development Guidelines (2006) and the Draft Wind Energy Guidelines (2019).

Cumulative effects may occur where other projects could contribute to impacts identified for the Development, including:

- Direct habitat loss;
- Disturbance and displacement during construction or operation;
- Collision risk; and
- Indirect effects via water quality changes.

Particular attention was paid to developments within the same hydrological catchment that could influence water quality and, therefore, wetland habitats used by IOFs. Permanent habitat loss during construction is only considered potentially cumulative if other developments occur within 300 m of the Development, and disturbance/displacement effects are expected to be spatially limited to approximately 300 m (Cutts *et al.,* 2009).

7.6.4.1 Wind Farms

Several wind farms exist within the 20 km study area, including operational, permitted, and proposed developments (Table 7-11). None of these are located within 300 m of the Development; therefore, cumulative effects due to direct habitat loss or disturbance are unlikely.

Table 7-11: Wind farms considered for cumulative impact assessment within 20 km of the Development

Wind Farm Name	No. of Turbines	Location	Status
Boolard Wind Farm	2	Boolard, Dromina, Co. Cork	Operational
Rathnacally Wind Farm	2	Rathnacally, Charleville, Co. Cork	Operational
Kilmeedy Wind Farm Limited	2	Ballinruane and Ballyhahil, Kilmeedy, Co. Limerick.	Operational
Ballyhoura Wind Farm	6	Streamhill East, Streamhill West, Doneraile, Co.Cork	Operational
Knockshany Wind Farm	9	Court, Kildimo, Co. Limerick	Proposed
Garrane Wind Farm	9	15 – 20 km northeast	Proposed

Assessment:

- Disturbance/displacement: No other wind farms lie within 300 m; therefore, cumulative effects negligible.
- Habitat loss: No cumulative loss is expected as other wind farms are beyond the 300 m influence zone.
- Collision risk: Spatial separation of turbines and low predicted CRM values indicate negligible cumulative collision risk.
- Water quality effects: The Development and Garrane Wind Farm are hydrologically connected. Combined sediment or nutrient run-off could indirectly affect wetland habitats used by IOFs. With the implementation of the WSMP, SuDS, and standard construction mitigation, any cumulative water quality effects are likely to be minor and not significant.

7.6.4.2 Other Developments

Major developments within 10 km of the Development that could contribute to cumulative effects via water quality were considered (Table 7-12). Only projects since 2019, not yet completed or under construction, and within the same hydrological catchment/sub-catchment/sub-basin (Morningstar_060 WFD sub-basin, Maigue_SC_030 sub-catchment, Shannon Estuary South WFD catchment) were included.

Table 7-12: Projects and plans considered for cumulative impact assessment from 2019 onwards, excluding retention, withdrawn and refused applications

Project	Applicant	Description	Location	Distance	Granted
Solar Farm System (19455)	Cappamore Kilmallock Area Planner	114 kWp solar farm, underground cable	Garrooe, Bruree House, Bruree, Co. Limerick	c. 6 km	2019
Farm Buildings (22457)	Fergal Hanrahan	Demolition and decommissioning of slurry storage; new agricultural buildings	Coolboy, Athlacca, Co. Limerick	c. 3.7 km downstream	2022
Dwelling Houses (2360796)	OMC Houses	Construction of 5-dwelling estate	The Grove, Bruff, Co. Limerick	c. 3.3 km upstream	2024
Bridge (218006)	–	Demolition and replacement of Ballysimon Bridge	Ballysimon, Co. Limerick	c. 2 km downstream via Groody River	2021
Substation (191250)	EirGrid / ESB	Minor modifications and extension of Killonan 220/110 kV substation	Milltown & Coolyhenan, Co. Limerick	Termination of GCR	2020

Assessment:

- Disturbance/displacement: All projects are beyond the 300 m influence zone; therefore, cumulative effects on IOFs are negligible.
- Habitat loss: Localised habitat impacts do not overlap with the Development; cumulative effects are negligible.

- Water quality: Projects hydrologically connected to the Development (e.g., farm buildings, solar farm, bridge works) may contribute to downstream sediment or nutrient inputs. With good practice mitigation (SuDS, WSMP, sediment control), any cumulative water quality effects are considered minor and reversible.

7.6.4.3 Summary of Cumulative Effects

Based on the assessments in **Sections 7.6.4.1** and **7.6.4.2**, the following summarises the potential cumulative effects arising from other developments and projects within the 20 km study area:

- Direct habitat loss: No cumulative loss expected, as no other developments occur within 300 m.
- Disturbance/displacement: Limited to construction within 300 m; cumulative effects negligible.
- Collision risk: Spatial separation and low predicted CRM make cumulative collision risk negligible.
- Water quality: Potential indirect effects via shared hydrological catchments; mitigated through WSMP, SuDS, and construction best practice.

Conclusion: No significant cumulative effects on ornithological features are predicted, either directly through habitat loss or disturbance, or indirectly via hydrological connectivity, provided mitigation measures are implemented.

7.7 Mitigation Measures

7.7.1 Embedded Mitigation

The Development layout and associated infrastructure have been carefully designed to minimise potential impacts on IOFs identified through comprehensive baseline surveys. Particular emphasis was placed on whooper swan, a species of high conservation concern and ecological sensitivity. As stated in **Chapter 3, Table 3-4**: Consideration of Alternatives, turbines were strategically sited to avoid key flight lines, core foraging fields, and known roost areas regularly used by swans, thereby reducing the risk of displacement and collision. Table 3-4 replicated below demonstrating the evolution of the design in response to Whooper Swan survey data.

Table 7-13: Design Evolution and Iterations (Extract from Chapter 3 Consideration of Alternatives)

Iteration	Description of Iteration	Reason for Change	Design Improvement
Initial	2 Areas: Camas South 7 No. turbines & Ballinlee 11 No. turbines. Up to 200m tip height (**Figure 3-7**).	N/A	N/A
1	Camas South: T2 & T5 dropped. T6 repositioned to accommodate flight	Swan population in Camas South.	Swan enhancement areas added to enhance areas for swan usage.

Iteration	Description of Iteration	Reason for Change	Design Improvement
	paths and foraging for Swans (**Figure 3-8**).		
2	Reposition of Ballinlee T8, T9, T13, T14, T17 (**Figure 3-9**).	Turbines repositioned to allow for GNI TX Transmission Pipeline. Smaller Turbine size to facilitate revised setback distances.	Outside setback distance of the pipeline.
3	Reposition of Camas South T1, T3, T4, T5, T7 (Renumbered T1 to T5) (**Figure 3-10**).	Greater setback from Swan Habitat areas. T5 moved to edge of Forestry. Reduction of Turbine Size 160m Tip Height which reduces visual impacts.	Reduced risk to swans and less forestry removal. Greater turbine separation. Reduced Turbine size.
4	Full site now known as Ballinlee WF and fully renumbered. New Tip Height of 160m except for T6 - 150m Tip Height (**Figures 3-11, 3-12**).	T1, T2, T3 realigned for Swans, T6 moved and Tip Height reduced to accommodate falling distance to Substation. T7, T8, T9, T10 moved for access track alignment. Reduced turbine height means revised house buffer can be used. This allows new Turbine T11. T12 moved to revised house buffer, also affects T13, T15, T17.	Reduced risk to swans and less forestry removal. Greater turbine separation. Reduced turbine size. Less hedgerow removal and better access track lay out and alignment.

This precautionary siting also results in secondary benefits for other species that utilise similar habitats, such as golden plover and lapwing, by reducing the likelihood of displacement from their main foraging fields.

Infrastructure placement, including access tracks and cabling, has been designed to follow existing field boundaries and avoid high-value habitats such as hedgerows and wetlands wherever possible. This approach minimises direct habitat loss and fragmentation, while retaining features of structural diversity important for passerines and other bird species.

Through this embedded mitigation by design, the Development avoids or reduces potential effects at source. These measures form the foundation of the impact assessment, with additional mitigation strategies set out in this section to address residual risks.

7.7.2 Construction Phase

Mitigation and monitoring during the construction phase of the Development will focus on minimising disturbance and avoiding displacement of whooper swans from key foraging habitats, particularly at Camas South, in accordance with the Whooper Swan Management Plan (WSMP, **Appendix 7D**). While collision risk is not expected to be significant during construction, this phase is critical for establishing the basis for long-term mitigation success and for capturing baseline data under both habitat conditions and activity conditions, reflecting the effects of ongoing construction on swan behaviour and habitat use. Measures will ensure that enhanced habitats

are functional and actively used by swans prior to and during the construction period, providing a robust reference for operational-phase monitoring and adaptive management.

7.7.2.1.1 Construction Phase Mitigation Measures

Mitigation during construction will focus on disturbance reduction, early establishment of alternative foraging areas, and deterrence from high-risk turbine locations. These include:

- Habitat Enhancement Completion:
  All enhancement works at Camas South (e.g. reseeding, fencing, field amalgamation, and water scrape creation) will be completed prior to the onset of construction to allow swans to become habituated to the improved habitat.
- Deterrence Measures Near Turbines:
  If swan usage of fields within 200 m of turbines is recorded prior to construction, temporary deterrents (e.g. bird-scaring lines, acoustic deterrents, visual flags) will be deployed to dissuade feeding in areas at future collision risk. These will be monitored to prevent displacement to less secure or less visible areas.
- Scrub Removal and Drainage Management:
  Scrub removal and minor drainage works will be undertaken prior to the first arrival of wintering swans (i.e., by early October), to maximise attractiveness of the enhanced fields and minimise construction-phase overlap.
- Vegetation Removal/Breeding Bird Safeguards:
  All vegetation removal or scrub clearance within potential nesting habitat will follow the Bird Breeding Season (BBS) restrictions. Where vegetation removal cannot be avoided during the breeding season, pre-clearance nest checks will be conducted by a qualified ecologist to ensure no active nests are destroyed.
- Buffer Zones Around Foraging Swans:
  A minimum 300 m[20] exclusion zone will be maintained around active swan foraging flocks, within which no high-noise or high-movement construction activity will be permitted during the winter season (October to March).
- Timing Restrictions on Construction:
  No heavy construction works ((e.g. turbine foundation pouring, excavation, major crane operations) will occur on turbines T1 to T5 during the core wintering period (October to March) in accordance with the Whooper Swan Management Plan (WSMP, Appendix 7D). Light works (such as cable laying, minor civil works, or component delivery without lifting) may proceed on T1, T2, T4, and T5, but no work will be conducted around T3 during this period.
- Seasonal Exclusion Zones for Construction Disturbance:
  To minimise disturbance to wintering whooper swans, all construction works (including groundworks, plant operation, and vehicle movement) will be excluded from designated buffer zones around core swan foraging areas (e.g. Camas South) from 1 October to 31 March annually.

20 - The 300 m buffer is based on the lower end of NatureScot's recommended 200–600 m range for human-related disturbance to large waterbirds (Goodship & Furness 2022, NatureScot 2025a). This is supported by empirical studies (e.g. Fijn et al. 2012) showing that swans typically adjust flight paths or show avoidance at or beyond 300 m from disturbance sources. See also WSMP Executive Summary and Appendix B.4.4, B.5.1.

- Buffer distances will be informed by previous swan usage data and typically extend at least 300 m from active foraging fields.
- Where proximity to turbines or haul routes cannot be avoided, temporary screening and noise suppression measures (e.g. acoustic barriers, directional lighting) will be applied.
- Work scheduling will prioritise quiet periods (e.g. mid-day) and avoid early morning and late evening periods when swan activity peaks.

These measures will be reviewed every three months (between September to March) and updated through adaptive management based on monitoring results and swan sensitivity at each location.

7.7.3 Operational Phase

During the operational phase, a comprehensive programme of habitat management, turbine operation mitigation, deterrence, and ongoing monitoring will be implemented, in accordance with the Whooper Swan Management Plan (WSMP, Appendix 7D). The principal aim is to safeguard the long-term viability of swan usage within the Development and surrounding landscape whilst minimising the risk of displacement, disturbance, or collision to wintering whooper swans.

Adaptive management will ensure mitigation remains responsive to observed swan behaviour, habitat condition, and turbine interaction over time. Contingency measures, including temporary curtailment or additional deterrents, will be deployed if swans are observed in unsafe proximity to turbines, with actions informed by the operational-phase monitoring programme (see Section 7.8.2).

7.7.3.1 Habitat Enhancement and Maintenance at Camas South

- Sward Management:
  - Continue rotational grazing and/or cutting to maintain a sward height of 5–10 cm, optimising forage accessibility.
  - Apply slurry or lime before 1 October to support autumn sward productivity. Application should follow guidance on nitrate vulnerable zones to avoid runoff and support biodiversity.

The enhancement area will be closed to grazing and disturbance between 15 October and 31 March annually to maintain optimal sward conditions for whooper swans. Annual monitoring of sward composition and persistence will be undertaken using transects and quadrats, with reseeding or remedial action implemented where necessary. Enhancement measures are designed to support a minimum of 2,112 ± 245 swan-days, based on five years of survey data.

- Water Retention:
  - Maintain and monitor wetland areas and shallow pools to ensure persistent damp ground throughout the winter period.
  - Adjust hydrology as needed to prevent desiccation or excessive poaching.
- Soil Fertility:
  - Conduct periodic soil testing to monitor nutrient status.
  - Amend soil fertility as necessary to sustain palatable sward composition and biomass production.

Habitat Deterrence Around Turbines

- Sward Composition Management:
  - In turbine-adjacent fields (particularly near T3), actively suppress ryegrass dominance through mechanical means or overseeding with less palatable grasses[21].
  - Avoid any nutrient applications after 1 October in these areas to deter grazing or loafing by swans.
- Post-and-Flag Deterrents:
  - Deploy physical deterrents (e.g. posts with flags or tapes) reactively in fields where swans are observed near turbines.
  - Maintain deterrents until vegetative deterrence measures (e.g. sward unpalatability) prove effective.

The enhancement area includes both western and eastern portions of the WSMP lands, as shown in Figure 7-8. Visual connectivity between enhancement fields and adjacent foraging areas will be maintained through selective hedgerow management and access control.

7.7.3.2 Turbine Operation Mitigation

To minimise the collision risk to wintering whooper swans during the operational phase of the Development, a targeted curtailment protocol will be implemented at turbines located within or adjacent to areas of high swan activity. This approach prioritises responsiveness to swan behaviour and environmental conditions, while remaining grounded in long-term monitoring and modelling outputs as outlined in the Whooper Swan Management and Monitoring Plan (WSMP; **Appendix 7D**).

Turbines T1–T4 will be subject to temporary curtailment during the first winter of operation, to allow habituation of whooper swans to turbine structures. Adaptive curtailment protocols will be reviewed annually based on monitoring results, including flight path proximity, behavioural responses, and collision risk modelling.

- Initial Curtailment Strategy:
  - Apply a full curtailment of turbines T1–T4 during the first operational winter (October–March), allowing swans to habituate to the Development in the absence of operational rotor movement (to be reviewed post-season to determine whether continued or modified measures are warranted).
- Priority Curtailment Zones:
  - Focus curtailment at turbines in high-risk zones, especially T3 and those adjacent to Camas South.
  - Implement a dynamic curtailment protocol based on real-time observations, with shutdowns triggered by swan activity, proximity to turbines, time of day, weather conditions, and flight direction.
- Curtailment Protocol:
  - Turbines in Priority Curtailment Zones will be subject to temporary shutdowns or blade idling during high-risk periods, guided by the following criteria:
    - Time of Day: Morning and evening roost flights (typically dawn and dusk).
    - Seasonality: Active from October–March, encompassing the full wintering season.

21 - Less palatable grasses (e.g. Festuca arundinacea, Dactylis glomerata) may be trialled as vegetative deterrents, subject to compatibility with local agri-environmental guidelines.

- Weather Conditions: Activation during low visibility, fog, low cloud ceiling, or strong crosswinds, which reduce detectability and safe manoeuvring of swans.
- Swan Activity: Real-time or near-real-time detection of swans flying within proximity of turbines, or observations of flocks assembling for movement.

7.7.4 Decommissioning Phase

The decommissioning phase, although temporary, has the potential to cause short-term disturbance to wintering whooper swans, particularly if activities coincide with the non-breeding season. The decommissioning approach will aim to minimise disturbance, protect key habitats at Camas South, and ensure that any residual impacts are mitigated. Most concrete infrastructure will remain in place, limiting the extent of habitat disturbance during decommissioning.

Mitigation measures, described above for the construction phase (see Section 7.7.2) and which are relevant to decommissioning, updated to reflect good practice at the time, will be implemented for the decommissioning phase.

The implementation of similar mitigation measures, as detailed for the construction phase will help ensure that all decommissioning phase adverse effects are minimised or avoided. Therefore, it is proposed that a Decommissioning Plan will be drafted prior to the removal of the Development infrastructure. This will detail specific actions aimed at protecting IOFs. As for the construction phase, these will include limitations on the working corridor, minimised effects of vegetation, protection of water quality and protection of breeding and foraging species. Pre-decommissioning surveys will be undertaken with the specific objective of identifying any IOF's that may be affected by the decommissioning phase and works timed accordingly to avoid sensitive periods.

Prior to the Decommissioning Phase, a comprehensive plan will be drawn up that takes account of the findings of this EIAR and the contemporary best practice at that time, to manage and control the component removal and ground reinstatement.

7.8 Monitoring

7.8.1 Construction Phase

Construction-phase monitoring will mirror operational-phase monitoring methods where possible, to establish behavioural baselines and measure short-term effects of construction disturbance.

Displacement Monitoring – whooper swan

- Biweekly Swan Surveys (Camas South & Ballycullane):
  - Road transect counts of all swans (age, flock size, activity).
  - Target period: October–March.
  - Purpose: Identify changes in Development use frequency and flock structure.
- Flock Scan Behaviour Surveys:
  - Systematic scan sampling of flock behaviour (e.g. feeding, alert, walking, roosting) at Camas South and control site (Ballycullane).
  - Assess perception of disturbance and foraging efficiency.

- Dropping Density Surveys:
    - Monthly mapping of swan droppings to infer spatial habitat use within fields and assess any avoidance patterns relative to turbines or works zones.
- Field Quality Assessments:
    - Monthly qualitative and photographic assessment of grass cover, poaching, waterlogging, and nutrient enrichment to confirm habitat suitability.

Displacement Monitoring – golden plover

- Ad-hoc flock counts and behaviour scans during winter (October-March):
    - Target fields identified during baseline surveys.
    - Record presence, flock size, activity, and any displacement relative to active works.
    - Data used to adapt buffer zone enforcement and determine habitat continuity.

7.8.1.1 Collision Risk Monitoring (Pre-Operational Baseline)

- VP (Vantage Point) Surveys:
    - Monthly watches to capture arrival/departure flight lines, altitude, and interaction with the turbine layout.
    - Targeted watches during peak roost movement times (dawn/dusk).
    - Document early responses to turbines under construction and any shift in flyways.

7.8.1.2 Construction Reporting and Review

A Construction Phase Mitigation and Monitoring Report will be submitted at the end of each winter season during construction. This will include:

- Updated swan usage data for Camas South and Ballycullane.
- Behavioural trend analysis (e.g. alertness levels, time spent feeding).
- Evidence of displacement or deterrent effectiveness.
- Field condition status.
- Golden plover activity data and any spatial or behavioural changes.
- Recommendations for any adaptive management needed during the remaining construction or early operational phases.

Construction-phase findings will also be used to refine operational-phase monitoring protocols and mitigation strategies.

7.8.2 Operational Phase

A suite of structured monitoring activities will be implemented to assess swan usage of the Development, detect behavioural changes, and quantify potential turbine interactions. These will include:

- Pre- and Mid-Winter Biweekly field surveys:

- Fortnightly field visits (October–March) to both Camas South and Ballycullane control site to monitor swan abundance, distribution, and usage of the Development.
- Incorporate behavioural scan sampling and foraging efficiency observations.

- Vantage Point Flightline Mapping:
  - Monthly VP watches following NatureScot (2017) protocols to map swan flightlines, flight height, and potential turbine interactions.
- Dropping Density Surveys:
  - Monthly mapping to determine intra-site usage patterns and preference for specific fields at Camas South.
- Habitat Condition Monitoring:
  - Annual transect- and quadrat-based surveys to assess sward height, composition, and the persistence of sown cultivars.
  - Monthly inspections of wetland areas to ensure water levels are appropriate for roosting and loafing.

Monitoring will be conducted in accordance with the criteria outlined in Table 7.3 of the WSMP, which includes management criteria thresholds for triggering adaptive management or curtailment. These include:

- Swan mortality threshold: >1 confirmed collision in a single winter triggers review; ≥2 in two consecutive winters triggers curtailment.
- Site use decline: >30% reduction in mean flock size or swan-days compared to baseline triggers review; sustained decline over two winters triggers enhancement or curtailment.
- Behavioural change: <10% swan-days in enhanced fields or >25% alert/disturbed behaviour triggers corrective action.
- Collision risk modelling: Predicted annual collision rate >0.05 birds/year triggers strengthened curtailment protocols.

7.8.2.1 Collision Risk Monitoring

- Carcass Searches:
  - Systematic turbine base searches conducted at standard intervals using established protocols outlined in NatureScot (2019), adjusted for species detection bias, carcass persistence, and scavenger activity.
- Curtailment Efficacy & Risk Review:
  - Collision risk mitigation will be reviewed annually through integration of real-time monitoring data and statistical models to assess curtailment effectiveness.
  - Collision risk modelling will be updated where necessary based on empirical swan flight behaviour and mortality findings.

7.8.2.2 Operational Reporting and Review

Monitoring will be reported annually, with milestone reviews at Years 1, 2, 3, 5, 10, and 15 post-construction, in line with NatureScot guidance and WSMP commitments

- Annual Reporting:
    - Detailed annual reports will summarise all operational-phase mitigation and monitoring activities during each monitoring year. Reports will include:
        - Swan usage data and behavioural assessments at both receptor and control sites.
        - Habitat condition and management outcomes.
        - Summary of deterrence actions and turbine curtailment records.
        - Collision monitoring results and any detected fatalities.
- Long-Term Strategic Reviews:
    - Cumulative reviews will be carried out at Years 1, 2, 3, 5, 10, and 15.
    - These reviews will assess mitigation performance, detect any emerging trends or risks, and guide potential updates to management or monitoring protocols in consultation with relevant stakeholders.

7.9 Residual Effects

Residual effects are assessed by Development phase (construction, operational, and decommissioning), taking account of embedded and additional mitigation (**Sections 7.7**, **Appendix 6I** HSMP, and **Appendix 7D** WSMP). Effects are described in terms of magnitude, duration, reversibility, and spatial scale, and significance is evaluated at both the local and population level.

7.9.1 Construction Phase

7.9.1.1 Designated Sites and Habitats

Mitigation measures set out in **Section 7.7** and **Chapter 9** (Hydrology and Hydrogeology), together with the WSMP, will ensure protection of downstream European and national designated sites, including the River Shannon and River Fergus Estuaries SPA. With these measures in place, no significant residual effects on the conservation objectives or integrity of designated sites are predicted.

7.9.1.2 Habitats

Temporary residual effects include localised habitat loss or degradation (hedgerows, treelines, and woodland) until replacement planting becomes established. Construction compounds may also temporarily remove foraging/shelter habitat until reinstatement. Residual effects on soil and vegetation structure may persist locally, potentially affecting microhabitats for birds and other wildlife, although these impacts are temporary and reversible. Protective hydrological measures will prevent significant adverse changes to the Morningstar River and associated drainage features, minimising effects on riparian and wetland habitats.

7.9.1.3 Bird Species

- Waterfowl (mute swan, mallard, teal): disturbance to foraging or breeding (mute swan), but availability of alternative habitats reduces risk. Residual effects: minor adverse, not significant at population level.
- Whooper swan: temporary disturbance and displacement, particularly at Camas South. Residual effects: moderate adverse at local scale; not significant at population level.

- Waders (golden plover, lapwing, curlew, snipe): disturbance and displacement from foraging areas; temporary habitat loss. Residual effects: moderate local (golden plover), minor to moderate (lapwing), minor (curlew), minor and reversible (snipe); not significant at population level.
- Other waterbirds (cormorant, grey heron, little egret): minor temporary disturbance, with alternative foraging areas available. Residual effects: minor, not significant.
- Gulls (black-headed, lesser black-backed): short-term disturbance, displacement distances well within alternative habitat availability. Residual effects: negligible to minor, not significant.
- Raptors (buzzard, sparrowhawk, kestrel, peregrine, long-eared owl): temporary disturbance of foraging/nesting, managed by pre-construction surveys and timing restrictions. Residual effects: minor to moderate local, not significant population level.
- Passerines (meadow pipit, skylark, other amber-listed species): disturbance and temporary habitat loss during clearance. Residual effects: minor to moderate local, reversible, not significant.

7.9.2 Operational Phase

7.9.2.1 Designated Sites

With embedded mitigation, the WSMP, and hydrological safeguards, no adverse effects on the integrity of European or national designated sites are predicted.

7.9.2.2 Habitats

During the operational phase, long-term retention and enhancement of hedgerows, field margins, and woodland will maintain and improve habitat quality. Habitat management measures **(Appendix 6I)** ensure continued ecological connectivity, supporting bird foraging and movement and reducing displacement risk. Overall, the residual effect on habitats during operation is considered minor beneficial at the local scale, reflecting improved habitat structure and connectivity over pre-construction conditions.

7.9.2.3 Bird Species

- Waterfowl (mute swan, mallard, teal): negligible to minor disturbance; collision risk negligible (CRM: mallard 0.17/yr, mute swan/teal none). Residual effect: not significant.
- Whooper swan: displacement from Camas South remains the key effect. With WSMP implementation, residual effect: slight to moderate adverse at local/county scale; not significant at population level.
- Waders:
  – Golden plover: residual moderate and locally significant, due to displacement and low collision mortality (CRM: ~3.25/yr = 0.0035% national population). Not significant at population level.
  – Lapwing, curlew: residual negligible to minor, not significant.
  – Snipe: habitat reinstatement restores function; not significant.
- Other waterbirds: displacement minimal, turbines avoid core sites. Residual effect: negligible, not significant.
- Gulls: high mobility and adaptability; no significant collision or displacement. Residual effect: negligible, not significant.
- Raptors: turbine siting avoids nesting; residual effect negligible to minor adverse, not significant.
- Passerines: retained habitat and management ensure continued use. Residual effect: negligible to minor adverse, not significant.

7.9.3 Decommissioning Phase

7.9.3.1 Designated Sites

Decommissioning will follow a formal Decommissioning Plan. Protective measures will ensure no significant residual effects on European or national designated sites.

7.9.3.2 Habitats

Temporary disturbance and vegetation clearance will occur, similar to construction. Compensatory reinstatement measures will restore ecological function and connectivity. Overall, the residual effect on habitats is considered minor adverse and temporary at the local scale, with full recovery expected following habitat reinstatement and ongoing management.

7.9.3.3 Bird Species

- Waterfowl: minor temporary disturbance; residual effect: not significant.
- Whooper swan: temporary displacement during decommissioning works; residual effect: minor local, not significant.
- Waders, other waterbirds, gulls, raptors, passerines: temporary disturbance but reversible, not significant population level.

7.10 Summary of Potential Effects

Section 7.6 identified the potential for adverse effects on IOFs arising during the construction, operation, and decommissioning phases of the Development. Mitigation measures (Section 7.7; Appendices 6I and 7D) are designed to minimise these effects, with only IOFs likely to be significantly affected considered further here.

Embedded mitigation is sufficient to prevent significant population-level impacts for most IOFs. However, locally moderate effects are predicted for whooper swan, golden plover, and lapwing due to temporary disturbance and habitat displacement near key foraging areas.

Operational-phase risks for whooper swan, particularly displacement and collision, are addressed through targeted mitigation and long-term monitoring under the WSMP. This plan incorporates site-specific data and published guidance to inform turbine layout, habitat management, and curtailment protocols.

Standard good practice measures will be applied across all phases, including Grid Connection works, to ensure compliance with wildlife legislation and protection of nests, eggs, and dependent young.

Table 7-14 summarises the potential effects, mitigation measures, and residual outcomes for each IOF.

The adoption of appropriate mitigation measures for IOFs has ensured that the residual collision risk effects following successful implementation of the measures are not significant. Furthermore, in accordance with Article 16b of RED III, these effects shall not be considered to be deliberate and therefore prohibited by Article 5 of the Birds Directive where appropriate and necessary mitigation measures have been adopted.

Table 7-14: Summary of potential effects, proposed mitigation measures and residual effects

IOF	Development Phase	Potential Effect (Pre-mitigation)	Significance of Effect Without Mitigation	Proposed Mitigation	Residual Effect	Spatial Scale of Residual Effect[22]
River Shannon & River Fergus Estuaries SPA	Construction & Operation	Disturbance, displacement, collision risk (incidental species)	Negligible	SWMP implementation; no source–pathway–receptor linkages	No significant residual effects	N/A
Lough Gur pNHA	Construction	Disturbance to foraging whooper swans	Minor	Construction timing; buffer zones; WSMP	Negligible	Local / County
	Operation	Disturbance/displacement; collision risk (whooper swan)	Minor–Moderate	WSMP habitat enhancement; monitoring; adaptive management	Negligible	Local / County
Waterfowl – mute swan	Construction	Temporary disturbance, habitat loss	Minor	CEMP; phasing of works; habitat reinstatement	Minor adverse, not significant	Local
Waterfowl – mallard	Construction	Temporary disturbance, habitat loss	Minor	CEMP; phasing of works; habitat reinstatement	Minor adverse, not significant	Local
Waterfowl – teal	Construction	Temporary disturbance, habitat loss	Minor	CEMP; phasing of works; habitat reinstatement	Negligible	Local
Whooper swan	Construction	Disturbance/displacement; temporary loss of foraging habitat	Moderate	Construction phasing; avoidance of peak periods; WSMP	Moderate adverse at local/county scale; not significant	Local / County

22 - Spatial scale reflects the extent over which residual effects could theoretically occur, even if they are not significant.

IOF	Development Phase	Potential Effect (Pre-mitigation)	Significance of Effect Without Mitigation	Proposed Mitigation	Residual Effect	Spatial Scale of Residual Effect[22]
	Operation	Disturbance/displacement; CRM predicts up to 19 collisions/35 yrs	Moderate	WSMP habitat management; adaptive mitigation; curtailment protocol	Moderate adverse at local/county scale; not significant	Local / County
Wader – golden plover	Construction	Disturbance/displacement from works	Moderate	CEMP; buffer zones; habitat restoration	Moderate local; not significant	Local
	Operation	Ongoing displacement near turbines; low collision risk	Moderate	Enhancement through WSMP	Moderate local; not significant	Local
Wader – lapwing	Construction	Disturbance/displacement from works	Minor–Moderate	CEMP; buffer zones; habitat restoration	Minor to moderate; not significant	Local
	Operation	Ongoing displacement near turbines; low collision risk	Minor–Moderate	Enhancement through WSMP	Minor to moderate; not significant	Local
Wader – curlew	Construction	Disturbance/displacement from works	Minor	CEMP; buffer zones; habitat restoration	Minor; not significant	Local
	Operation	Ongoing displacement near turbines; low collision risk	Minor	Adaptive management	Minor; not significant	Local
Wader – snipe	Construction	Disturbance/displacement from works	Minor	CEMP; buffer zones; habitat restoration	Minor and reversible; not significant	Local
	Operation	Ongoing displacement near turbines; low collision risk	Negligible	Adaptive management	Minor and reversible; not significant	Local
Other waterbirds (cormorant, grey heron, little egret)	Construction	Temporary disturbance of wet features	Minor	SWMP; CEMP	Negligible	Local

IOF	Development Phase	Potential Effect (Pre-mitigation)	Significance of Effect Without Mitigation	Proposed Mitigation	Residual Effect	Spatial Scale of Residual Effect[22]
Other waterbirds	Operation	Temporary displacement; very low collision risk	Minor	SWMP; CEMP	Minor; not significant	Local
Gulls – black-headed and lesser black-backed	Construction	Disturbance from compounds and vehicle activity	Minor	CEMP	Negligible to minor; not significant	Local
	Operation	Disturbance and low collision risk	Minor	CEMP	Negligible to minor; not significant	Local
Raptors – buzzard, kestrel, sparrowhawk, peregrine, long-eared owl	Construction	Disturbance near nests; temporary displacement	Minor	CEMP; species-specific buffers	Minor to moderate local; not significant	Local
Raptors	Operation	Disturbance/displacement; low CRM mortality (<0.1% populations)	Minor	CEMP; species-specific buffers	Minor to moderate local; not significant	Local
Passerines	Construction	Temporary habitat loss (hedgerows, scrub)	Minor	Hedgerow reinstatement; CEMP	Minor to moderate local; reversible; not significant	Local
	Operation	Minimal disturbance; negligible collision risk	Negligible	Habitat retention and management	Minor to moderate local; reversible; not significant	Local
Water quality – Morningstar River, ditches, grassland	Construction	Risk of sedimentation/runoff	Minor	SWMP; CEMP	Minor to moderate local; reversible; not significant	Local
Water quality	Operation	No hydrological change anticipated	Negligible	SWMP; CEMP	Minor to moderate local; reversible; not significant	Local

7.11 Conclusion

This chapter has evaluated the likely significant effects of the Development on ornithological features across all phases, construction, operation, and decommissioning, based on a comprehensive suite of baseline surveys, detailed impact assessment methodologies, and precautionary design principles.

The assessment was underpinned by three years of systematic bird surveys (vantage point watches, walkovers, and waterbird counts), supported by Collision Risk Modelling (Appendix 7C) and species-specific evaluations. These data formed the basis for a robust appraisal of potential impacts on bird populations, designated sites, and functionally linked habitats within the zone of influence.

The results demonstrate that, with the full implementation of embedded and additional mitigation measures, including turbine layout design, curtailment protocols, habitat management and restoration, and post-consent monitoring, no residual effects are considered significant for any identified ornithological features, although some minor to moderate residual effects may remain at local or county scales.

Temporary impacts on habitat structure, such as hedgerows, treelines, and semi-natural grasslands, will occur during construction. However, these are considered reversible and will be addressed through targeted reinstatement and compensatory planting to maintain ecological connectivity and habitat availability across the Development.

With respect to designated sites, including the River Shannon and River Fergus Estuaries SPA, no significant adverse residual effects are anticipated, subject to the full implementation of mitigation and pollution prevention measures outlined in Chapter 9 Hydrology and Hydrogeology. No functional linkages between the Development and the SPA were identified for qualifying species.

For key bird species:

Whooper Swan: Construction-phase effects are assessed as moderate adverse at the local scale, relating to disturbance, displacement, and temporary habitat loss. During the operational phase, the long-term residual effect, with the full implementation of the WSMP, including habitat enhancement, spatial buffering, curtailment protocols, and post-construction monitoring, is considered moderate adverse but not significant at the local/county level. This adaptive management framework is designed to respond to ongoing monitoring results, reduce residual effects and support ongoing use of the Development by this Annex I species.

Golden Plover and Lapwing: Both BoCCI Red-listed species were regularly recorded foraging across the core study area and within the wider 5 km buffer during winter. Following the implementation of targeted mitigation measures during construction, including exclusion buffers, adaptive scheduling informed by pre-construction surveys, and ongoing vantage point monitoring, residual construction-phase effects are expected to be minor to moderate and not significant at the population level. During the operational-phase, potential effects for golden plover, including turbine-related displacement and low-level collision risk, are predicted to be minor and not significant, with residual effects assessed assuming full implementation of the WSMP and associated mitigation measures. Collision Risk Modelling predicts low but measurable annual mortality (e.g. 3.25 individuals/year, equivalent to 0.0035% of the national population; Appendix 7C), but these effects are not significant at the local or national scale.

Snipe: Effects on this more sedentary wader species are expected to be minor and not significant during construction, and negligible during operation. Post-construction habitat reinstatement will restore damp ground conditions and support continued foraging and roosting use.

The assessment acknowledges that some reliance is placed on the availability of alternative foraging habitat to accommodate temporary or permanent displacement. While formal habitat quality models were not developed, this conclusion is supported by empirical field data documenting flexible habitat use across the wider landscape, as well as precautionary turbine siting that avoids intensively used areas.

Cumulative effects, including those relating to displacement, collision risk, and broader landscape change, were also assessed and are not predicted to be significant in combination with other developments. Potential hydrological or pollution-related cumulative effects are addressed through coordinated mitigation strategies.

In conclusion, the Development, with full implementation of the identified mitigation and monitoring measures, is not predicted to give rise to significant adverse residual effects on most ornithological receptors. For whooper swan, operational-phase effects are assessed as moderate adverse but not significant at the local/county scale when the WSMP is implemented. The plan provides targeted habitat enhancement, spatial buffering, curtailment protocols, and post-construction monitoring to minimise residual effects and support ongoing use of the Development by this Annex I species.

Residual effects for other species are considered temporary, reversible, and of low magnitude, with no implications for conservation status at local, regional, or national population scales.

7.12 References

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