Cush Wind Farm

Environmental Impact Assessment Report

Chapter 5: Biodiversity

Cush Wind Limited

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5.1 Introduction

5.1.1 Background & Objectives

SLR Consulting Ireland Ltd was commissioned to carry out an ecological impact assessment of the project as part of this Biodiversity chapter.

This chapter presents an assessment of the likely significant effects of the project and associated infrastructure on the receiving environment.

This chapter outlines -:

- A baseline study of the receiving ecological environment, including survey methodology and results;
- An assessment of the likely significant effects of the project during construction, operation and decommissioning phases;
- An assessment of likely significant cumulative effects;
- Mitigation measures to avoid or reduce the likely significant effects anticipated;
- Residual effects;
- Enhancement measures.

5.1.2 Description of the Project

In summary, the project comprises the following main components as described in **Chapter 3**:-

- 8 no. wind turbines with an overall tip height of 200m, and all associated ancillary infrastructure;
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure and forestry felling.
- Temporary alterations to the turbine component haul route; and,
- Construction of an electricity substation, Battery Electricity Storage System and installation of 5.6km of underground grid connection to facilitate connection of the proposed electricity substation to the existing 110kV substation at Clondallow, County Offaly;

The project site is located in rural County Offaly, approximately 4km north of the town of Birr and 28km south-west of Tullamore, County Offaly. Off-site and secondary developments; including the forestry replant lands and candidate quarries which may supply construction materials; also form part of the project.

The turbine component haul route and associated temporary road alteration works are located within counties Galway, Roscommon, Westmeath, and Offaly. It is envisaged that the turbines will be transported from the Port of Galway, through the counties of Galway, Roscommon, Westmeath and Offaly, to the project site.

A full description of the project is presented in **Chapter 3**.

5.1.3 Statement of Authority

The report has been written by **Sinéad Clifford**. Sinéad has worked in the environmental sector since 2015 and joined SLR Consulting in 2021. She holds a BSc in Wildlife Biology from Institute of Technology Tralee, and a Certificate (Distinction) in Ecological Consultancy from Ecology Training UK (formerly Acorn Ecology). Sinéad

has strong field skills, and regularly carries out bat, ornithological, botanical and mammalian surveys. In addition, she has extensive experience managing bat surveys for large scale projects, including wind energy developments. She is also an experienced GIS user, having produced multiple maps and species distribution models. She is proficient in using ArcGIS, QGIS, and Arc Field Maps software. Sinéad has prepared a wide variety of ecological reports, including biodiversity chapters for Environmental Impact Assessment Reports (EIAR), Ecological Impact Assessments (EcIA), Appropriate Assessment (AA) screening reports, Natura Impact Statements (NIS), and bat reports.

Dr Jonathon Dunn coordinated the bird surveys and authored the ornithological elements in this EIAR. Jonathon has worked in the environmental sector since 2014 and joined SLR Consulting in 2021. Prior to working in environmental consultancy, he used to undertake research at Newcastle University on avian ecology and conservation. He holds a PhD in avian ecology from Newcastle University, a MSc in Ecology, Evolution and Conservation from Imperial College London and a MA (Cantab.) in Natural Sciences from the University of Cambridge. Jonathon has extensive experience managing bird surveys. He also has a strong analytical background and is experienced in experimental design, data presentation, statistical analysis and modelling (including avian collision risk modelling). Jonathon has both completed a wide variety of ornithological surveys and has project-managed bird surveys for wind farms both pre- and post-construction. He has experience of vantage point viewshed analysis, ground-truthing VPs and identifying height bands required for collision risk modelling. In addition to VP surveys, Jonathon has undertaken surveys for hen harriers (including roost watches), red grouse (tape lure under licence from NPWS), breeding bird transect surveys, IWeBS, barn owl, kingfisher, breeding wader (upland and lowland) and breeding raptor surveys. Jonathon has prepared a wide variety of ecological reports, including Environmental Impact Assessment Report (EIAR) chapters, Ecological Impact Assessment (EcIA) reports, Natura Impact Statements (NIS), reports to inform Appropriate Assessment (AA) screenings, bird and bat reports, and collision risk modelling reports. Jonathon has worked on a wide variety of projects with a focus on wind farms.

The collision risk modelling report was written by **Michael Austin**. Mike is a Senior Consultant (in Ecology) with SLR. He has over 30 years' experience within ecology and ornithology, both in conservation and consultancy. He has experience of ECoW work at a number of sites (predominantly at wind farms but also in other sectors). He holds a CSCS card for working on construction sites. Mike has managed a wide range of major Environmental Impact Assessment projects for infrastructure developments throughout the UK, in particular within the renewables industry. Since 2007 Mike has project managed a range of major Environmental Impact Assessment Reports for wind farms and other developments. In addition to this he is proficient in data management systems and GIS. Prior to joining SLR, he held a number of positions as a consultant within RPS Planning and Development and Ecology UK. Before joining the consultancy industry Mike worked within conservation on species recovery projects and habitat management, for RSPB and local wildlife trusts.

Ross Macklin PhD (in preparation) B.Sc. (Hons) MCIEEM., MIFM, HDip GIS, PDip IPM (Principal ecologist with **Triturus Environmental Ltd**.) is an ecologist with over 16 years' professional experience in Ireland. He specialises in freshwater fisheries ecology, biology and water quality. He has considerable experience in a wide range of

ecological and environmental projects including EIAR, EcIA, AA/NIS, CEMP reporting, as well as biodiversity, water quality monitoring, invasive species and fisheries management. He also has expert identification skills in macrophytes, freshwater invertebrates, protected aquatic habitats and protected aquatic species including freshwater pearl mussel. His diverse project list includes work on renewable energy developments, flood relief schemes, road schemes, blueways/greenways, biodiversity projects, fisheries management projects and catchment wide water quality management. He is currently completing his Ph.D. on the ecology and impact of common carp (Cyprinus carpio) in Irish waters.

Triturus Environmental Ltd. have completed over 100 renewable energy projects that have been granted planning. As a company Triturus specialise in aquatic ecology and fisheries and provide in-depth catchment wide knowledge on the key aquatic and fisheries constraints associated with each renewable energy project completed. Their skills in aquatic ecology include invertebrates, fish, macrophytes, Annex I aquatic habitats and aquatic invasive species. They also have expert knowledge in project design, planning and the merging of interdisciplinary chapters as part of EIAR preparation.

Ken Bond is Ireland's leading authority on Lepidoptera, having spent almost 40 years surveying and recording moths and butterflies for all counties in Ireland. He has amassed a database of 50,000 records on Lepidoptera, making a huge contribution to our understanding of Irish Lepidoptera. He is recognised as a leading regional authority on moths, being particularly expert on the taxonomy of some of the moth groups usually referred to as micro-Lepidoptera.

Ken holds a BSc in Zoology at Trinity and has completed further studies at University College Cork working on the taxonomy of the larvae of Phyllonorycter.

Ken has published more than 3O papers on various aspects of Lepidoptera, and was one of the main contributors to The Butterflies of Great Britain and Ireland (Emmet, A.M. & Heath, J. (Eds.) 1990).

This Chapter has been reviewed by **Richard Arnold** BSc MRes MCIEEM CEnv. Richard has 24 years of experience as a consultant ecologist, which has included preparing and overseeing assessments under the Environmental Impact Assessment Regulations for multiple projects, including small and large infrastructure projects. Richard Arnold is a Technical Director at SLR Consulting Ltd.

5.1.4 Relevant Guidance

Guidance documents consulted include the following[1]:-

- *All-Ireland Pollinator Plan 2021-2025. National Biodiversity Data Centre Series No. 25, Waterford. March 2021;*
- *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities. Department of Environment Heritage and Local Government (2010);*

[1] A complete list of references is included at the end of this chapter.

- *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (2018, version 1.2 updated 2022. Chartered Institute of Ecology and Environmental Management (CIEEM));*
- *Developing Field and Analytical Methods to Assess Avian Collision Risk at Wind Farms. Band, W., Madders, M. and Whitfield, D.P. (2007);*
- *Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd edition (Collins, 2016);*
- *Bats and onshore wind turbines - survey, assessment and mitigation. Nature Scot (2021);*
- *Guidelines on the information to be contained in Environmental Impact Assessment Reports Environmental Protection Agency. (2022).;*
- *Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage. Goodship, N.M. and Furness, R.W. (2022).;*
- *Ireland's Butterflies Series No. 1: Habitat Management for the Marsh Fritillary. Phelan, N., Nelson, B., Harding, J. & Lysaght, L. (2021) National Biodiversity Data Centre, Waterford;*
- *Recommended bird survey methods to inform impact assessment of onshore windfarms. Nature Scot (2017);*
- *Assessing Connectivity with Special Protection Areas (SPAs). Scottish Natural Heritage (SNH) (2016).;*
- *Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms. Scottish Natural Heritage (SNH) (2017).;*
- *Assessing Significance of Impacts from Onshore Wind Farms on Birds Outwith Designated Areas. Scottish Natural Heritage (SNH) (2018).;*
- *Assessing the Cumulative Impact of Onshore Wind Energy Developments. Scottish Natural Heritage (SNH) (2018).;*
- *Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model. Scottish Natural Heritage (SNH) (2018).;*
- *Wind Turbine/Wind Farm Development Bat Survey Guidelines. Bat Conservation Ireland (2012); and,*
- *European Union Environmental Objectives (Freshwater Pearl Mussel) (Amendment) Regulations 2018.*

5.1.4.1 Policy & Legislation

This chapter has been prepared in accordance with guidance contained in the following:-

- *Guidance Document on Wind Energy Developments and EU Nature Legislation (European Commission, 2020);*
- *Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);*
- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Environmental Protection Agency (2022);*
- *Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements. Institute of Geologists Ireland (2013);*
- *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. National Roads Authority (2005);*

- *Wind Farms and Groundwater Impacts – A guide to EIA and Planning Considerations. DOE/NIEA (2015);*
- *Wind Energy Development Guidelines for Planning Authorities 2006. Department of the Environment, Heritage, and Local Government (2006);*
- *Draft Revised Wind Energy Development Guidelines. Department of the Housing, Planning, and Local Government (2019);*
- *Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission (2004), Edinburgh;*
- *Forest Operations & Water Protection Guidelines. Coillte (2009);*
- *(Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures. Forest Services;*
- *Forestry and Water Quality Guidelines. Forest Service (2000);*
- *Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads. COFORD (2004);*
- *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters. Inland Fisheries Ireland (2016);*
- *Good Practice During Wind Farm Construction. Scottish Natural Heritage (2010);*
- *PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);*
- *PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);*
- *Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006. Construction Industry Research and Information Association(CIRIA) 2006);*
- *Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. CIRIA, London, 2006.*
- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment. Department of Housing, Planning & Local Government (2018); and,*
- *Offaly County Development Plan 2021-2027.*

5.1.4.2 International Legislation

- *The UN Convention on Biological Diversity (CBD);*
- *The Berne Convention on the Conservation of European Wildlife and Natural Habitats;*
- *The Bonn Convention on the Conservation of Migratory Species of Wild Animals;*
- *The Ramsar Convention on Wetlands of International Importance;*
- *The Berne Convention on the Conservation of European Wildlife and Natural Habitats;*
- *The Bonn Convention on the Conservation of Migratory Species of Wild Animals; and,*
- *The Ramsar Convention on Wetlands of International Importance.*

5.1.4.3 European Legislation

- *The Environmental Liability Directive (2004/35/EC);*
- *European Communities (Environmental Liability) Regulations, 2008;*
- *EIA Directive (2014/52/EU)*
- *European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018, as amended;*

- *EU Habitats Directive (92/43/EEC)*
- *EU Birds Directive (2009/147/EC);*
- *European Communities (Water policy) Regulations, 2003 (as amended);*
- *European Communities Environmental Objectives (Surface Waters) Regulations 2009;*
- *EU Water Framework Directive 2000/60/EC;*
- *Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species, as amended, together with Commission Implementing Regulation (EU) 2016/1141 and Implementing Regulation (EU) 2019/1262;*
- *S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988;*
- *S.I. No. 477/ 2011 - Regulation 49 and 50 of European Communities (Birds and Natural Habitats) Regulations 2011; and,*
- *European Union Environmental Objectives (Freshwater Pearl Mussel) (Amendment) Regulations 2009 to 2018.*

5.1.4.4 National Legislation

- *The Wildlife Acts 1976 to 2021 (as amended);*
- *The Floral (Protection) Order 2022;*
- *The Heritage Act 2018; and,*
- *Planning and Development Act 2000 (as amended).*

5.1.4.5 National Policy

- *National Heritage Plan 2030;*
- *National Biodiversity Action Plan 2017-2021;*
- *Project Ireland 2040 - National Planning Framework; and,*
- *Regional and Spatial Economic Strategy (RSES) – Eastern and Midland Regional Assembly.*

5.1.4.6 Local Policy

- *Offaly County Development Plan 2021-2027, Wind Energy Strategy;*
- *Chapter 4 (Biodiversity and Landscape) of the Offaly County Development Plan 2021 – 2027;*
- *Laois County Development Plan 2021 – 2027; and,*
- *Tipperary County Development Plan 2022-2028*

5.1.5 Limitations

The survey and assessment are subject to a number of limitations and uncertainties as set out below.

5.1.5.1 Bats

- **Access** : Some of the structures identified as potential bat roosts were not accessible. This was because they were either within occupied dwellings or within third party lands. The latter was true for most of the structures adjacent to the proposed grid connection route. Only one structure was targeted for emergence surveys. This was because either the potential roosts were not

accessible (see above) or they were outside the project footprint, with no potential for direct or indirect effects on roosting bats.

- **Static Detector (ground-level) Locations**: There were also some locations where it was impractical to place ground-level static detectors at the exact proposed turbine location due to the indicative turbine locations being located within woodland habitats which will require keyhole felling prior to the installation of turbines. Consequently, where possible, detectors were located at nearby edges or firebreaks, which will be more representative of the baseline immediately prior to turbine operation once keyhole felling has occurred.
- **Layout Changes**: The project originally comprised 11 no. turbines. As such, in line with Nature Scot guidance, 10 no. static detectors were deployed at T1, T2, T4, T5, T6, T7, T8, T9, T10, and T11. In 2023 (i.e. following completion of static detector (ground-level) surveys), the project layout was revised to an 8 no. turbine layout, with the omission of T9-T11 (see **Chapter 2**). As such, the requirement as per NS guidance is that all 8 no. turbine locations should be surveyed. However, T3 had not been included in the surveys which were based on the 11-turbine layout. While this is below the survey effort required by Nature Scot's guidance, it should be noted that T3 is in similar habitat and c. 633m east of T1, and is also c. 129m east of the at-height detector location. As such, the data collected from both T1 and the at-height detector survey are considered likely to be similar to that at T3.
- **Automated Survey (Ground-Level): Weather**: In all the deployment sessions, it was not possible to collect 10 no. consecutive nights of static bat data in suitable weather conditions. However, there were 11, 10 and 10 no. suitable nights for the spring, summer and autumn sessions, respectively. All survey dates were retained for analysis, as bat calls were still recorded in sub-optimal weather conditions, suggesting that the conditions recorded did not significantly reduce bat activity. Furthermore, nights with suitable weather conditions sometimes had lower levels of bat activity than those with apparently unsuitable weather conditions.

5.1.5.2 Birds

- **Weather**: Although some surveys were completed in suboptimal conditions with regard to weather conditions (i.e., visibility during VP watches falling to between 1-3km), in most cases all of the relevant 2km viewing arc was visible and this is not considered to significantly affect the validity of the data collected. It is also noted that during such an extensive series of surveys it is inevitable that some surveys were completed in suboptimal conditions.
- **Barn owl *Tyto alba* Survey**: Barn owl were recorded as an incidental species during a bat activity transect survey. While no dedicated barn owl survey was undertaken, all potential bat roosts were checked for barn owl pellets and other signs of occupancy. It has been assumed that the habitats at the project site are used by this species for foraging as a precaution.
- **Kingfisher *Alcedo atthis* Survey**: Kingfisher were recorded during a habitat survey flying along the Rapemills River. While no dedicated kingfisher survey was undertaken, kingfisher nests were searched for during the aquatic ecology surveys.

- **Passerine Surveys**: While no dedicated surveys for passerines were carried out, those of conservation concern (e.g. BoCCI red- or amber-listed) were recorded during other types of bird survey.

None of the limitations outlined above are considered to significantly affect the validity of the data on which the assessment is based.

5.1.6 Consultations

Consultation requests were issued to the following consultees. **Table 5.1** details the response received, to-date. The responses are included in **Annex 1.7**.

Consultee	Date of Consultation	Response
An Taisce	02/06/2022	No response.
Bat Conservation Ireland	02/06/2022	BCI advised they don't comment on planning applications but asked that all best practice guidelines are followed.
Birdwatch Ireland	02/06/2022	No response.
Offaly County Council	02/06/2022	Potential connectivity to designated sites via Rapemills river to be considered. EIAR should include an assessment of biodiversity.
Department of Agriculture, Food and the Marine	02/06/2022	Received 20th June 2022. Felling licence to be acquired, and the EIA and appropriate assessment procedures to be followed.
Department of Environment, Climate and Communications	02/06/2022	No response.
Department of Housing, Local Government & Heritage	02/06/2022	No response.
Environmental Protection Agency	02/06/2022	No response.
Inland Fisheries Ireland	02/06/2022	No response.
Irish Peatland Conservation Council	02/06/2022	No response.
Irish Raptor Study Group	02/06/2022	No response.
Irish Wildlife Trust	02/06/2022	No response.
National Parks and Wildlife Service	02/06/2022	No response.
Office of Public Works	02/06/2022	The proposed site is located in lands that benefit from the Boolinaraig Drainage District. There may be a risk of flooding at this location. The Local Authority and the developers should satisfy themselves that there is adequate level of protection against flooding at this location. Datasets prepared by the Office of Public Works identifying land that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and indicating areas of land subject to flooding or poor drainage. The channel in question [at the Project Site] is not an OPW maintainable channel; however, it is good practise that a 10-metre-wide strip be retained adjacent to the channel to permit access to the local authority for maintenance. Ideally, the strip should not be

Consultee	Date of Consultation	Response
		fenced, paved or landscaped in a manner that would prevent access by maintenance plant. Further to this, please note that for the construction, replacement or alteration of any bridge or culvert over any channel which appears on a 6-inch to 1 mile map, Prior Section 50 consent must be sought under Section 50 of the Arterial Drainage Act, 1945.
Eastern and Midland Regional Assembly	02/06/2022	No response.
Sustainable Energy Authority of Ireland	02/06/2022	No response.
The Heritage Council	02/06/2022	No response.
Waterways Ireland	02/06/2022	No response.

Table 5.1: Consultations

5.2 Methodology

5.2.1 Study Area

5.2.1.1 Habitats, Flora, Terrestrial Mammals (Excluding Bats) & Other Protected Fauna

The survey area for habitats, flora, terrestrial mammals (excluding bats) and other protected fauna included lands within the site boundary plus lands adjacent to the grid connection, haul route, and offsite (existing) Dallow 110kv substation at Clondallow.

All areas within 50m of any proposed infrastructure of the project were surveyed for signs of mammals. Areas within the site boundary were assessed for habitat suitability for amphibians and reptiles.

Annex 1 habitat surveys were conducted at locations where potential links to Annex 1 habitat types were suspected.

Marsh fritillary surveys were carried out on the 13th-14th June 2022. Areas within the project site were assessed for habitat suitability for the species.

5.2.1.2 Bats

The survey areas used for bat impact assessment were as recommended by relevant good practice survey guidance (NatureScot, 2021). These are summarised below and are described in more detail within the baseline bat report (**Annex 5.3**).

5.2.1.3 Birds

The survey areas used for the ornithological impact assessment differ according to receptor as recommended by relevant good practice survey guidance (Nature Scot, 2017). These are summarised in **Section 5.2.3.5** below and are described in more detail within the baseline survey reports (**Annex 5.2**).

For the assessment of effects on bird species, a variety of buffer distances have been applied to each turbine location and around all other infrastructure, where appropriate. These buffers are in accordance with current guidance and evidence-

based research.

5.2.1.4 Fisheries & Aquatic Ecology

The survey areas used for the fisheries and aquatic ecology impact assessment followed a catchment-level approach. Note, the surveys were based on a larger site layout with 5 no. grid connection options. Hence, the survey area is far greater than that required for the project. All freshwater watercourses which could be affected directly or indirectly by the project were considered with a total of 25 no. riverine sites, 1 no. canal site, and 1 no. lacustrine targeted for detailed aquatic assessment. These sites were both within the project site boundary and along the grid connection. The surveys are summarised below and are described in more detail within the baseline survey report (**Annex 5.4**).

5.2.2 Desk Study

A desk study was carried out to inform the biodiversity input to the scoping report for the project. The desk study involved using online resources to collate information on areas designated for nature conservation and previous ecological studies undertaken for other projects in the wider local area.

The following online and other resources were accessed as part of the desk study, searching for all relevant records up to 20km radius of the site boundary:

- Satellite imagery[2];
- Environmental Protection Agency (EPA) maps[3];
- National Biodiversity Data Centre (NBDC) database[4];
- Environmental Sensitivity Mapper[5];
- National Parks and Wildlife Services (NPWS)[6];
- NPWS data request (Request received on 17/08/2022);
- Bat Conservation Ireland (BCI) data request (Results accurate as of 24/06/2022);
- The Irish Wetland Bird Survey (I-WeBS)[7];
- Birds of Conservation Concern 3 (BoCCI3): 2014-2019 (Colhoun & Cummins, 2013); and
- Birds of Conservation Concern in Ireland 4 (BoCCI4): 2020-2026 (Gilbert, Stanbury, & Lewis, 2021).

5.2.2.1 Designated Sites

The following websites were accessed for information on designated sites in the vicinity of the project:

- NPWS; and,
- NBDC.

2 www.google.ie/maps Last accessed 05/01/2024
3 https://gis.epa.ie Last accessed 05/01/2024
4 https://maps.biodiversityireland.ie/ Last accessed 05/01/2024
5 https://airomaps.geohive.ie/ESM/ Last accessed 05/01/2024
6 www.npws.ie/ Last accessed 05/01/2024
7 www.birdwatchireland.ie/our-work/surveys-research/research-surveys/irish-wetland-bird-survey/ Last accessed 05/01/2024. Data were supplied by the Irish Wetland Bird Survey (I-WeBS), a scheme coordinated by BirdWatch Ireland under contract to the National Parks and Wildlife Service of the Department of Housing, Local Government and Heritage

As a starting point, all European and national sites within 20 km surrounding the project were identified. For international sites, this included SACs, candidate SACs, proposed SPAs, SPAs, Important Bird Areas (IBAs) and Ramsar sites. For national sites, this included NHAs, pNHAs and nature reserves. The rationale for this search distance is explained later in **Section 5.2.4**.

5.2.3 Field Surveys

Ecological surveys were carried out to yield sufficient data to support this assessment. A brief description of the surveys undertaken, and survey dates are presented in **Table 5.2** below.

Survey	Brief Description	Timing
Site Walkover	An initial walkover of the site was undertaken to identify any major constraints.	11th May 2022
Habitats	Survey to determine habitats present within the main wind farm site, grid-connection route, and substation.	18th – 21st July 2022 23rd and 26th August 2022 31st August 2023
Annex I Habitats	A survey to determine if areas identified as bog woodland (Fossitt code WN7) correspond with Annex I habitat 91D0.	24th – 25th August 2022
Invasive Species	Recording non-native invasive species observed during habitat surveys, and on an ad-hoc basis during other surveys. The location and area covered by invasive plant species (i.e. area or length(m^2)/(m)) of plant species was also noted.	11th May 2022 and 18th – 21st July 2022.
Aquatic Surveys	Undertaken on a catchment-wide scale, the baseline surveys focused on aquatic habitats in relation to fisheries potential (including both salmonid and lamprey habitat), white-clawed crayfish (*Austropotamobious pallipes*), freshwater pearl mussel (*Margaritifera margaritifera*) (eDNA only), macro-invertebrates (biological water quality), macrophytes and aquatic bryophytes, aquatic invasive species, and species of conservation value which may use the watercourses in the vicinity of the project. Full details of the survey methodology are included in section 2 of the aquatic survey report in **Annex 5.4.**	Tuesday 23rd to Thursday 25th August 2022
Invertebrate, Amphibian and Reptile Suitability Assessment	Invertebrate species observed were noted throughout the entirety of ecological surveys on an ad-hoc basis. Suitability for and evidence of amphibians and reptiles also noted during surveys.	11th May 2022 18th – 21st July 2022 24th – 25th August 2022
Marsh Fritillary	Habitat assessment to determine potential and suitability for marsh fritillary.	13th – 14th June 2022
Bird Surveys Full details of survey dates are contained within **Annex 5.2**.	Vantage point (VP) surveys covering each turbine location plus a 500m radius around the same. Two VPs x 36 hours/VP/season (minimum) over two years.	Breeding season 2020: 6th May 2020 to 8th September 2020.
		Non-breeding season 2020/21: 6th October 2020 to 12th March 2021.
		Breeding season 2021:

Survey	Brief Description	Timing
		29th April 2021 to 15th September 2021.
		Non-breeding season 2021/22: 13th October 2021 to 16th March 2022.
	Breeding wader surveys within the site plus a 500m buffer zone.	Breeding season 2020: 5th and 29th May and 26th June 2020.
		Breeding season 2021: 13th May, 1st and 17th June 2021.
		Breeding season 2022: 9th and 17th May, and 8th June 2022.
	Breeding raptor surveys within the site plus a 2km buffer zone.	Breeding season 2020: 5th and 29th May, 26th June and 8th July 2020.
		Breeding season 2021: 13th May, 1st and 16th June, and 18th and 20th July 2021.
		Breeding season 2022: 9th and 17th of May, 7th of June, 14th of July and 2nd of August 2022.
	Winter swan and goose feeding distribution surveys within the site plus at least a 500m buffer zone.	Non-breeding season 2020/21: fortnightly from 4th November 2020 to 12th March 2021.
		Non-breeding season 2021/22: fortnightly from 13th October 2021 to 16th March 2022.
		Non-breeding season 2022/23: fortnightly from 5th October 2022 to 13th March 2023.
	Winter hen harrier roost surveys at suitable habitat within the site plus a 2km buffer zone.	Non-breeding season 2021/22: 18th January, 16th February and 2nd March 2022.
	Nocturnal golden plover surveys at suitable habitat within the site.	Non-breeding season 2022/23: 3rd January and 13th March 2023.
Terrestrial Mammals (excluding bats)	Survey carried out within 50m of site infrastructure. Surveys for otter also extended 150m upstream/downstream of water crossings (300m total).	11th May 2022 18th – 21st July 2022 22nd – 24th August 2022
	Trail Camera survey of suspected badger sett	14th (deploy) – 26th September (collect) 2023
Bats	Preliminary ecological appraisal of project site to determine presence of potential commuting, foraging, and roosting habitat.	11th May 2022

Survey	Brief Description	Timing
	Preliminary roost assessment targeting (trees and structures):	6th-8th April 2022
	Ground-level Static Detectors:	Spring: 11th May – 23rd May 2022 Summer: 12th July – 23rd July 2022 Autumn: 28th September – 11th October 2022
	Static Detector at Height:	Spring: 18th May – 08th June 2022 Summer: 01st July – 04th September 2022 Autumn: 28th September – 18th October 2022
	Transects:	Spring: 18th May 2022 • Start:21:28 • End: 23:28 Summer: 21st July 2022 • Start: 21:43 • End: 23:43 Autumn: 27th September 2022 • Start: 19:18 • End: 21:18
	Survey of Trees along grid connection routes:	18th-21st July 2022 23rd and 26th August 2022

Table 5.2: Survey Dates

5.2.3.1 Habitats & Flora

Terrestrial habitats and flora (including invasive plant species) were mapped according to Fossitt (2000) and the good practice measures outlined in Heritage Council guidance (Smith, O'Donoghue, O'Hora, & Delaney, 2011). The locations of any rare or invasive plant species were recorded using a hand-held GPS.

All habitat surveys were conducted during optimal times of year.

Annex I Habitats

An Annex 1 habitat survey was carried out on 24th – 25th August 2022 to determine if areas identified as bog woodland (Fossitt code WN7) correspond with Annex I habitat 91D0.

A total of 10 no. 10x10m relevés were randomly selected within the bog woodland habitat to survey the vegetation in greater detail and to understand the habitat condition. The Relevé number was selected based on the estimated size of total bog woodland (17.10 ha). Full data is presented in **Annex 5.5** of this EIAR.

Methodology was in accordance with Cross and Lynn, (2013). This involved assigning

a DAFOR[8] scale score to the species present, with particular focus on the presence or absence of indicator species for bog woodland 91D0.

5.2.3.2 Fisheries & Aquatic Ecology

Baseline surveys were carried out in August 2022. Full data are presented in **Annex 5.4** of this EIAR with a summary provided below. Surveys focused on the detection of freshwater habitats and species of high conservation value. A strict biosecurity protocol was used following guidance and the 'Check-Clean-Dry' approach with further details in **Annex 5.4**.

Physical Surveys

All survey sites were assessed in terms of physical watercourse characteristics, substrate and flow.

Fish Stock Assessment

Electro-fishing was undertaken at all riverine survey sites containing water or where prohibitive depths meant electro-fishing was not viable. Sites A1 (Woodfield River), B2 (Eglish Stream) and B11 (Milltown Stream) were dry at the time of survey, whilst sites B5 (West Galros Stream), B6 (West Galros Stream) and D4 (Grand Canal) were found to not be suitable for electro-fishing due to prohibitive depths. In a similar fashion the quarry lake site (L1) was not suitable for electro-fishing. Therefore, a total of 20 no. sites were surveyed via electro-fishing. The survey was undertaken in accordance with best practice (CEN, 2003; CFB, 2008) and Section 14 licencing requirements.

In addition, a fisheries habitat appraisal was undertaken to establish the importance of the survey sites for fish species.

White Clawed-crayfish Survey

Surveys were undertaken under a NPWS open licence (C31/2022) to capture and release crayfish at their site of capture. Hand searching and sweep netting was undertaken following Reynolds et al. (2010). An appraisal of crayfish habitat was undertaken.

Freshwater Pearl Mussel Survey

Suitability for freshwater pearl mussel (*Margaritifera margaritifera*) was assessed at each survey site with environmental DNA (eDNA) sampling undertaken for the species at 2 no. strategically chosen riverine locations within the vicinity of the project.

eDNA Analysis

To validate site surveys and to detect potentially cryptically-low populations of sensitive aquatic receptors within the study area, 3 no. composite water samples were collected from the Little Brosna River (A3) and Rapemills River (B8) and analysed for freshwater pearl mussel, white-clawed crayfish, European eel, crayfish plague, and

[8] (D = Dominant; A = Abundant; F = Frequent; O = Occasional; R = Rare). This is a subjective form of habitat description commonly used in conjunction with habitat classifications.

smooth newt environmental DNA (eDNA)

Otter Survey

Searches were made for otter signs and sightings within 150 m of each aquatic survey site and mapped using a hand-held GPS. Notes were made on the quantity and visible constituents of spraint.

Biological Water Quality (Q-sampling)

Biological water quality was assessed via Q-sampling at all riverine survey sites (25 no. sample sites). Methodology followed Feeley et al. (2020) and samples were converted into Q-ratings per Toner et al. (2005). Any rare invertebrate species were identified.

Lake & Canal Macro-invertebrate Communities

The lake survey site (L1) and the Grand Canal (D4) was sampled for macro-invertebrates via sweep netting. A standard pond net (250mm width, mesh size 500µm) was used to sweep macrophytes to capture macro-invertebrates. The net was also moved along the lakebed to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). A 3-minute sampling period was employed. To ensure appropriate habitat coverage, the sampling period was also divided amongst the range of meso-habitats present at the survey sites to get a representative sample for sub-habitats.

Macrophytes & Aquatic Bryophytes

Botanical surveys were conducted via instream wading at all riverine sites. Specimens were collected for on-site identification. Any rare macrophyte or bryophyte species were recorded, and the aquatic vegetation community assessed for correspondence with Annex 1 habitat types. Links with Annex 1 lake habitats were also assessed at lacustrine sites.

5.2.3.3 Other Protected Fauna

Invertebrate species were recorded on an ad hoc basis during all surveys.

No specific surveys for reptiles were conducted and were searched for on an ad hoc basis during other surveys, as NRA (2009) guidance states that direct observation is an effective survey technique.

Amphibians were surveyed for during aquatic ecology surveys and on an ad hoc basis during other surveys.

5.2.3.4 Marsh Fritillary

Dedicated surveys for marsh fritillary butterfly were undertaken in the summer of 2022. Numerous devil's bit scabious *Succisa pratensis* (the foodplant for the butterfly species) was recorded in the Northern Cluster. An assessment of habitat suitability was undertaken. The habitat suitability assessment and larval web survey was based upon the methodology outlined in the National Biodiversity Data Centre's monitoring scheme (NBDC, 2023).

5.2.3.5 Bird Surveys

Baseline ornithology surveys were conducted during the period May 2020 to March 2023. Full data are presented within **Annex 5.2.**

Target Species

NatureScot guidance (NatureScot, 2017) recommends that species targeted for surveys are split into two groups: primary and secondary species. During field surveys, recording of secondary target species is subsidiary to recording primary target species. This approach is explained in more detail below.

Passerines (relating to the largest order of birds, *Passeriformes*, which includes over half of all living birds and consists chiefly of altricial songbirds of perching habits) are generally not considered to be significantly impacted by wind farms (NatureScot, 2017; Garcia, Canavero, Ardenghi, & Zambon, 2015; Beston, Diffendorfer, Loss, & Johnson, 2016; Stewart, Pullins, & Coles, 2007), so were not included as primary or secondary target species. However, amber- and red-listed passerine species were recorded as incidentals to provide a full picture of ornithology at the project site.

Primary Target Species

Current NatureScot guidelines (NatureScot, 2017) state that "*in most circumstances the target species will be limited to those species which are afforded a higher level of legislative protection*".

Primary target species were specifically limited to species upon which effects are most likely to be potentially significant in EIA terms, e.g. breeding and non-breeding species forming qualifying features (sometimes termed 'special conservation interests' or SCIs) for nearby SPAs, or species listed on Annex I of the Birds Directive. In addition, some species red-listed under the BoCCI scheme (Colhoun & Cummins, 2013; Gilbert, Stanbury, & Lewis, 2021) were also included as primary targets. While being red-listed does not afford species a higher level of legislative protection, it does reflect poor conservation status and vulnerability of bird populations to negative effects from wind farms. All red-listed non-passerine species were included as primary target species.

This approach to identifying primary target species enabled recording to focus on the species of greatest importance without the distraction of having to record detailed flight data for a larger number of more common species.

Breeding Season

The recorded primary target species for VP surveys during the breeding season included:-

- Black-headed gull *Chroicocephlus ridibundus*;
- Common kestrel *Falco tinnunculus*;
- Common ringed plover *Charadrius hiaticula*;
- Common snipe Gallinago gallinago;
- European golden plover *Pluvialis apricaria*;
- Northern lapwing *Vanellus vanellus*; and,
- Peregrine falcon *Falco peregrinus*.

Non-Breeding Season

The recorded primary target species for VP surveys during the non-breeding season included:-

- Black-headed gull;
- Common kestrel;
- Common snipe;
- Eurasian teal *Anas crecca;*
- Eurasian wigeon *Mareca penelope;*
- European golden plover *Pluvialis apricaria ;*
- Great cormorant *Phalacrocorax carbo;*
- Great white egret *Ardea alba;*
- Greylag goose *Anser anser;*
- Hen harrier Circus cyaneus;
- Little egret *Egretta garzetta;*
- Mallard *Anas playtyrhynchos;*
- Merlin *Falco columbarius;*
- Northern lapwing;
- Peregrine falcon; and,
- Whooper swan *Cygnus cygnus*.

Secondary Target Species

Secondary target species were limited to species that may be affected by wind farms but either lack a higher level of legislative protection (not listed on Annex I of the Birds Directive or listed as SCIs) and/or are not red-listed under the latest BoCCI4 scheme.

Secondary target species included the following:

- any other wildfowl and wader species not recorded as primary target species;
- common buzzard *Buteo buteo;*
- Eurasian sparrowhawk *Accipiter nisus;*
- grey heron *Ardea cinerea*; and,
- gulls *Larus* spp. (where not recorded as primary target species).

In the 2020 breeding and 2020/21 non-breeding seasons, common kestrel was recorded as secondary targets as they were still amber-listed at the time of surveys. Mallard was also treated as secondary targets for the 2020/21 non-breeding, 2021 breeding, 2021/22 non-breeding and 2022 breeding seasons. Little egret was treated as a secondary target for the 2021/22 non-breeding and 2022 breeding seasons.

Baseline Survey Methodologies

Surveys were carried out following NatureScot guidance (NatureScot, 2017). Further details are provided in **Annex 5.2** with a summary provided below.

Flight Activity Surveys

Surveys first commenced in May 2020 and ended in March 2023. As per current guidance, a minimum of 72 hours of flight activity surveys per year were conducted from each of two VP locations across three years for the two breeding seasons.

More than the minimum survey effort was carried out (99 hours for the breeding season for each VP; 114.5 and 114 hours for the non-breeding season for VPs 1 and 2,

respectively).

The number of hours completed at each VP, in each season, is summarised in **Table 5. 3**.

VP Number	Hours of Survey Completed (hh:mm)						
	May -Aug 2020	Sep 2020 – Mar 2023	Apr – Sep 2021	Oct 2021 – Mar 2022	May – Aug 2022	Oct 2022 – Mar 2023	Total
1	27:00	42:30	36:00	36:00	36:00	36:00	213:30
2	27:00	42:00	36:00	36:00	36:00	36:00	213:00

Table 5. 3 VP Surveys Undertaken at the Project Site

Breeding Wader Surveys

Surveys were undertaken in 2020, 2021 and 2022 within the project site plus a 500 m buffer zone beyond as recommended by NatureScot (2017) guidance, using the methodology described in O'Brien and Smith (1992) which is suitable for lowland grassland sites. Three survey visits were undertaken in each year between the middle of April to June inclusive, at least one week apart.

Full details are provided in **Annex 5.2**.

Breeding Raptor Surveys

The survey methodology for breeding raptors in 2020, 2021 and 2022 used short watches of potentially suitable habitat from appropriate viewpoints to identify potential nesting territories for raptors within the project site plus a 2km buffer. This included surveys at [redacted] in 2022.

Survey timings followed those in Hardey et al. (2013), as per current NatureScot (2017) guidelines. At least four survey visits were undertaken between April to August, inclusive.

Full details are provided in **Annex 5.2** .

Swan & Goose Feeding Distribution Surveys

Feeding distribution surveys were carried out on every fortnight between October to March inclusive for the 2020/21, 2021/22 and 2022/23 non-breeding seasons to surveys for swans and geese using fields within the project and a 500m buffer, as recommended by NatureScot (2017) guidance. These surveys were undertaken by driven transect, stopping on a regular basis to check all fields for swan and goose feeding activity.

Full details are provided in **Annex 5.2.**

Hen Harrier Roost Surveys

Due to a few sightings of foraging hen harrier in the 2021/22 non-breeding season, hen harrier winter roost surveys were carried out as a precaution, following NatureScot (2017) guidance. These were carried out on three occasions between January to March 2022 at suitable roosting habitat within the project site and a 2km buffer. Methodology followed that given by the Irish Hen Harrier Winter Roost Survey (O'Donoghue, 2019).

Full details are provided in **Annex 5.2**.

Nocturnal Golden Plover Surveys

Nocturnal surveys were undertaken to investigate whether flocks of golden plover (and other nocturnal bird species) recorded during diurnal surveys were also foraging within the project site at night. A thermal monocular was used to detect and identify the presence of target species.

Full details are provided in **Annex 5.2**.

5.2.3.6 Terrestrial Mammals (Excluding Bats)

Dedicated mammal surveys were carried out May-August 2022. The focus of these surveys was to search for mammal resting/breeding places, which are most vulnerable to disturbance and habitat loss. In addition, any other signs/sightings were recorded and mapped using a hand-held GPS during both dedicated mammal surveys and opportunistically, during other ecological surveys. Survey methodology followed that outlined Cresswell et al. (2012), with a particular focus on badger *Meles meles*, pine marten *Martes martes*, and red squirrel *Sciurus vulgaris*.

Trail cameras were also deployed at a suspected badger sett under licence from NPWS (License no. 111/2022 (amended)).

Otters *Lutra lutra* were searched for during the aquatic surveys (see **Section 5.2.3.2**). Signs were recorded during other surveys, if observed.

5.2.3.7 Bats

Baseline bat surveys were conducted during the period April 2022 to October 2022.

Surveys were carried out following the relevant NatureScot guidance (NatureScot, 2021).

Further details are provided in **Annex 5.3** with a summary provided below.

Habitat Appraisal for Potential Bat Roost Features & Assessment of Habitat Risk

A desk study was used to compile information on potential roosts and foraging habitats within the project and along the grid connection route, plus along the turbine delivery route where any works will take place. The survey area was walked April and May 2022 to search for potential winter and summer roosts, plus to undertake an initial site risk assessment for bats.

Activity Survey – Transect Survey

Activity surveys were carried out once per season (spring, summer and autumn 2022) at two transects within the project. Transects were conducted simultaneously using BatLogger-M detectors to record calls. Flight lines were recorded, following methodology from Collins (2016).

Activity Survey – Static Bat Detector Survey (Ground-Level and At-Height)

Ground-level full spectrum bat detectors (Anabat Swift, Titley Scientific) were deployed at 7 no. turbine locations for the spring, summer and autumn 2022 seasons, following methodology from NatureScot (2021).

An 'at-height' full spectrum bat detector (Wildlife Acoustics, SM4BatFS) was deployed at the temporary met mast between May and October 2022, following methodology

from NatureScot (2021).

5.2.4 Evaluation Criteria for Ecological Assessment

5.2.4.1 Assessing Impact Significance

CIEEM guidelines state that ecological receptors which are important (i.e., Important Ecological Features or 'IEFs') and potentially affected by the project should be subject to detailed assessment. It is not necessary to carry out detailed assessment of receptors that are sufficiently widespread, unthreatened and resilient to project effects and would remain viable and sustainable. However, the EU Biodiversity Strategy 2020 and Irish National Biodiversity Action Plan 2017-2021 emphasise the need to achieve no net loss and enhancement of biodiversity.

5.2.4.2 Determining the Zone of Influence

Determining whether an IEF has the potential to be affected by the project relates to the concept of the Zone of Influence (ZoI). The ZoI relates to the nature of the project, its likely effects and the presence of connections or pathways between ecological receptors and the project. Thus, ecological receptors that lack a connection to the project are considered outside the ZoI, even if they are directly within the project site. Conversely, receptors that are considerably removed from the project can still be considered within the ZoI if a pathway for effects exists.

All connections (ecological, hydrological and hydrogeological) which provide pathways for effects between the project and ecological receptors in the surrounding area are identified and described in **Section 5.4**.

For all receptors that are not designated nature conservation sites, the initial ZoI for the construction and decommissioning phase is as follows:

- Direct effects: up to a 50m buffer surrounding permanent and temporary proposed site infrastructure for the project (wind farm) site and substation, and up to a 5 m buffer along the cable corridor and haul route; and,
- Indirect effects: dependent on the type of works and the published sensitivities of the ecological receptor.

For all receptors that are not designated nature conservation sites, the ZoI for the operational phase is dependent on the published sensitivities of the ecological receptor.

Regarding designated nature conservation sites, DoEHLG (2010) guidelines suggest that a 15 km study area is adopted as a starting point when assessing the potential for source-receptor connectivity between a project and European sites. However, this is an arbitrary distance and, in some cases, could be much smaller or larger depending on whether there is hydrological, hydrogeological or ecological connectivity present. A 20km study area has been used initially, which is slightly larger than the 15 km recommended, in recognition that 20km is the maximum distance SPA Qualifying Interests (QI) bird species typically travel (NatureScot, 2016). This initial search area was then reappraised during impact assessment.

5.2.4.3 Determining Importance

Ecological features can be important for a variety of reasons. The importance of ecological receptors should be considered within a defined geographical context

and for this Project the following geographic frame of reference is used:

- International (i.e. Europe);
- national (i.e. Ireland);
- regional/county (i.e. County Offaly);
- local (i.e. the townlands containing the project); and,
- site (i.e. the project).

Key ecological receptors (for assessment) are those deemed to be above the 'Local' Importance (lower value) evaluation. Evaluation criteria are outlined below in **Table 5.4.**

Resource Evaluation	Defining Criteria (adapted from NRA, 2009)
International Importance	'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA), candidate Special Area of Conservation (cSAC) or proposed Special Protection Area (pSPA). Sites that fulfil the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). Features essential to maintaining the coherence of the Natura 2000 Network. Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). World Heritage Site (Convention for the Protection of World Cultural and Natural Heritage, 1972). Biosphere Reserve (UNESCO Man and The Biosphere Programme). 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). Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe. Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).
National Importance	Site designated or proposed as a Natural Heritage Area (NHA). Statutory Nature Reserve. Refuge for Fauna and Flora protected under the Wildlife Acts. National Park. Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA). Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. Resident or regularly occurring populations (assessed to be important at the

Resource Evaluation	Defining Criteria (adapted from NRA, 2009)
	national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.
County 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 the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared. Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. Sites containing habitats and 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 or habitats or natural heritage features identified in the Local BAP, if this has been prepared. Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats 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)	Sites containing small areas of semi natural habitat that are of some local importance for wildlife. Sites or features containing non-native species that are of some importance in maintaining habitat links.

Table 5.4: Evaluation Criteria

5.2.4.4 Impact Assessment

The main purpose of an EIAR is to identify, describe and present an assessment of the likely significant effects of a project on the environment.

The CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM,

2018, updated 2022) (hereafter referred to as 'the CIEEM guidelines') form the basis of the impact assessment presented in this chapter. Reference has also been made to other relevant guidance, as appropriate.

The impact assessment process involves the following steps:-

- Identifying and characterising potential impacts and their effects ;
- Incorporating measures to avoid and mitigate negative impacts and effects;
- Assessing the significance of any residual effects after mitigation;
- Identifying appropriate compensation measures to offset significant residual effects; and,
- Identifying opportunities for ecological enhancement.

The description of the likely significant effects on the receiving environment should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the project. This description should take into account the environmental protection objectives established at EU or Member State level which are relevant to the project.

When describing effects, reference has been made to specific characteristics, as appropriate. Following CIEEM (2018) and EPA (2022) guidelines, impacts and effects have been described in terms of:-

- quality e.g. positive/neutral/negative;
- extent e.g. spatial area;
- context e.g. conform/contrast with baseline conditions;
- magnitude e.g. size/amount/intensity/volume;
- probability e.g. likely/unlikely;
- duration e.g. temporary/short-term/medium-term/long-term/permanent;
- frequency e.g. once/rarely/occasionally/frequently/constantly;
- timing e.g. critical life-stage or season; and,
- reversibility e.g. reversible/irreversible.

The assessment will describe those characteristics that are relevant to understanding the ecological effect and determining the significance, and as such does not need to incorporate all stated effects.

5.2.4.5 Significant Effects

The concept of ecological significance is addressed in paragraphs 5.24 through to 5.28 of the CIEEM guidelines. Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of Ecological Impact Assessment (EcIA), a 'significant effect' is an effect that is sufficiently important to require assessment and reporting so that the competent authority is adequately informed of the environmental consequences of permitting a project. Effects can be considered significant at a wide range of scales from international to site, and the scale of significance of an effect may or may not be the same as the geographic context in which the feature is considered important.

The nature of the identified effects on each assessed feature is characterised in accordance with the process at **Section 5.5**. This is considered alongside available research and professional judgement about the sensitivity of the feature affected; and professional judgement about how the impact is likely to affect the site, habitat,

or population's structure and continued function. Where it is concluded that an effect would be likely to reduce or increase the importance of an assessed feature, it is described as significant.

5.2.4.6 Cumulative Effects

Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location. Cumulative effects can occur where a project results in individually insignificant effects that, when considered in-combination with effects of other proposed or permitted plans and projects, can result in significant effects.

Other plans and projects (refer to **Chapter 1**) that should be considered when establishing cumulative effects include:-

- Proposals for which consent has been applied but which are awaiting determination;
- Projects which have been granted consent, but which have not yet been started or which have been started but are not yet completed (i.e. under construction);
- Proposals which have been refused permission, but which are subject to appeal, and the appeal is undetermined.
- Constructed developments whose full environmental effects are not yet felt and therefore cannot be accounted for in the baseline; or,
- Developments specifically referenced in a national policy, a national plan or a local plan.

5.2.4.7 Avoidance, Mitigation, Compensation & Enhancement

Where likely significant effects have been identified, the mitigation hierarchy has been applied, as recommended in the CIEEM Guidelines. The mitigation hierarchy sets out a sequential approach beginning with the avoidance of effects where possible, the application of mitigation measures to minimise unavoidable effects and then compensation for any remaining effects. Once avoidance and mitigation measures have been applied, residual effects are then identified along with any necessary compensation measures, and incorporation of opportunities for enhancement.

It is important to clearly differentiate between avoidance mitigation, compensation and enhancement and these terms are defined here, as follows:-

- Avoidance is used where an impact has been avoided, e.g. through changes in scheme design;
- Mitigation is used to refer to measures to reduce or remedy a specific negative impact in situ;
- Compensation describes measures taken to offset residual effects, i.e. where mitigation in situ is not possible; and
- Enhancement is the provision of new benefits for biodiversity that are additional to those provided as part of mitigation or compensation measures, although they can be complementary.

5.2.4.8 Residual Effects

Where likely significant effects have been identified, the mitigation hierarchy has

been applied, as recommended in the CIEEM guidelines. The mitigation hierarchy sets out a sequential approach beginning with the avoidance of effects where possible and followed by the application of mitigation measures to minimise unavoidable effects. The remaining effects are termed 'residual effects'. If significant residual effects remain, then compensation for any remaining effects may be undertaken.

It is important to clearly differentiate between avoidance mitigation, compensation and enhancement and these terms are defined here as follows:

- avoidance is used where an impact has been avoided, e.g. through changes in scheme design;
- mitigation is used to refer to measures to reduce or remedy a specific negative impact in situ;
- compensation describes measures taken to offset residual effects, i.e. where mitigation in situ is not possible; and,
- enhancement is the provision of new benefits for biodiversity that are additional to those provided as part of mitigation or compensation measures, although they can be complementary.

5.3 Description of the Existing Environment

This section presents a description of the general context of the receiving (baseline) environment associated with the project.

For all receptors, other than designated nature conservation sites, the results of both the desktop studies and field surveys are presented together. Full details of the sources for desktop data (including when the data searches were made) are presented in **Annex 5.6**. Full details of the field surveys (including when the surveys were made) are shown in **Section 5.2.3**.

5.3.1 Designated Sites

European sites are assessed in the Appropriate Assessment (AA) Screening and Natura Impact Statement (NIS) which accompanies the relevant planning applications for the project. Nationally designated sites are discussed in the following sections.

5.3.1.1 International Sites

There are 29 no. internationally designated sites within 20km of the project (i.e. 20 no. SACs, 7 no. SPAs, and 2 no. Ramsar sites). The project is not situated within any internationally designated site. These are presented in **Figure 5.1**.

Table 5.5 provides a list of the designated sites and identifies any source-receptor pathways. These can be considered within the ZoI. Qualifying interests with connectivity to the project are highlighted in bold. The NIS concluded:

"*With the identified mitigation measures in place, it can be concluded, beyond all reasonable scientific doubt that the Project, either alone or in combination with other plans or projects will not undermine the conservation objectives of any European sites. It can therefore be concluded that the Project would not have an adverse effect on the integrity of any European site.*".

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
SACs & cSACs					
Ridge Road, SW of Rapemills SAC	000919	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210]	International	0.26	**Hydrological & Hydrogeological** The qualifying interest is a terrestrial habitat and thus there is no connectivity. **Ecological** No ecological connectivity as the designated feature is a habitat which does not occur on the Project site, therefore, no pathway. However, due to the proximity of the SAC to the project site, pollution, such as dust generated during construction and vehicle emissions, may impact upon the habitat.
All Saints Bog and Esker SAC	000566	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150] Bog woodland [91D0]	International	2.22	**Hydrological and Hydrogeological** Raised bogs (and the associated depressions on peat substrates of the Rynchosporion) are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. The other qualifying habitat features are terrestrial in nature. Therefore, no connectivity. **Ecological** No ecological connectivity as the designated features are habitats which do not occur on the Project site. Therefore, no pathway.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
Ballyduff/Clonfinane Bog SAC	000641	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150] Bog woodland [91D0]	International	5.26	**Hydrological & Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. Furthermore, although the SAC is mostly within the same groundwater body (Banagher; IE_SH_G_040) as the Project it is a considerable distance from the Project site for hydrogeological links. A study of the watercourses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
River Shannon Callows SAC	000216	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [6510] Alkaline fens [7230] Limestone pavements [8240] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae,	International	6.23	**Hydrological and Hydrogeological** Construction/ decommissioning of wind farm - release of suspended solid (and other) pollution – (alkaline fens, alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* and otter) **Ecological** Construction/decommissioning of wind farm - physical injury to otter, physical damage to otter breeding/ resting/ foraging sites, disturbance/ displacement or reduction in foraging opportunities for otter.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		Salicion albae) [91E0] *Lutra lutra* (Otter) [1355]			
Lisduff Fen SAC	002147	Petrifying springs with tufa formation (*Cratoneurion*) [7220]	International	6.59	**Hydrological and Hydrogeological** The SAC is located in a different groundwater body to the SAC. Therefore, no hydrogeological connectivity. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated feature is a habitat, therefore, no pathway
Island Fen SAC	002236	Alkaline fens [7230]	International	7.31	**Hydrological and Hydrogeological** The SAC is located in a different groundwater body to the SAC. Therefore, no hydrogeological connectivity. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
Redwood Bog SAC	002353	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of	International	7.84	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. Furthermore, Redwood Bog SAC is within a different sub-catchment as the Project and at a considerable distance from the project site for hydrogeological links.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		the Rhynchosporion [7150]			A study of the watercourses revealed no hydrological connectivity. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
Sharavogue Bog SAC	000585	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150]	International	7.96	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. Furthermore, Sharavogue Bog SAC is within a different groundwater body as the Project and thus there is no hydrogeological link. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
Arragh More (Derrybreen) Bog SAC	002207	Degraded raised bogs still capable of natural regeneration [7120]	International	8.56	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. Furthermore, the SAC is within a different groundwater body as the Project and thus there is no hydrogeological link. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated feature is a habitat, therefore, no pathway.
Kilcarren-Firville Bog SAC	000647	Active raised bogs [7110] Degraded raised bogs still capable	International	9.26	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. Furthermore, the

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150]			SAC is within a different groundwater body as the Project and thus there is no hydrogeological link. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
Liskeenan Fen SAC	001683	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* [7210]	International	12.03	**Hydrological and Hydrogeological** The SAC is within a different groundwater body as the Project and thus there is no hydrogeological link. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated feature is a habitat, therefore, no pathway
Moyclare Bog SAC	000581	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150]	International	12.34	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. Furthermore, the SAC is within a different groundwater body as the project. and at a considerable distance from the Project site for hydrogeological links. A study of the water courses revealed no hydrological connectivity. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
Slieve Bloom Mountains SAC	000412	Northern Atlantic wet heaths with *Erica tetralix* [4010]	International	13.79	**Hydrological and Hydrogeological** The SAC is within a different groundwater body as the Project and thus there is no hydrogeological link. A study of the water courses revealed no

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		Blanket bogs (* if active bog) [7130] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0]			hydrological connectivity. Furthermore, blanket bog and upland wet heath are usually rainwater fed. **Ecological** No ecological connectivity as the designated features are habitats which do not occur on the project site. Therefore, no pathway.
Ferbane Bog SAC	000575	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150]	International	14.48	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. Furthermore, the SAC is within a different groundwater body as the project and at a considerable distance from the Project site for hydrogeological links. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
Lough Derg, North-east Shore SAC	002241	*Juniperus communis* formations on heaths or calcareous grasslands [5130] Calcareous fens with *Cladium mariscus* and species of the *Caricion*	International	14.81	**Hydrological** Construction/ decommissioning of wind farm - release of suspended solid (and other) pollution via the Rapemills River and River Shannon – (calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*, Alkaline fens, Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*). **Hydrogeological** The SAC is within a different groundwater body as the Project and at a considerable distance from

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		davallianae [7210] Alkaline fens [7230] Limestone pavements [8240] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] *Taxus baccata* woods of the British Isles [91J0			the project site for hydrogeological links. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
Clonaslee Eskers and Derry Bog SAC	000859	Petrifying springs with tufa formation (*Cratoneurion*) [7220] Alkaline fens [7230] *Vertigo geyeri* (Geyer's Whorl Snail) [1013]	International	15.33	**Hydrological and Hydrogeological** The SAC is within a different groundwater body as the Project and at a considerable distance from the project site for hydrogeological links. A study of the water courses revealed no hydrological connectivity. **Ecological** No ecological connectivity as the distance between the SAC and project site is too large (>15 km) for Geyer's whorl snail to travel.
Scohaboy (Sopwell) Bog SAC	002206	Degraded raised bogs still capable of natural regeneration [7120]	International	17.02	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. Furthermore, the SAC is within a different groundwater body as the project and at a considerable distance from the Project site for hydrogeological links. A study of the water courses revealed no hydrological connectivity as the SAC

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
					is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated feature is a habitat, therefore, no pathway.
Fin Lough (Offaly) SAC	000576	Alkaline fens [7230] *Vertigo geyeri* (Geyer's Whorl Snail) [1013]	International	18.03	**Hydrological and Hydrogeological** The SAC is within a different groundwater body as the project and at a considerable distance from the project site for hydrogeological links. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the distance between the SAC and project site is too large (>18 km) for Geyer's whorl snail to travel.
Mongan Bog SAC	000580	Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]	International	19.42	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. The SAC is within a different groundwater body as the project and at a considerable distance from the project site for hydrogeological links. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
Ardgraigue Bog SAC	002356	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration	International	19.65	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. Ardgraigue Bog SAC is within a different groundwater body as the project and at a

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		[7120] Depressions on peat substrates of the *Rhynchosporion* [7150]			considerable distance from the Project site for hydrogeological links. A study of the water courses revealed no hydrological connectivity. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.
SPAs (no proposed SPAs were present)					
Dovegrove Callows SPA	004137	Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]	International	0.001 from grid connection. 1.71 from main project site.	**Ecological** Greenland white-fronted goose was not recorded during the baseline ornithological study. However, due to the proximity of the grid connection to this SPA the construction of the grid connection could cause disturbance and/or displacement of Greenland white-fronted geese.
River Little Brosna Callows SPA	004086	Whooper Swan (*Cygnus cygnus*) [A038] Wigeon (*Anas penelope*) [A050] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (*Anas clypeata*) [A056] Golden Plover (*Pluvialis apricaria*) [A140] Lapwing (*Vanellus vanellus*) [A142] Black-tailed Godwit (*Limosa limosa*) [A156]	International	1.65	**Hydrological & Hydrogeological** The SPA is within the same groundwater body as the project. Therefore, there is potential hydrogeological connectivity. A study of the water courses revealed no hydrological connectivity. **Ecological** Whooper swan, golden plover, lapwing, wigeon, teal and black-headed gull were recorded in flight within the project site. Therefore, there is a potential ecological connection for these species. Greenland white-fronted goose was not recorded during the baseline ornithological study. However, due to the proximity of the grid connection to this SPA the construction of the grid connection may cause disturbance and/or displacement of Greenland white-fronted geese.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] Wetland and Waterbirds [A999]			
All Saints Bog SPA	004103	Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]	International	2.23	Greenland white-fronted goose was not recorded during the baseline ornithological study. However, due to the proximity of the grid connection to this SPA the construction of the grid connection may cause disturbance and/or displacement of Greenland white-fronted geese.
Middle Shannon Callows SPA	004096	Whooper Swan (*Cygnus cygnus*) [A038] Wigeon (*Anas penelope*) [A050] Corncrake (*Crex crex*) [A122] Golden Plover (*Pluvialis apricaria*) [A140] Lapwing (*Vanellus vanellus*) [A142] Black-tailed Godwit (*Limosa limosa*) [A156] Black-headed Gull (*Chroicocephalus ridibundus*) [A179]	International	6.24	**Hydrological & Hydrogeological** There is hydrological connectivity between Middle Shannon Callows SPA and the project site via the Rapemills River and River Shannon. The SPA is also present within the same groundwater body as the project site and thus there is potential hydrogeological connectivity. **Ecological** Whooper swan, golden plover, wigeon, lapwing and black-headed gull were recorded during flight activity surveys. Therefore, there is a potential ecological connection for these species. Corncrake and black-tailed godwit were not recorded during the baseline ornithological study. Therefore, no ecological connection.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		Wetland and Waterbirds [A999]			
Slieve Bloom Mountains SPA	004160	Hen Harrier (*Circus cyaneus*) [A082]	International	11.65	**Ecological** A total of four hen harrier flight lines were recorded during flight activity surveys. No breeding or wintering hen harriers were observed within the survey area. Therefore, there is a potential ecological connection.
Lough Derg (Shannon) SPA	004058	Cormorant (*Phalacrocorax carbo*) [A017] Tufted Duck (*Aythya fuligula*) [A061] Goldeneye (*Bucephala clangula*) [A067] Common Tern (*Sterna hirundo*) [A193] Wetland and Waterbirds [A999]	International	15.07	**Hydrological & Hydrogeological** There is hydrological connectivity between Lough Derg (Shannon) SPA and the Project site via the Rapemills River and River Shannon. The SPA is within a different groundwater body to the project site, and at a considerable distance from the Project site. Therefore, there is no hydrogeological connectivity. **Ecological** Cormorant was recorded during flight activity surveys with a peak count of two birds. Therefore, there is a potential ecological connection for these species.
River Suck Callows SPA	004097	Whooper Swan (*Cygnus cygnus*) [A038] Wigeon (*Anas penelope*) [A050] Golden Plover (*Pluvialis apricaria*) [A140] Lapwing (*Vanellus vanellus*) [A142] Greenland White-	International	17.11	**Hydrological & Hydrogeological** River Suck Callows SPA is within a different groundwater body as the project and at a considerable distance from the Project site for hydrogeological links. A study of the water courses revealed no hydrological connectivity as the SPA is situated upstream of the nearest potentially connected water course. **Ecological** Whooper swan, golden plover, wigeon and lapwing were recorded during flight activity surveys. Therefore, there is a potential ecological

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		fronted Goose (*Anser albifrons flavirostris*) [A395] Wetland and Waterbirds [A999]			connections for these species In addition, lapwing was recorded breeding within 500 m of the Project site. Therefore, there is a potential ecological connection for this species. Wigeon and Greenland white-fronted goose were not recorded during the baseline ornithological study. Therefore, there is no ecological connection for these species.
Ramsar Sites					
Slieve Bloom Mountains Ramsar Site	335	Transitional elements between raised and blanket bogs. Substantial areas of conifer plantation surround the Site. One of Ireland's most important sites for the rare breeding Hen Harrier, and indeed, is the most easterly regular population. It also supports a range of other breeding bird, insects and mammals along with frog, lizard and smooth newt.	International	15.65	**Hydrological and Hydrogeological** The Ramsar site is within a different groundwater body as the Project and thus there is no hydrogeological link. A study of the water courses revealed no hydrological connectivity. Furthermore, blanket bog and upland wet heath are usually rainwater fed. **Ecological** No ecological connectivity to the habitats for which the site is designated. A total of four hen harrier flight lines were recorded during flight activity surveys. No breeding or wintering hen harriers were observed within the survey area. Therefore, there is potential ecological connectivity for this species.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
Mongan Bog Ramsar Site	416	Raised bog. *Rhynchosporion* habitat. Several rare invertebrate species are known to occur on the bog. Breeding birds include Snipe and Curlew and historically the site was used by a wintering flock of Greenland White-fronted Geese.		19.44	**Hydrological and Hydrogeological** Raised bogs are typically rainwater fed, and so are not usually dependent on surface or groundwater from elsewhere. It is within a different groundwater body as the project and at a considerable distance from the project site for hydrogeological links. A study of the water courses revealed no hydrological connectivity as the SAC is situated upstream of the nearest potentially connected water course. **Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway.

Table 5.5: European Sites

5.3.1.2 National Sites

The rationale for identifying ecological connectivity to SACs, cSACs and SPAs has also been extended to NHAs and pNHAs. Sites beyond 20 km were also considered if there was hydrological or ecological connectivity.

There are 64 no. nationally designated sites within 20km of the project (i.e. 14 no. NHAs, and 50 no. pNHAs). Part of the grid connection overlaps with the boundary of Ross and Glenns Eskers pNHA along the existing road network. These are presented in **Figure 5.2**.

There are 18 no. pNHAs within 20 km of the project that overlap with European sites and for which no site synopsis is available. As such, there is no information available to inform an impact assessment for these sites. Therefore, the European site designation supersedes that of the pNHA, and effects on these have been assessed in the NIS and are not considered in the current chapter. A summary of these pNHAs, the European site with which they overlap, and the Source – Pathway – Receptor (SPR) identified in the NIS is presented in **Table 5.6** below.

Nationally Designated Site	Distance (km) of pNHA from Project	Overlapping European Site	Source – Pathway – Receptor as identified in the NIS
Ridge Road, SW Of Rapemills pNHA (000919)	0.27	Ridge Road, SW Of Rapemills SAC (000919)	Due to the proximity of the SAC to the Project Site, pollution, such as dust generated during construction and vehicle emissions, may impact upon the habitat.
Dovegrove Callows pNHA (000010)	0.53	Dovegrove Callows SPA (004137)	Due to the proximity of the grid connection to this SPA, the construction of the grid connection may cause disturbance and/or displacement of Greenland white-fronted geese.
All Saints Bog And Esker pNHA (000566)	2.23	All Saints Bog SPA (004103)	The Greenland white-fronted goose population at Dovegrove Callows SPA, for which a potential pathway for disturbance/displacement has been identified, has also been recorded utilising this SPA. Therefore, an effect on Dovegrove Callows SPA also affects this SPA.
Ballyduff/Clonfinane Bog pNHA (000641)	5.29	Ballyduff/Clonfinane Bog (000641)	No hydrological, hydrogeological, or ecological connectivity.
River Shannon Callows pNHA (000216)	6.24	River Shannon Callows SAC (000216)	Hydrological connectivity via Rapemills river. Ecological connectivity via otter

Nationally Designated Site	Distance (km) of pNHA from Project	Overlapping European Site	Source – Pathway – Receptor as identified in the NIS
		Middle Shannon Callows SPA (004096)	Hydrological connectivity via Rapemills river. Ecological connectivity via Whooper swan, wigeon, golden plover, lapwing and black-headed gull.
Redwood Bog pNHA (000654)	7.84	Redwood Bog SAC (002353)	No hydrological, hydrogeological, or ecological connectivity.
Sharavogue Bog pNHA (000585)	7.95	Sharavogue Bog (000585)	No hydrological, hydrogeological, or ecological connectivity.
Kilcarren-Firville Bog pNHA	9.27	Kilcarren-Firville Bog SAC (000647)	No hydrological, hydrogeological, or ecological connectivity.
Liskeenan Fen pNHA (001683)	12.03	Liskeenan Fen SAC (001683)	No hydrological, hydrogeological, or ecological connectivity.
Moyclare Bog pNHA (000581)	12.33	Moyclare Bog SAC (000581)	No hydrological, hydrogeological, or ecological connectivity.
Slieve Bloom Mountains pNHA (000412)	13.92	Slieve Bloom Mountains SAC (000412)	No hydrological, hydrogeological, or ecological connectivity.
		Slieve Bloom Mountains SPA (004160)	Ecological connectivity via hen harrier (operational stage risk to commuting birds)
Ferbane Bog pNHA	14.47	Ferbane Bog SAC (000575)	No hydrological, hydrogeological, or ecological connectivity.
Lough Derg NHA (000011)	14.96	Lough Derg, North-east Shore SAC(002241)	Hydrological connectivity via Rapemills river.
		Lough Derg (Shannon) SPA (004058)	Hydrological connectivity via Rapemills river. Ecological connectivity for cormorant.
Clonaslee Eskers And Derry Bog pNHA (000859)	15.33	Clonaslee Eskers and Derry Bog SAC (000859)	No hydrological, hydrogeological, or ecological connectivity.
Fin Lough (Offaly) pNHA (000576)	18.05	Fin Lough (Offaly) SAC (000576)	No hydrological, hydrogeological, or ecological connectivity.
Clorhane Wood pNHA (000894)	18.37	River Shannon Callows SAC (000216)	Hydrological connectivity via Rapemills river. Ecological connectivity via otter
		Middle Shannon Callows SPA (004096)	Hydrological connectivity via Rapemills river. Ecological connectivity via Whooper swan, wigeon, golden plover, lapwing and black-headed gull.
Mongan Bog pNHA (000580)	19.42	Mongan Bog SAC (000580)	No hydrological, hydrogeological, or

Nationally Designated Site	Distance (km) of pNHA from Project	Overlapping European Site	Source – Pathway – Receptor as identified in the NIS
			ecological connectivity.
		Mongan Bog SPA (004017)	No hydrological, hydrogeological, or ecological connectivity.
Ardgraigue Bog pNHA (001224)	19.64	Ardgraigue Bog SAC (002356)	No hydrological, hydrogeological, or ecological connectivity.

Table 5.6: Nationally Designated Sites Which Overlap with European Sites

For all of the sites presented in **Table 5.6** the NIS concluded With the identified mitigation measures in place, it can be concluded "*with the identified mitigation measures in place, it can be concluded, beyond all reasonable scientific doubt that the Project, either alone or in combination with other plans or projects will not undermine the conservation objectives of any European sites. It can therefore be concluded that the Project would not have an adverse effect on the integrity of any European site*". As such, the same conclusion is assumed for these pNHAs.

Table 5.7 provides a list of the designated sites and identifies any source-receptor pathways. These can be considered within the ZoI. Qualifying interests with connectivity to the project are highlighted in bold. None of the NHAs or pNHAs described in **Table 5.7** are nature reserves.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
NHAs					
River Little Brosna Callows NHA	000564	Peatlands Birds	National	1.65	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. The project site could be used by the wintering waterfowl for which the NHA is designated. Due to the proximity to the grid connection, there could be a pathway for dust pollution by air. **Hydrological** There is no hydrological connection between this NHA and the project site.
Killeen Bog NHA	000648	Peatlands	National	4.14	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
Arragh More Bog NHA	000640	Peatlands	National	8.20	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
Lorrha Bog NHA	001684	Peatlands	National	10.23	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
Kilnaborris Bog NHA	000284	Peatlands	National	10.32	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
					designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
Ballymacegan Bog NHA	000642	Peatlands	National	11.23	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
Cangort Bog NHA	000890	Peatlands	National	13.25	**Ecological** There is no ecological connection between the project Sste and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the Project Site.
Meeneen Bog NHA	000310	Peatlands	National	13.34	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
Scohaboy Bog NHA	000937	Peatlands	National	16.93	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
Suck River Callows NHA	000222	Peatlands Birds	National	17.11	This is considered under the River Suck Callows SPA. There is no hydrological or hydrogeological

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
					connection between the project site and the peatlands for which the NHA is designated. The ecological connectivity to the birds for which the NHA are designated are considered under the River Suck Callows SPA in the NIS.
Capira/Derrew Bog NHA	001240	Peatlands	National	18.2	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
Moorfield Bog NHA	001303	Peatlands	National	18.4	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
Monaincha Bog/Ballaghmore Bog NHA	000652	Peatlands	National	19.58	**Ecological** There is no ecological connection between the project site and the peatlands for which this NHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.
pNHAs					
Ross And Glenns Eskers pNHA	000920	Gravel esker ridge grading into a cutaway bog of good peat depth. Esker colonised by undisturbed hazel scrub, yew and white willow. Buckthorn *Rhamnus catharticus,* and bee orchid	National	0.00	**Ecological** Due to the proximity to the grid connection, there could be a pathway for dust pollution by air. **Hydrological** Surface run-off during installation of the grid connection could enter the pNHA.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		ophrys apifera also present. Marsh helleborine present on the cutaway bog.			
Woodville Woods pNHA	000927	Estate woodland with peripheral lake/wetland. Harbours wetland species, and considerable numbers of Snipe.	National	0.02	**Ecological** Common snipe was recorded within the project site. As such, there is a potential ecological connection. Due to the proximity to the grid connection, there could be a pathway for dust pollution by air. **Hydrological** There is no hydrological connection between the project site and this pNHA.
Ridge Road, SW Of Rapemills pNHA	000919	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	0.27	See **Table 5.6**
Dovegrove Callows pNHA	000010	There is no site synopsis available for this pNHA. However, it overlaps with the SPA of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	0.53	See **Table 5.6**
Lough Coura pNHA	000909	In-filled lake transitioned to dry fen. Dominated by purple moorgrass with scarcer plants recorded, including .	National	1.11	**Ecological** There is no ecological connection between the project site and the qualifying interests for which this pNHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
All Saints Bog and Esker pNHA	000566	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	2.23	See **Table 5.6**
Birr (Domestic Dwelling No. 2, Occupied) pNHA	000568	A nursery site for over 200 Leisler's bats *Nyctalus leisleri*	National	2.97	**Ecological** The project site lies within the core sustenance zone for this roost population (i.e. 3km). **Hydrological** Not applicable as the pNHA is a dwelling.
Birr (Domestic Dwelling No.1, Occupied) pNHA	000569	A nursery site for Leisler's bats.	National	3.02	**Ecological** The project site lies within the core sustenance zone for this roost population (i.e. 3km). **Hydrological** Not applicable as the pNHA is a dwelling.
Bracken's Dwelling, Near Whiteford pNHA	002058	A nursery roost for Leisler's bats.	National	3.86	**Ecological** No. The project site is outside the core sustenance zone for this species at this site (i.e. 3km). **Hydrological** Not applicable as the pNHA is a dwelling.
Ballyduff/Clonfinane Bog pNHA	000641	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	5.29	See **Table 5.6**
Banagher (Domestic Dwelling, Occupied) pNHA	000567	Summer and possibly winter roost of the Brown Long-eared Bat Plecotus auritus	National	5.84	**Ecological** No. The project site is outside the core sustenance zone for this species (i.e. 3km). **Hydrological** Not applicable as the pNHA is a dwelling.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
River Shannon Callows pNHA	000216	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	6.24	See **Table 5.6**
Cloghanbeg pNHA	002059	A nursery roost for a colony of Leisler's Bat	National	6.98	**Ecological** The project site is outside the core sustenance zone for this species (i.e. 3km). **Hydrological** Not applicable as the pNHA is a dwelling.
Redwood Bog pNHA	000654	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	7.84	See **Table 5.6**
Sharavogue Bog pNHA	000585	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	7.95	See **Table 5.6**
Derrykeel Meadows pNHA	000897	Wet meadows with a stream running through. Stream has a gravel base and lime on top.	National	8.30	**Ecological** There is no ecological connection between the project site and the habitats or flora for which this pNHA is designated. **Hydrological** There is no hydrological connection between this NHA and the project site.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
Grand Canal pNHA	002104	Otter, Smooth newt, opposite-leaved pondweed.	National	8.66 (c. 15km in-stream distance)	**Ecological** There is a lack of ecological connection between this pNHA and the project site. **Hydrological** There is a lack of hydrological connection between this pNHA and the project site.
Kilcarren-Firville Bog pNHA	000647	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	9.27	See **Table 5.6**
Lough Boora pNHA	001365	Drained lake surrounded by bog. Lake contains shallow fen peat with calcareous shell-marsh. Mixture of fen and bog species.	National	9.79	**Ecological** There is a lack of ecological connection between the project site and the habitats for which this pNHA is designated. **Hydrological** There is a lack of hydrological connection between this pNHA and the project site.
Kinnitty (Domestic Dwelling, Occupied) pNHA	000579	Summer roost for Leisler's bat.	National	10.25	**Ecological** No. The project site is outside the core sustenance zone for this species (i.e. 3km). **Hydrological** There is a lack of hydrological connection between this pNHA and the project site.
Liskeenan Fen pNHA	001683	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	12.03	See **Table 5.6**
Moyclare Bog pNHA	000581	There is no site synopsis	National	12.33	See **Table 5.6**

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.			
Friar's Lough pNHA	000933	Small lake with adjacent woodland. Lake is fringed with reed-beds. Broadleaved woodland is the dominant habitat. Population of alder buckthorn *Frangula alnus*.	National	13.35	**Ecological** No. There is no ecological connection between the project site and the habitats for which this pNHA is designated. **Hydrological** There is a lack of hydrological connection between this pNHA and the project site.
Fiagh Bog pNHA	000932	Calcium-rich fen, and lowland raised bog. Black bog-rush, and calpylium stellatum. *Vertigo geyeri* also recorded.	National	13.60	**Ecological** No. There is no ecological connection between the project site and the habitats or species for which this pNHA is designated. **Hydrological** There is a lack of hydrological connection between this pNHA and the project site.
Camcor Wood pNHA	000889	Woodland with wet marshy areas. Wet woodland species present, including oak, ash, hazel, willow. Native bluebell also present.	National	13.79	**Ecological** No. There is no ecological connection between the project site and the habitats or species for which this pNHA is designated. **Hydrological** There is a lack of hydrological connection between this pNHA and the project site.
Slieve Bloom Mountains pNHA	000412	There is no site synopsis available for this pNHA. However, it overlaps with the SAC and SPA of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	13.92	See **Table 5.6**

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
Lough Nahinch (Tipperary) pNHA	000936	Common redshank *Tringa tetanus* Common snipe Water rail Rallus arquaticus	National	13.95	**Ecological** Snipe recorded during bird surveys. Therefore, there is a potential ecological connection between the project site and this pNHA. **Hydrological** Furthermore, the pNHA is within a different groundwater body as the project site and thus there is no hydrogeological link. A study of the water courses revealed no hydrological connectivity.
Clonfert Cathedral pNHA	000244	Large colony of brown long-eared bats.	National	14.32	**Ecological** No. The project site is outside the core sustenance zone for this species (i.e. 3km). **Hydrological** There is a lack of hydrological connection between this pNHA and the project site.
Ferbane Bog pNHA	000575	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	14.47	See **Table 5.6**
Lough Derg pNHA	000011	There is no site synopsis available for this pNHA. However, it overlaps with the Lough Derg, north-east shore SAC. As such, it is assumed the pNHA is designated for the same interests.	National	14.96	See **Table 5.6**
Drumakeenan, Eagle Hill And Perry's Mill pNHA	000900	Blue moor-grass *Sesleria caerulea*. Nettle-leaved bellflower *Campanula trachelium*	National	15.01	**Ecological** No ecological connectivity as the designated features are habitats and flora. Therefore, no pathway. **Hydrological and Hydrogeological**

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
					There is a lack of hydrological connectivity between the project site and this pNHA.
Golden Grove Woods pNHA	000903	Beech plantation edged with natural woodland.	National	15.08	**Ecological** No ecological connectivity as the designated features are habitats and flora. Therefore, no pathway. **Hydrological and Hydrogeological** There is a lack of hydrological connectivity between the project site and this pNHA.
Clonaslee Eskers And Derry Bog pNHA	000859	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	15.33	See **Table 5.6**
Spring Park Wetlands pNHA	000941	Two small wetlands separated by agricultural land. Extensive reed beds and turlough-like waterbody with little or no emergent vegetation.	National	15.83	**Ecological** No ecological connectivity. **Hydrological and Hydrogeological** There is a lack of hydrological connectivity between the project site and this pNHA.
Clonlyon Glebe Bog pNHA	000893	Domed bog	National	15.91	**Ecological** No ecological connectivity as the designated features are habitats. Therefore, no pathway. **Hydrological and Hydrogeological** There is a lack of hydrological connectivity between the project site and this pNHA.
Mount St.Joseph Woods pNHA	000913	Esker woodland, much of which has been felled and modified.	National	16.05	**Ecological** No ecological connectivity as the designated features are habitats and flora. Therefore, no pathway. **Hydrological and Hydrogeological** There is a lack of hydrological connectivity between

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
					the project site and this pNHA.
Drumakeenan National School pNHA	002064	Large colony of brown long-eared bat.	National	16.07	**Ecological** No. This pNHA is outside the core sustenance zone for this species (i.e. 3km). **Hydrological and Hydrogeological** There is a lack of hydrological connection between this pNHA and the project site.
St. Joseph's, Mountheaton pNHA	002063	Colony of brown long-eared bat.	National	16.88	**Ecological** No. The project site is outside the core sustenance zone for this species (i.e. 3km). **Hydrological** There is a lack of hydrological connection between this pNHA and the project site.
Kilcormac Esker pNHA	000906	Esker ridge supporting woodland.	National	17.09	**Ecological** No ecological connectivity as the designated features are habitats and flora. Therefore, no pathway. **Hydrological and Hydrogeological** There is a lack of hydrological connectivity between the project site and this pNHA.
Miltown, Shinrone pNHA	002065	Winter roost for Natterer's bat *Myotis nattereri*	National	17.11	**Ecological** No. The project site is outside the core sustenance zone for this species (i.e. 4km). **Hydrological and Hydrogeological** There is a lack of hydrological connection between this pNHA and the Project Site.
Fin Lough (Offaly) pNHA	000576	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	18.05	See **Table 5.6**

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
Clorhane Wood pNHA	000894	There is no site synopsis available for this pNHA. However, it overlaps with the River Shannon Callows SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	18.37	See **Table 5.6**
Lough Nanag Esker pNHA	000910	Esker, and acid peatland lake and wetland.	National	18.69	**Ecological** No ecological connectivity as the designated features are habitats and flora. Therefore, no pathway. **Hydrological and Hydrogeological** There is a lack of hydrological connectivity between the project site and this pNHA.
Clonfinlough Esker pNHA	000892	Long ridge of glacial till which supports species-rich vegetation.	National	18.80	**Ecological** No ecological connectivity as the designated features are habitats and flora. Therefore, no pathway. **Hydrological and Hydrogeological** There is a lack of hydrological connectivity between the project site and this pNHA.
Roscrea Bog pNHA	000583	A fen developed on poorly drained glacial drift over limestone and shales. Vertigo genesii, Agriolimax laevis, Snipe and Curlew.	National	18.82	**Ecological** Although snipe was recorded during surveys, the foraging distance for the species is thought to be <500m. As such, the pNHA is outside this foraging range. **Hydrological and Hydrogeological** There is a lack of hydrological connectivity between the project site and this pNHA.
Pallas Lough pNHA	000916	Mallard Eurasian teal Eurasian wigeon Western marsh harrier *Circus*	National	19.37	Mallard, teal and wigeon all recorded during surveys. Potential ecological connection.

Site Name	Code	Qualifying Interests	Value	Distance (km) from Proposed Project	Connectivity
		aeruginosus			
Mongan Bog pNHA	000580	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	19.42	See **Table 5.6**
Ardgraigue Bog pNHA	001224	There is no site synopsis available for this pNHA. However, it overlaps with the SAC of the same name. As such, it is assumed the pNHA is designated for the same interests.	National	19.64	See **Table 5.6**

Table 5.7: Nationally Designated Sites

5.3.2 Habitats & Flora

5.3.2.1 Desktop Study

There are no previously mapped Annex I habitats (GeoHive, 2023) present within the project site.

There is an area of bog woodland (non-Annex I) south of T2 within the project site.

Habitat contribution to ecological networks has been assessed by Parker et al. (2016). Those areas that contribute most to ecological networks (i.e. those that contribute to three ecological networks) are considered to have the highest biodiversity value. The lands in the southwest, east, and northwest contribute to three ecological networks. The other areas, bar the centre and southeast, contribute to two ecological networks. The centre and southeast contribute to one ecological network. Thus, most of the land at the project site (excluding grid connection) has an intermediate biodiversity value in this regard.

Records of seven species of rare and/or protected flora were yielded from the data search.

5.3.2.2 Field Survey

No rare or protected flora were recorded within the study area during surveys.

The following describes the habitats recorded within the project site (including grid connection). These are also presented in **Figures 5.3 - 5.5** and **Table 5.8**.

(Mixed) broadleaved Woodland (WD1)

(Mixed) broadleaved woodland occupies almost a third of the western section of the project site. It is comprised of a mixture of broadleaved woodland and conifer plantation. The broadleaved component is dominated by Scots pine *Pinus sylvestris*, and downy birch *Betula pubescens*. Sitka spruce *Picea sitchensis* is planted throughout and dominates the western section of this habitat.

Amenity Grassland (GA2)

This habitat is present adjacent to the proposed grid connection, within Birr Golf Course. The dominant species present was annual meadow grass *Poa annua*.

Bog Woodland (WN7)

Bog Woodland is dominated by downy birch, with rowan *Sorbus aucuparia* and Scot's pine also abundant. Holly *Ilex aquifolium* and hazel *Corylus avellana* are present occasionally. The shrub layer is dominated by bracken *Pteridium aquilinum* and bramble *Rubus fruticosus* agg. The ground layer is dominated by ling heather *Calluna vulgaris*, bilberry *Vaccinium myrtillus*, and bramble, with purple moor-grass *Molinia caerulea* present frequently. Mosses, dominated by *Sphagnum* sp. are most present along the edges of drains at the periphery of this habitat.

To determine if this habitat corresponds with Annex I habitat [91D0] *Bog woodland, an Annex I habitat survey was carried out. However, the results indicated this did not correspond with the Annex I habitat. The full species list recorded for the Annex I survey are presented in **Annex 5.5**.

Buildings and Artificial Surfaces (BL3)

There are farm buildings and concrete paving in a number of locations in the project site. The majority of the grid connection route will be confined to the existing road network which also comprises this habitat type.

Conifer Plantation (WD4)

Conifer Plantation is dominated sitka spruce. The plantation is grown on peat. However, the lower layers of vegetation within the plantation is sparse and comprised of wood sorrel and *Polytrichum commune* where present.

Cutover Bog (PB4)

The northern section of the project site is dominated by cutover bog. This is comprised of exposed, cut peat with drains running at regular intervals throughout.

Cutover bog x Recently-felled woodland (PB4 x WS5)

In the south and centre of the project site are two sections of recently-felled woodland on cutover bog. There is little vegetation present, with brash throughout the areas.

Cutover bog x Scrub (PB4 x WS1)

Scrub growing on cutover bog is present at the north-east of the project site, and the south. The dominant species present here is bramble, with gorse *Ulex europaeus abundant* also.

Dense bracken (HD1)

At the centre of the site, east of T4, is an area of dense bracken. This is present on the periphery of an agricultural field, adjacent to woodland.

Depositing/Lowland Rivers FW2

The Rapemills river runs east-west through the project site. Within the project site, eastern sections of the river are heavily poached by livestock. These sections also presented lower diversity of in-stream vegetation (dominated by algal growth) and invertebrate species (based on visual survey; Q sampling detailed in **Annex 5.4**). Livestock are excluded from the western section of the river due to more secure fencing. These sections also presented greater levels of diversity compared to the eastern sections (based on visual survey). Plant species present include bullrush *Typha latifolia*, common reed *Phragmites australis*, and water-cress *Nasturtium officinale,* with meadowsweet along the verge. There was also high levels of lepidoptera, damselflies, and dragonflies. These are detailed under **Section 5.3.7.2**.

Drainage ditch (FW4)

Drainage ditches are present throughout the project site.

Dry meadows and Grassy Verges (GS2)

Dry meadows and grassy verges is widespread throughout the project, primarily as grassy verges along paths and roads. The dominant species recorded include sweet vernal-grass *Anthoxanthum odoratum*, bush vetch *Vicia sepium*, hedge bindweed *Calystegia sepium*, cocksfoot *Dactylis glomerata*, lesser hawkbit *Leontodon saxatilis*,

cats ear *Hypochaeris radicata*, silverweed *Potentilla anserina*, cleavers *Galium aparine*, Timothy *Phleum pratense*, rosebay willowherb *Chamaenerion angustifolium*, and herb Robert *Geranium robertanium*. Other species recorded occasionally include bracken, meadowsweet *Filipendula ulmaria*, bramble, knapweed *Centaurea* sp., columbine *Aquilegia* sp, mallow *Malva* sp., teasle *Dispsacus fullonum*, burdock *Arctium* sp, Angelica *Angelica sylvestris*, spear thistle *Cirsium vulgare*, St John's wort *Hypericum* sp., mint *Mentha* sp., and horsetail *Equisetum arvense*.

Hedgerow (WL1)

This habitat is present throughout the project, primarily along field boundaries and along roads. The dominant species were hawthorn *Craetagus monogyna* and blackthorn *Prunus spinosa*. Other species recorded include willow *Salix* sp., oak *Quercus* sp., alder *Alunus glutinosa*, downy birch, and a single lodgepole pine *Pinus contorta*.

Hedgerow x Treeline (WL1 x WL2)

This habitat is present throughout the project and adjacent to the grid connection. The dominant species were hawthorn and blackthorn, with ash *Fraxinus excelsior* the dominant mature tree species.

Hedgerow x Treeline x Dense bracken (WL1 x WL2 x HD1)

Growing in a linear arrangement, this habitat comprises a matrix of these three habitat types.

Hedgerow x Treeline x Dry Meadows and Grassy Verges (WL1 x WL2 x GS2)

Growing in a linear arrangement, this habitat comprises a matrix of these three habitat types.

Improved Agricultural Grassland (GA1)

Improved agricultural grassland is one of the dominant habitats within the project site. These are highly-modified habitats and species-poor.

The dominant species present is *Lolium perrene*, with annual meadow grass *Poa annua*, and mouse ear *Cerastium fontanum* also abundant. Daisy *Bellis perennis* and dandelion *Taraxacum officinale* agg. were also recorded frequently throughout this habitat.

Improved Agricultural Grassland x Cutover Bog (GA1 x PB4)

In the north-west of the project site, there is an area of improved agricultural grassland established on cutover bog. The species present correspond with those described above for Improved Agricultural Grassland. However, angelica, and soft rush *Juncus effusus* are present occasionally due to the underlying peat and proximity to the Rapemills river.

Improved agricultural grassland x Dense bracken (GA1 x HD1)

Firebreaks through the missed broadleaved/conifer woodland (WD2) are comprised of improved agricultural grassland (GA1) with dense bracken throughout.

Improved Agricultural Grassland x Scrub (GA1 x WS1)

There are two areas within the project site comprised of scattered scrub growing on improved agricultural grassland. This is dominated by gorse, with bramble abundant, and occasional bracken.

Mixed Broadleaved/Conifer Woodland (WD2)

Mixed broadleaved/conifer woodland dominates the western portion of the project site. The conifer species present are Sitka spruce, Scot's pine with occasional lodge pole pine. Downy birch is the dominant broadleaved species present, with willow, ash and oak also present in lower densities.

The understorey is species poor, with bramble and bracken the dominant species present.

Recolonising Bare Ground (ED3)

There are agricultural access tracks throughout the site comprised of recolonising bare ground. The only vegetation present grows along the centre of the tracks and is comprised primarily of annual meadow grass *Poa annua*, yarrow *Achillea millefolium*, and daisy.

Scattered trees and Parkland (WD5)

There is an area of scattered trees south of Rapemills river. This is growing on improved agricultural grassland with downy birch the dominant species.

Scrub (WS1)

There are stands of scrub to the south of the site dominated by gorse with abundant bramble also present.

Scrub x Hedgerow (WS1 x WL1)

Growing in a linear arrangement, this is a matrix of these two habitat types.

Scrub x Immature Woodland (WS1 x WS2)

Growing in a linear arrangement, this is a matrix of these two habitat types. The immature woodland comprises goat willow *Salix caprea*.

Spoil and Bare Ground (ED2)

There are agricultural access tracks comprised of bare ground.

Stone Walls and Other Stonework (BL1)

Adjacent to the grid connection, there are stone walls in front of residential dwellings.

Treeline (WL2)

This habitat is present along the existing N52 and within the southern section of the site. The dominant species present are hawthorn, goat willow, oak, and ash.

Wet Grassland (GS4)

Wet grassland is present north of T2, south of and areas adjacent to Rapemills river.

This is dominated by meadowsweet. The western section also contains yellow flag iris *Iris pseudacorus*.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)			Occurrence within Proposed Project
			Main Project Site	Grid Connection	Total	
WD1	(Mixed) broadleaved woodland	No	1.03 ha	0.03ha	1.06 ha	Within project site, and adjacent to the grid connection.
GA2	Amenity grassland	No	0	0.14ha	0.14ha	Adjacent to the grid connection within golf club.
WN7	Bog Woodland	No	17.10 ha	0.11ha	17.21 ha	In the south-western section of the project site, and adjacent to the grid connection.
BL3	Buildings and artificial surfaces	No	2.78 ha	0.17ha	2.97ha	Within project site as tracks and ground-surfacing around buildings, and along the grid connection (i.e. the existing road network).
			58.50m	4970.13m	5,028.63m	
WD4	Conifer Plantation	No	37.09 ha	0.45ha	37.54 ha	Within project site, and adjacent to the grid connection.
PB4	Cutover Bog	No	30.31 ha	0	30.31 ha	Within project site.
PB4 x WS5	Cutover Bog x Recently-Felled Woodland	No	6.73 ha	0	6.73 ha	Within the eastern section of the project site.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)			Occurrence within Proposed Project
			Main Project Site	Grid Connection	Total	
PB4 x WS1	Cutover Bog x Scrub	No	0.57 ha	0	0.57 ha	Within the eastern section of the project site.
HD1	Dense bracken	No	1.41 ha	0	1.41 ha	Within project site.
			261.26m	0	261.26m	
FW2	Depositing lowland river	No	3359.95m	0	3359.95m	Runs through project site.
FL4	Drainage Ditch	No	11914.54m	0	11914.54m	Within project site.
GS2	Dry meadows and grassy verges	No	0.03 ha	0.08ha	0.11ha	Within project site, and adjacent to the grid connection.
			0	1364.02m	1364.02m	
WL1	Hedgerow	No	3186.82m	6175.64m	9,362.46m	Within project site, and adjacent to the grid connection.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)			Occurrence within Proposed Project
			Main Project Site	Grid Connection	Total	
WL1 x WL2	Hedgerow x Treeline	No	3474.24m	2051.57m	5,525.81m	Within project site, turning area, and adjacent to and through grid connection.
WL1 x WL2 x HD1	Hedgerow x Treeline x Dense Bracken	No	210.23m	0	210.23m	Within project site.
WL1 x WL2 x GS1	Hedgerow x Treeline x Dry meadows and grassy verges	No	687.71m	67.41m	755.12m	Within project site, and adjacent to the grid connection.
GA1	Improved agricultural grassland	No	87.76 ha	6.50ha	94.26ha	Within project site, turning area, and adjacent to the grid connection.
GA1 x PB4	Improved Agricultural Grassland x Cutover Bog	No	14.95 ha	0	14.95 ha	Within project site.
GA1 x HD1	Improved agricultural grassland x Dense bracken	No	1377.80m	0	1377.80m	Within project site.
GA1 x WS1	Improved Agricultural Grassland x Scrub	No	5.90 ha	0	5.90 ha	Within project site.
WD2	Mixed broadleaved/conifer woodland	No	70.17 ha	0	70.17 ha	Within project site.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)			Occurrence within Proposed Project
			Main Project Site	Grid Connection	Total	
ED3	Recolonising bare ground	No	2.37 ha	1.06ha	3.46ha	Within project site, and adjacent to the grid connection.
WD5	Scattered trees and parkland	No	0.94 ha	0	0.94 ha	Within project site.
WS1	Scrub	No	0	0.09ha	0.09ha	Adjacent to the grid connection.
WS1 x WL1	Scrub x Hedgerow	No	0.03 ha	0	0.03 ha	Within project site.
WS1 x WS2	Scrub x Immature woodland	No	0.07 ha	0	0.07 ha	Within project site.
ED2	Spoil and bare ground	No	0.08 ha	0	0.08 ha	Within project site.
BL1	Stone walls and other stonework	No	4986.33m	20.83m	5,007.16m	Within project site, and adjacent to the grid connection.
WL2	Treeline	No	385.94m	614.15m	1,000.09m	Within project site, and adjacent to the grid connection.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)			Occurrence within Proposed Project
			Main Project Site	Grid Connection	Total	
GS4	Wet grassland	No	6.32 ha	0	6.32 ha	Within the south western section of the project site.

Table 5.8: Habitat Types Within Proposed Project Site

5.3.3 Birds

5.3.3.1 Desktop Study

BirdWatch Ireland has created a sensitivity mapping tool, which assesses the potential sensitivity of at-risk bird populations to wind energy developments (McGuinness, et al., 2015). The areas of the project site all lacked data i.e. there is no prior information to suggest that avian populations in the general area thought to be particularly sensitive to wind farm developments.

The data search yielded records of 64 no. species which are rare, declining, restricted to a few sites, or have a large proportion of the European population occurring in Ireland (breeding or wintering) (red- or amber-listed) and/or specially protected (Annex I) birds at the project site and surrounding area (see **Annex 5.6**) for details on data sources). This included opportunistic data and data collected for other purposes.

There are desktop records for 15 no. Annex I species: bar-tailed godwit *Limosa lapponica*, common kingfisher, corncrake, European golden plover, European nightjar *Caprimulgus europaeus*, great white egret, Greenland white-fronted goose, hen harrier, little egret, merlin *Falco columbarius*, peregrine falcon, ruff *Philomachus pugnax*, short-eared owl *Asio flammeus*, spotted crake *Porzana porzana* and whooper swan.

In addition, there are desktop records for 21 no. red-listed species: barn owl, black-tailed godwit *Limosa limosa*, common kestrel, common pochard *Aythya farina*, common quail *Coturnix coturnix*, common redshank *Tringa tetanus*, common snipe, common swift *Apus apus*, dunlin *Calidris alpina*, Eurasian curlew *Numenius arquata*, Eurasian woodcock, grey partridge *Perdix perdix*, grey wagtail *Motacilla cinerea*, meadow pipit *Anthus pratensis*, northern lapwing, northern shoveler *Anas clypeata*, red grouse *Lagopus lagopus*, red knot *Calidris canutus,* redwing *Turdus iliacus*, stock dove *Columba oenas*, whinchat *Saxicola rubetra* and yellowhammer *Emberiza citrinella*.

Finally, there are records for 26 no. amber-listed species: barn swallow *Hirundo rustica,* black-headed gull, common coot *Fulica atra*, common gull *Larus canus*, common linnet *Linnaria cannabina*, common sandpiper *Actitis hypoleucos*, common shelduck *Tadorna tadorna*, common starling *Sturnus vulgaris,* Eurasian teal, Eurasian wigeon, European greenfinch *Carduelis chloris*, gadwall *Anas strepera*, goldcrest *Regulus regulus*, great cormorant, great crested grebe *Podiceps cristatus*, herring gull *Larus argentatus,* house martin *Delichon urbichum*, house sparrow *Passer domestricus,* lesser black-backed gull *Larus fuscus,* mallard, mute swan *Cygnus olor*, northern pintail *Anas acuta*, sand martin *Riparia riparia*, skylark *Alauda arvensis*, spotted flycatcher *Muscipapa striata* and tufted duck *Aythya fuligula*.

Thus, there is the potential for these and other bird species to be present within or nearby the project site.

5.3.3.2 Field Survey

Flight Activity Surveys

Full details of the flight activity survey results (including figures showing flight lines for primary target species) are provided in **Annex 5.2**. The following sections present seasonal summaries of 'at risk' flight activity within the Collision Risk Zones (CRZ), defined as the areas encompassed by the relevant Wind Farm Polygon (WP) (i.e. the area within 500m of the outermost turbine blades). 'At risk' flights are defined as those crossing the relevant WP at Potential Collision Height (PCH), i.e. within each rotor-swept area (between 28m above ground level (AGL) and 200m AGL).

17 no. primary target species were recorded during flight activity surveys.

In general, there were very few 'at risk' flight events for any primary target species; the only exception was for European golden plover and northern lapwing.

Table 5.9 summarises the cumulative numbers of birds recorded passing through the CRZ during baseline surveys undertaken during May 2020 to March 2023 inclusive, and those potentially at risk of turbine collision.

Species Name	Period of Analysis (Season)	Peak Count	Cumulative Number of Flight Lines and Flights within WP at PCH	
			Flight Lines	Flights
Black-headed gull	Breeding 2021	14	21	36
	Non-breeding 2021/22	46	4	56
	Breeding 2022	34	73	134
	Non-breeding 2022/23	23	3	32
Common kestrel	Breeding 2021	1	4	4
	Non-breeding 2021/22	1	19	19
	Breeding 2022	1	20	20
	Non-breeding 2022/23	2	19	19
Common snipe	Breeding 2021	1	0 (not within the PCH)	0 (not within the PCH)
	Non-breeding 2021/22	7	1	7
	Breeding 2022	2	22	30
	Non-breeding 2022/23	2	3	3
Eurasian teal	Non-breeding 2022/23	42	1	42
Eurasian wigeon	Non-breeding 2022/23	13	1	13
European golden plover	Breeding 2021	5	1	5
	Non-breeding 2021/22	2,000	2	2,042
	Non-breeding 2022/23	3,500	13	4,479
Great cormorant	Non-breeding 2022/23	1	9	9
Great white egret	Non-breeding 2022/23	1	0 (not within the PCH)	0 (not within the PCH)
Greylag goose	Non-breeding 2022/23	3	1	3

Species Name	Period of Analysis (Season)	Peak Count	Cumulative Number of Flight Lines and Flights within WP at PCH	
			Flight Lines	Flights
Hen Harrier	Non-breeding 2020/21	1	2	2
	Non-breeding 2021/22	1	2	2
	Non-breeding 2022/23	1	3	3
Little egret	Non-breeding 2022/23	2	3	5
Mallard	Non-breeding 2022/23	5	3	7
Merlin	Non-breeding 2022/23	1	1	1
Northern lapwing	Breeding 2020	1	2	2
	Non-breeding 2020/21	13	1	13
	Breeding 2021	4	14	26
	Non-breeding 2021/22	27	2	28
	Breeding 2022	13	10	36
	Non-breeding 2022/23	250	24	635
Peregrine falcon	Non-breeding 2021/22	1	4	4
	Breeding 2022	1	0 (not within the PCH)	0 (not within the PCH)
	Non-breeding 2022/23	1	1	1
Ringed plover	Breeding 2022	3	1	2
Whooper swan	Non-breeding 2020/21	8	0 (not within the PCH)	0 (not within the PCH)
	Non-breeding 2021/22	12	2	16
	Non-breeding 2022/23	9	3	18

Table 5.9: Summary of 'At Risk' Flights of Primary Target Species by Season

Breeding Wader Surveys

The results of the 2020, 2021 and 2023 breeding wader surveys are summarised below:-

- 2020: no breeding waders recorded;
- 2021: non-breeding common snipe recorded and confirmed breeding (one adult and two chicks), northern lapwing recorded c. 410m from turbine T8); and,
- 2022: non-breeding common snipe and Eurasian curlew recorded (peak count of two curlew), and probable northern lapwing breeding territory recorded in same location as in 2021.

Breeding Raptor Surveys

The results of the 2020, 2021 and 2023 breeding raptor surveys are summarised below:-

- 2020: common buzzard recorded with suspected nest location c. 345m west of turbine T8;

- 2021: non-breeding common kestrel and peregrine falcon recorded, and a single probable common buzzard territory was recorded c. 500m west of turbine T2; and,
- 2022: two probable common buzzard territories were recorded, non-breeding common kestrel and Eurasian sparrowhawk were recorded, and peregrine falcon were recorded probably breeding within [redacted] c. 1.3km from turbine T7.

Swan & Goose Feeding Distribution Surveys

The results of the 2020/21, 2021/22 and 2022/23 swan and goose feeding distribution surveys are summarised below:-

- 2020/21: only a single mute swan was recorded more than2km from the project;
- 2021/22: no swans or geese were recorded; and,
- 2022/23: no swans or geese were recorded.

Hen Harrier Winter Roost Surveys

No hen harrier roosts were recorded during the 2021/22 non-breeding season surveys. It was concluded that the majority of the habitat within the 2km survey buffer is of limited suitability for roosting hen harrier and that the observations recorded were of birds passing through the area.

Nocturnal Golden Plover Surveys

No golden plover was recorded foraging at night. A small flock (c. 10) northern lapwing were recorded foraging within an agricultural field c. 300m from turbine T7 on a single occasion. Eurasian curlew calls were also heard at night but nearer to the existing met mast location.

Incidental Sightings

Barn owl were recorded hunting during a bat survey in May c.500m from turbine T3 (no evidence of breeding / roosting was recorded during bat roost searches). Roding Eurasian woodcock were also recorded in the same area during the same survey. A foraging kingfisher was observed during the habitat surveys along the Rapemills River, c. 180m from turbines T2, and a sandwich tern *Sterna sandvicensis* was heard flying overhead during breeding raptor surveys in 2022.

5.3.4 Terrestrial Mammals (Excluding Bats)

5.3.4.1 Desktop Study

The data search yielded records of nine species of rare and/or protected mammals (see **Annex 5.6**) namely Eurasian badger *Meles meles*, Eurasian pygmy shrew *Sorex minutus*, Eurasian red squirrel *Sciurus vulgaris*, European otter *Lutra lutra*, fallow deer *Dama dama*, pine marten *Martes martes*, red deer *Cervus elaphus*, sika deer *Cervus nippon*, west European hedgehog *Erinaceus europaeus*. There is the potential for these species to be present within the project site.

There are also records of four species of invasive or non-native mammals: American mink *Mustela vison*, brown rat *Rattus norvegicus*, eastern grey squirrel *Sciurus carolinensis*, European rabbit *Oryctolagus cuniculus*, fallow deer *Dama dama*, house

mouse *Mus musculus*.

5.3.4.2 Field Survey

Four species of mammals (i.e. either live sightings or evidence of) were recorded during the dedicated mammal surveys (see **Figure 5.6**). A summary is provided for each species below. Note that Eurasian otter results are discussed in **Section 5.3.7.2** under aquatic ecology.

In addition, while they were not recorded by field surveys, it is likely that the following species are also present based on desktop data and the availability of suitable foraging/breeding habitats: Irish hare, pygmy shrew, and west European hedgehog.

Badger

Latrines and snuffle pits were recorded at 607156.02, 710082.78, c. 93m northeast of T4. However, no setts were recorded within 100 m of any other proposed infrastructure.

Badger droppings were also recorded at the side of the road at 605689.47, 709322.27. A suspected badger sett was recorded at [redacted], c. 32m from the grid connection (**Figure 5.7 and 5.8**). A trail camera was deployed under NPWS license no. 111/2022 (amended) for one week. No badger was captured on the trail camera. However, this was outside the most active survey period (i.e. the breeding season December-June, inclusive). Therefore, considering the secondary signs recorded in proximity, it is considered likely to be badger sett.

No other suspected setts were recorded. The woodland and hedgerow habitats present provide foraging and breeding habitats for this species.

Pine Marten

Three live pine marten (one young) was recorded 709867.73, 606241.26 scaling up and down trees during bird surveys in 2022 (c. 79m north west of T2). No dens (breeding places) were recorded within 100 m of the project. However, the woodlands provide foraging and potential breeding habitats for this species.

Red Squirrel

No evidence or live sighting of red squirrel were yielded during surveys. No dreys (breeding places) were recorded within 100 m of the project. However, the woodlands provide potential foraging and breeding habitat.

Fallow Deer

A herd of fallow deer (both adult and young) were recorded outside the project site at 709994.13, 606017.99 during habitat surveys, c. 320m northwest of T2.

5.3.5 Bats

5.3.5.1 Desktop Study

Potential Roost Feature Assessment

Online satellite images, and the Environmental Sensitivity Mapper identified a number of buildings that could be used by roosting bats within 279.35m (200m plus blade length) of the optioned lands during the desk study. These were situated c. 295m east of T8, c. 787m south-west of T6, c. 870m south of T2, c. 479m east of T4, and c. 252

south-west of T3.

Bat Landscapes

The mean bat landscapes suitability index across all bat species differs across the project site, with most of the northern half less suitable for bats than the southern half. For the northern section (T1, T3, T4, T5, T8), the score is 26.56 (out of a maximum score of 100). For the south-eastern section (T6, T7) the score is 31.67 (out of a maximum score of 100). For the south-western section (T2) the score is 39.22 (out of a maximum score of 100). A full breakdown is provided in Table 7 of the Bat Report (**Annex 5.3**) with an explanation provided below.

The area within which T1, T3, T4, T5, T8 are located has a high bat landscapes suitability index for soprano pipistrelle, brown long-eared bat, common pipistrelle, and Leisler's bat. There is moderate suitability for whiskered bat, Daubenton's bat, and Natterer's bat. The bat landscapes suitability index is classified as low for lesser horseshoe bat, and Nathuisus' pipistrelle.

The area within which T6 and T7 are located has a high bat landscapes suitability index for soprano pipistrelle, brown long-eared bat, common pipistrelle, Leisler's bat, whiskered bat, and Natterer's bat. It has a moderate bat landscapes suitability index for Daubenton's bat. The bat landscapes suitability index is classified as low for lesser horseshoe bat and Nathuisus' pipistrelle.

The area within which T2 is located has a high bat landscapes suitability index for soprano pipistrelle, brown long-eared bat, common pipistrelle, Leisler's bat, whiskered bat, Daubenton's bat and Natterer's bat. The bat landscapes suitability index is classified as low for lesser horseshoe bat, and Nathuisus' pipistrelle.

NBDC Data

NBDC has records for six bat species recorded within the 10 km grid squares (N00, N01, N10, N11) that overlaps the project site as shown in Table 8 of the Baseline Bat Report (**Annex 5.3**).

Bat Conservation Ireland Data

Bat Conservation Ireland data (confidential Appendix D and Appendix E of **Annex 5.3**) show that 12 recorded bat roosts are located within 10km from the project site. The closest roost (c. 900m west of the application boundary (proposed turning head works at the N52/N62 junction) and c. 2.3km south of T2) is a mixed-species roost for whiskered bat, and brown long-eared bat. The remaining roosts are for soprano pipistrelle (two separate roosts), Leisler's bat (five separate roosts), Daubenton's bat (two separate roosts), whiskered bat (one separate roost) and common pipistrelle (one separate roost).

Only two roosts are likely to have ecological connectivity to the project site i.e., the core sustenance zones (CSZ) as measured from the roost, overlap with the project site. Both of these are mixed species roosts. Only one of these overlaps with the (wind farm) project site (i.e. whiskered bat, brown long-eared). Of these species, only brown long-eared bat roost is likely to have ecological connectivity as the project site is within the CSZ for the species (i.e. 2km). The other roost (common pipistrelle, soprano pipistrelle, Leisler's) overlaps with the application boundary but only the proposed turning head works at the N52/N62 junction, and not the main project site.

The BCI data showed there were no roosts adjacent to the grid connection.

Eight species were recorded by transects or as ad-hoc observations: Daubenton's bat, brown long-eared bat, common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, Natterer's bat and whiskered bat.

National & Designated Sites Within 10km of the Project Site

There are 17 no. pNHAs and two NHAs within 10km of the project site. None of the NHAs are designated for bats; however, there are five pNHAs designated for bats.

There are no SACs within 10km of the Project Site that are designated for bats.

These are presented in **Table 9** and **Figure 3** of **Annex 5.3.**

Location of Project Site Relative to Bat Range Edges

The location of the project site is at the range edge (the definition of range used here is the Extent of Occurrence) for Nathusius' pipistrelle and whiskered bat. The 10km square (N01) that contains the project site is within the range of both species, but the next 10km square to the north (N01) is outside the range of Nathusius' pipistrelle. According to NS guidance, the potential for negative impact is likely to increase where there are high risk bat species on the edge of their range. This applies to Nathusius' pipistrelle (high risk) but not for whiskered bat (low risk). However, the range data comes from the latest Article 17 report. That report acknowledged that there is much uncertainty surrounding its range and could be reflective of survey effort rather than true absence.

Other Wind Energy Developments or Projects

Table 10 in **Annex 5.3** outlines wind farms have been granted planning consent located within 10km of the project site. There are two operational wind farms and one under construction within 10km of the project site. Apart from the consented wind farms named, there are no other operational or consented projects located within 10km from the project site boundary that could give rise to cumulative effects on bat populations located within the project site.

5.3.5.2 Field Survey

The results of the bat surveys are summarised below. Full details are provided in the baseline bat survey report in **Annex 5.3.**

Habitat Appraisal for Potential Bat Roost Features & Assessment of Habitat Risk

No evidence of roosting bats was observed in any of the structures surveyed. None of these buildings will be impacted by the project.

16 no. trees were classified as having low suitability and the remainder were deemed to have negligible suitability due to the absence of potential roosting features.

A map showing the locations of potential roost features and a full description of each potential roost feature is provided in **Annex 5.3**

Activity Survey – Transect Survey

5 no. species were recorded during transect surveys in 2022; common pipistrelle, soprano pipistrelle, Leisler's bat, Daubenton's bat, whiskered bat, and brown long-

eared bat. Flight lines from the 2022 surveys showed that bats used the hedgerows and woodland edges for commuting and were recorded foraging along the same.

Activity Survey – Static Detector Surveys (Ground-Level)

8 no. bat species were recorded during the ground-level automated activity surveys conducted in 2022: brown long-eared bat, common pipistrelle, Daubenton's bat, Leisler's bat, Nathusius' pipistrelle, Natterer's bat, soprano pipistrelle and whiskered bat.

Bat activity at ground-level was highest in spring (a mean of 1,553 no. bat passes per night) and lowest in autumn (a mean of 245 no. bat passes per night). The difference in activity between the highest and lowest season was 1,308 no. bat passes per night on average.

Bats were recorded at all detector locations, but generally locations T2 (woodland edge habitat) had the greatest number of bat passes per night, across all seasons. Locations T7 and T8 (grassland habitats) had the lowest number of bat passes per night across all seasons.

Bat activity was typically higher at woodland edge habitats (locations T2, T5, T6), where a mean of 575 no. bat passes per night was recorded. Grassland and woodland firebreak habitats (locations T1, T7, T8, and T4, respectively) had lower levels of activity, where a mean of 182 and 156 no. bat passes per night was recorded, respectively.

Activity Survey – Static Detector Surveys (At Height)

6 no, species were recorded during the static detector (at-height) surveys, namely Daubenton's bat, brown long-eared bat, Leisler's bat, soprano pipistrelle, common pipistrelle, and Nathuisus' pipistrelle.

Bat activity at-height was highest in round 2 survey period (a mean of 15 no. bat passes per night) and lowest in round 3 (a mean of 2 no. bat passes per night). The difference in activity between the highest and lowest season was 13 no. bat passes per night on average.

5.3.6 Other Protected Flora

5.3.6.1 Desktop Study

Records of 2 no. protected species of amphibian were yielded from the data search, namely smooth newt and common frog.

No records of common lizard *Zootoca vivipara* were yielded from the data search. However, the species can utilise a variety of habitats. As such, south-facing habitats within the project site could support common lizard.

Records of four protected invertebrate species were yielded from the data search. As such, there may be potential for these species to be present within the project site.

5.3.6.2 Field Survey

Reptiles

No reptiles were recorded during other ecological surveys.

Amphibians

Neither common frog or smooth newt were recorded during surveys. However, suitable habitat is present.

Marsh Fritillary

A marsh fritillary butterfly was recorded along the Rapemills river c. 100m north of T2 during breeding bird surveys in 2021. As such, a dedicated habitat suitability survey for marsh fritillary was undertaken 13-14th June 2022. No suitable habitat was recorded within the project site. The baseline survey report is presented in **Annex 5.8**.

Other Invertebrates

Invertebrate species recorded during surveys are listed below. Note, aquatic invertebrates recorded during Q sampling are detailed in **Annex 5.4.**

- Silver-washed fritillary *Argynnis paphia.*
- Gatekeeper butterfly *Pyronia Tithonus*
- Specked wood butterfly *Pararge aegeria*
- Meadow brown butterfly *Maniola jurtina*
- Ringlet *Aphantopus hyperantus*
- Red admiral butterfly *Vanessa atalanta*
- Common blue butterfly *Polyommatus icarus*
- Peacock butterfly *Inachis io*
- Orange tip butterfly *Anthocharis cardamines*
- Small white butterfly *Pieris rapae*
- Giant tachinid fly *Tachina grossa*
- Common Frog Hopper *Philaenus spumarius*
- Azure damselfly *Coenagrion puella*
- Common darter *Sympetrum striolatum*
- Four-spotted chaser *Libellula quadrimaculata*

5.3.7 Fisheries & Aquatic Ecology

5.3.7.1 Desktop Study

The desktop data available for fisheries and aquatic ecology is shown in full in **Annex 5.4**. A summary is provided below.

A low number of records for Annex II white-clawed crayfish were available for N00, N10, and N11.

Records for Annex II otter were widespread within the respective grid squares. However, most records were historical only (c.1980). More contemporary records (2000 onwards) were available for the Rapemills River, Silver River, Little [Cloghan] River and Blackwater [Shannonbridge] River.

A high number of records (>50) for the Flora Protection Order species opposite-leaved pondweed *Groenlandia densa* were available for back channels of the River Shannon in the vicinity of Meelick near Eyecourt, Co. Galway (grid square M91, data not shown). These records ranged from 1991 to 2021.

A low number of records for the near threatened (Wyse-Jackson et al., 2016) macrophyte tubular water-dropwort Oenanthe fistulosa were available for the River Shannon callows both north and west of Shannon Harbour and downstream of Friar's

Island (NPWS & NBDC data). The species occupies a limited Irish distribution and is found in of damp, often seasonally inundated wetland habitats (Stroh, 2015).

Common frog *Rana temporaria* records were widespread in the M91, M92, N00, N01, N02, N11 & N12 grid squares, although none overlapped with the proposed wind farm site (data not shown). A low number of contemporary records for smooth newt *Lissotriton vulgaris* were available but these also did not overlap with the Proposed Project.

5.3.7.2 Field Survey

See **Annex 5.4** of this EIAR for the full fisheries and aquatic ecology survey results and **Figure 5.8** for a drawing of where streams and rivers are located. A summary is provided below.

Habitats

The watercourses and aquatic surveys sites in the vicinity of project site are typically small, lowland depositing channels which have been historically modified for land drainage purposes (FW2; Fossitt, 2000). Predominantly, the watercourses flow over areas of Tournaisian limestone and Visean limestone & calcareous shale (Geological Survey of Ireland data). Land use practices in the wider survey area comprise mixed forests (CORINE 313), agricultural areas (CORINE 242), land principally occupied by agriculture with significant areas of natural vegetation (CORINE 243), peat bogs (CORINE 412) and pastures (CORINE 231).

Q-sampling

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from 20 no. riverine sites in August 2022.

None of the survey sites achieved target good status (≥Q4) requirements of the EU Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC).

Sites on the Little Brosna River (A3), Rapemills River (B1, B3 & B10), River Brosna (D6), Blackwater River (D7) and Silver River (E1) achieved Q3-4 (moderate status) water quality. This was given the low numbers (<5%) of group A species, such as the mayfly *Ecdyonurus dispar*, low numbers of group B species such as the mayfly *Alainites muticus* and Limnephilid cased caddis, and a dominance of group C species such as the mayflies *Baetis rhodani* and *Serratella ignita*, New Zealand mud snail *Potamopyrgus antipodarum*, freshwater shrimp *Gammarus duebeni* and blackfly *Simuliidae* larvae. Site B10 on the Rapemills River was the only site to support the group A mayfly *Ephemera danica*.

With the exception of site D1, all other sites achieved Q3 (poor status) (i.e. sites A2, B4, B5, B6, B7, B8, B9, B12, B13, C1, D5 & E2). This rating was based on an absence of group A species, low numbers of group B species (such as the caddis *Halesus radiatus* and *Potamophylax cingulatus* and the damselfly *Calopteryx splendens*), and a dominance of group C species, particularly the freshwater shrimp *Gammarus duebeni* and the non-native snail *Potamopyrgus antipodarum*. Group D species, chiefly *Asellus aquaticus*, were also common at most of these sites.

Site D1 on Grant's Island River achieved Q1 (bad status) given the macro-invertebrate

community comprised exclusively group E Chironomid and Tubificid species. However, it should be noted that due to poor flows and or an absence of suitable riffle areas for sampling, the Q-ratings for this site, in addition to sites B10 (moderate status) and sites A2, B5, B6, B12, B13, C1 (poor status), are tentative.

Macrophytes & Aquatic Bryophytes

No rare or protected macrophytes or aquatic bryophytes were recorded at the 27 no. survey sites. Similarly, no examples of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation or aquatic mosses [3260]' (aka floating river vegetation) was recorded during the surveys.

Pearl Mussels

Composite water samples collected from the from the Little Brosna River (A3) and Rapemills River (B8) returned a negative result for freshwater pearl mussel eDNA, i.e. freshwater pearl mussel eDNA not present or was present below the limit of detection in a series of 12 no. qPCR replicates (0 positive replicates out of 12 no., respectively). These results were considered as evidence of the species' absence at and or upstream of the sampling locations and support the absence of records for the species within the wider survey area.

Salmonids

Salmonids were recorded from a total of 11 no. sites, namely sites on the Little Brosna River (A3), Rapemills River (B1, B3, B4, B8 & B13), Feeghroe River (B12), Little River (D5) and the Silver River (E1 & E2). However, these populations comprised brown trout only, with the exception of sites A3 on the Little Brosna River and E2 on the Silver River which also supported low numbers of Atlantic salmon parr. This restricted distribution of Atlantic salmon in the vicinity of the project is unsurprising given widespread historical modifications in the Shannon [Lower]_SC_060, Shannon [Lower]_SC_040, Shannon [Lower]_SC_030 and Brosna_SC_080 river sub-catchments (which have evidently reduced the quality of salmonid habitat), in addition to significant downstream barriers on the River Shannon (i.e. hydro-electric dams). Other pressures within the wider survey area, such as hydromorphological modifications, eutrophication and, in particular, siltation, also reduced the quality of salmonid habitat in many watercourses in the vicinity of the proposed wind farm.

Lamprey

Lamprey ammocoetes (*Lampetra* sp., likely *L. planeri* given known catchment barriers) were recorded from a total of 8 no. sites on the Rapemills River (B1, B3 & B4), Mullaghakaraun Bog Stream (B9), Little River (D5) and the Silver River (E1 & E2) (Table 3.1, 3.2). Higher densities of ammocoetes were recorded at sites B1 (20 per m2), D5 (13.2 per m2) and D7 (11 per m2). These sites featured the deposition of fine, organic-rich sediment ≥5cm in depth; areas considered optimal for larval *Lampetra* spp. (Aronsuu & Virkkala, 2014; Goodwin et al., 2008; Gardiner, 2003). However, suitability was typically poor elsewhere in the survey area as a result of historical modifications to hydromorphology which have resulted in often poor-quality lamprey habitats. This was especially so with reference to spawning habitats which were heavily silted or even absent at many of the survey sites. *Lampetra* sp. generally fine, clean gravels required for spawning (Dawson et al., 2015; Rooney et al., 2013; Lasne et al., 2010).

Larval lamprey distribution and settlement is passive and entirely regulated by local, dynamic hydrographical (flow) regimes (Kelly & King,, 2001; Potter, 1980; Hardisty & Potter 1971). Thus, a paucity of suitable spawning sites (i.e. sources of larvae) can often counteract the presence of even widespread ammocoete burial habitat (i.e. soft sediment) and limit the success of local populations. This was exemplified at surveys sites on the lower Rapemills River, where mean densities of 0-≤2 larvae per m2 were recorded.

European Eel

European eel were only recorded from sites on the Little Brosna River (A3), Rapemills River (B10, B13) and Little River (D5), and were present in low numbers only. As outlined above, the distribution of eel in the Shannon catchment is significantly impacted by instream barriers.

Other fish species

Other fish species recorded were minnow, stone loach, ten-spined stickleback, three-spined stickleback, pike, roach, and stone loach.

White-clawed crayfish

Live white-clawed crayfish were recorded from sites on the Mullaghakaraun Bog Stream (B9) and Feeghroe River (B12). Both sites supported low densities of juveniles only.

Crayfish remains were identified in otter spraint at sites on the Little Brosna River (A3), Rapemills River (B1 & B3) and Blackwater River (D7). The remains on an adult crayfish (possibly preyed upon by otter) were also recorded at site B5 on the West Galros Stream, in addition to widespread crayfish burrows in sloping clay banks. Crayfish burrows were also visibly widespread at site B6 on the West Galros Stream.

Environmental DNA analysis detected white-clawed crayfish in the Little Brosna River (A3) and Grand Canal (D4).

Otter

Despite some good suitability at numerous survey locations, otter signs were only recorded at a total of n=5 sites during the course of aquatic surveys undertaken in August 2022.

Regular otter spraint sites were recorded at sites on the Rapemills River (B1 & B3), River Brosna (D6) and Blackwater River (D7). An old otter spraint site (not regularly used) was also recorded on the Little Brosna River at site A3. With the exception of site D6 on the River Brosna, all spraint sites recorded contained identifiable white-clawed crayfish remains. Fresh otter prints were recorded on littoral mud alongside regular spraint sites at site D7 on the Blackwater River.

No breeding (holts) or resting (couch) areas were identified in the 150m vicinity of the survey sites in August 2022.

Invasive aquatic species

Zebra mussel *Dreissena polymorpha* was recorded in high abundances at site D4 on the Grand Canal in August 2022. This invasive bivalve is well-established in the Shannon catchment, having proliferated in the mid to late 1990's (Minchin et al.,

2002). Zebra mussel is both considered a high-risk impact species in Ireland (O' Flynn et al., 2014) and is subject to restrictions under Regulations 49 and 50 of the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011).

The non-native (potentially invasive) amphipod species Caspian mud shrimp *Chelicorophium curvispinum* was also recorded, in low numbers, at site D4 on the Grand Canal. The species is commonly found associated with the druses of the zebra mussel and has been known in the Shannon system since 2003 (Lucey et al., 2004).

The New Zealand mud snail *Potamopyrgus antipodarum* was the most widespread non-native invertebrate recorded in the study being recorded at sites A2, B1, B3, B4, B5, B6, B7, B8, B10, B12, D6, D7, E1 and E2. The species is thought to have been introduced to Ireland in the early 19th century and has a ubiquitous distribution nationally (Anderson, 2016). The species can dominate molluscan communities and reduce the growth rates of native molluscs while also resulting in weight loss to fish species that consume it in abundance, given it survives passage through the digestive tract (CABI, 2020 & references therein).

eDNA analysis (site D4 only) and macro-invertebrate sampling did not detect quagga mussel *Dreissena bugensis rostriformis*, an invasive bivalve mollusc recently discovered in the Shannon system, in the vicinity of Loughs Ree and Derg (Baars & Minchin, 2021). However, eDNA analysis did detect the non-native pathogen crayfish plague (Aphanomyces astaci) in the Little Brosna River, Rapemills River and Grand Canal.

Roach (Rutilus rutilus) is a medium impact invasive fish species in Ireland (O'Flynn et al., 2014) also listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011) and was recorded via electro-fishing at site D5 on the Little [Cloghan} River.

The invasive macrophyte Nuttall's pondweed *Elodea nuttallii* was recorded at site D4 on the Grand Canal. The closely related Canadian pondweed *Elodea canadensis* was recorded at site B13 on the lower Rapemills River. Both species are very widespread in Ireland and are listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011). Both are considered a high-risk invasive species in Ireland (O' Flynn et al., 2014).

Spraint of the invasive mink *Neovison vison* was recorded at sites D5 (Little River) and E2 (Silver River).

5.4 Evaluation of Ecological Features

An evaluation of ecological features within the ZoI is provided in **Table 5.10**.

Only those evaluated as an 'Important Ecological Feature' (IEF) are brought forward for impact assessment. These include those protected by law or policy. Note that all habitats have been brought forward for assessment, to facilitate a fuller assessment of any net changes to biodiversity because of the project, c.f. the EU Biodiversity Strategy 2020 and Irish National Biodiversity Action Plan 2017-2021, which emphasise the need to achieve no net loss of biodiversity.

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
Designated Nature Conservation Sites	River Shannon Callows SAC 000216	Protected under the Habitats Directive, derived domestic legislation, and national, regional and local planning policy. NIS determined potential hydrological and ecological connectivity.	International	Part of European Natura 2000 network.	Y
	Lough Derg, North-east Shore SAC 002241	Protected under the Habitats Directive, derived domestic legislation, and national, regional and local planning policy. NIS determined potential hydrological connectivity	International	Part of European Natura 2000 network.	Y
	River Little Brosna Callows SPA 004086	Protected under the Habitats Directive, derived domestic legislation, and national, regional and local planning policy. The NIS determined a potential hydrogeological and ecological connection.	International	Part of European Natura 2000 network.	Y
	Middle Shannon Callows SPA 004096	Protected under the Habitats Directive, derived domestic legislation, and national, regional and local planning policy. The NIS determined there is hydrological, hydrogeological, and ecological connectivity to this SPA.	International	Part of European Natura 2000 network.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Slieve Bloom Mountains SPA 004160	Protected under the Habitats Directive, derived domestic legislation, and national, regional, and local planning policy. The NIS determined potential ecological connectivity to this SPA.	International	Part of European Natura 2000 network.	Y
	Lough Derg (Shannon) SPA 004058	Protected under the Birds/Habitats Directive, derived domestic legislation, and national, regional, and local planning policy. The NIS determined potential hydrological and ecological connectivity to this SPA.	International	Part of European Natura 2000 network.	Y
	River Suck Callows SPA 004097	Protected under the Birds/Habitats Directive, derived domestic legislation, and national, regional, and local planning policy. The NIS determined potential ecological connectivity to this SPA.	International	Part of European Natura 2000 network.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Suck River Callows NHA 000222	Protected under the Wildlife Amendment Act (2000) and local planning policy. There is a potential ecological connection between the Project Site and this NHA.	National	Statutory designated Irish conservation site.	Y
	Woodville Woods pNHA 000927	Protected under local planning policy. There is a potential ecological connection between the Project Site and this pNHA.	National	Non-statutory designated Irish conservation site.	Y
	Birr (Domestic Dwelling No. 2, Occupied) pNHA 000569	Protected under local planning policy. There is an ecological connection between the Project Site and this pNHA.	National	Non-statutory designated Irish conservation site.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Birr (Domestic Dwelling No.1, Occupied) pNHA 002058	Protected under local planning policy. There is an ecological connection between the Project Site and this pNHA.	National	Non-statutory designated Irish conservation site.	Y
	River Shannon Callows pNHA 000216	Protected under local planning policy. There is a potential hydrological and ecological connection between the Project Site and this pNHA.	National	Non-statutory designated Irish conservation site.	Y
	Slieve Bloom Mountains pNHA 000412	Protected under local planning policy. There is a potential ecological connection between the Project Site and this pNHA.	National	Non-statutory designated Irish conservation site.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Lough Nahinch (Tipperary) pNHA 000936	Protected under local planning policy. There is a potential ecological connection between the Project Site and this pNHA	National	Non-statutory designated Irish conservation site.	Y
	Lough Derg pNHA 000011	Protected under local planning policy. There is hydrological and ecological connectivity between the Project Site and this pNHA.	National	Non-statutory designated Irish conservation site.	Y
	Clorhane Wood pNHA 000894	Protected under local planning policy. There is hydrological and ecological connectivity between the Project Site and this pNHA.	National	Non-statutory designated Irish conservation site.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Roscrea Bog pNHA 000583	Protected under local planning policy.	National	Non-statutory designated Irish conservation site.	Y
	Pallas Lough pNHA 000916	Protected under local planning policy. There is a potential ecological connection between the Project Site and this pNHA.	National	Non-statutory designated Irish conservation site.	Y
Ramsar Sites	Slieve Bloom Mountains Ramsar Site 335	There is a potential ecological connection via hen harrier.	International	The population of hen harrier overlap with Slieve Bloom Mountains SPA. As such, this ecological connection is considered under the SPA in the NIS.	N
	Mongan Bog Ramsar Site 416	There is a lack of ecological or hydrological connection between the Ramsar site and the project site.	International	There is an absence of an impact pathway.	N
Birds	Barn owl	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of >50% over longer time period); ROI population: 46 territorial pairs (Wilson-Parr & O'Brien, 2019) but this is likely to	County / Regional	The breeding season peak count (N=1) is less than 1% of the ROI population (0.125%) but it is greater than 1% of the County Offaly population (4.39%). Although this species was only observed in summer, it is resident and so the same is likely true for both breeding and non-breeding seasons. On this basis, the resident population is of county /	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		represent a massive underestimate as the Article 12 report (NPWS, 2022) estimates an ROI population of 400 pairs, so this has been assumed here; County Offaly population: 11 pairs (inferred); Baseline surveys: Breeding raptor surveys: no potential roosts or nests were detected; Incidental: Single barn owl was observed south of the existing met mast during a bat survey in 2022 c. 500m from turbine T3. No breeding or roosting sites detected during investigations of potential bat roosts.		regional importance.	
	Black-headed gull	BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding range of 58% and 55% over short and longer time periods, respectively; localized breeder with >50% breeding population in 10 or fewer sites); ROI population; 20,197 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 9,318 breeding pairs (2010-2012: (NPWS, 2022)); County Offaly population: 271	County / Regional	The breeding season peak count (N=34) is not significant within the context of the ROI population (0.18%)but it is within the context of the County Offaly population (6.4%). The same is true for the wintering season peak count (N=46), which is less than 1% of the ROI population (0.23%) but it is within the context of the County Offaly population (8% - 17% depending on whether the Offaly winter population is based on the IweBS data or is inferred). The wintering season peak count represents 45.5% - 2.37% of the River Little Brosna Callows SPA population, depending on whether the population is based upon the IweBS or site synopsis	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		– 575 wintering individuals (lower estimate is IWeBS counts and upper estimate is inferred) and 531 breeding individuals (inferred); River Little Brosna Callows SPA winter population: 101 (IweBS 5-year mean peak count 2016/17 – 2020/21) – 1,939 individuals (site synopsis 2-year mean peak count 1999/20 – 2000/01); Middle Shannon Callows SPA winter population: 1,209 individuals (site synopsis 4-year mean peak count 1995/96 – 1999/20; no IweBS data available); Baseline surveys: Flight activity surveys: wintering peak count 46 individuals (non-breeding 2021/22) and breeding peak count 32 individuals (breeding 2022).		data. The wintering season peak count represents 3.8% of the Middle Shannon Callows SPA population. On this basis, the resident population is of county / regional importance.	
	Common gull	BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding population of 25% over the longer time period); ROI population: 8,032 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 1,927 breeding pairs (2012: (NPWS, 2022); County Offaly population: 0 –	County / Regional (non-breeding only)	The breeding season peak count (N=1) is not significant within the context of the ROI population (0.03%) or County Offaly population (0.91%). The non-breeding season peak count (N=8) is not significant within the context of the ROI population (0.1%) but is it for the County Offaly population (3.5%). On this basis, the non-breeding population is of county / regional importance and the breeding population is likely to be of site importance only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		229 wintering individuals (lower estimate is IweBS counts and upper estimate is inferred) and 55 breeding pairs (inferred). Baseline surveys: Flight activity surveys: wintering peak count eight individuals (non-breeding 2021/22) and breeding peak count one individual (breeding 2022).			
	Common kestrel	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 53% over short time period); ROI population: 36 territorial pairs (Wilson-Parr & O'Brien, 2019) but this is likely to represent a massive underestimate as the Countryside Bird Survey 2011-2016 (Lewis, et al., 2019) estimates an ROI population of 13,500 individuals, so 6,750 pairs is the more likely estimate; County Offaly population: 384 resident individuals (inferred); Baseline surveys: Flight activity surveys: wintering peak count of two birds (winter 2022/23) and breeding peak count of one bird (breeding 2021 and	Local	The breeding peak count (N=1) is not significant within the context of the ROI population (0.007%) or County Offaly population (0.26%). The same is true for the non-breeding peak count (N=2), which is not significant within the context of the ROI population (0.01%) or County Offaly population (0.52%). It is likely that the resident population is of local importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		2022). Breeding raptor surveys: no probable or confirmed breeding recorded.			
	Common kingfisher	Annex I Birds Directive; BoCCI 4: Amber list (qualifying criteria: species has unfavourable conservation status in Europe but where global population is concentrated outside Europe; moderate decline in breeding population of 45% and 44% over short and longer time periods); ROI population: 368 pairs (NPWS, 2022); County Offaly population: 11 pairs (inferred) Baseline surveys: Incidental: single bird was seen foraging during habitat surveys in 2022 along the Rapemills River c. 500 m from turbines T2 and T5.	County / Regional	The peak breeding season count (N=1) is not significant in the context of the ROI population (0.14%) but it is in the context of the County Offaly population (4.77%). On this basis, it is likely that the resident population is of county / regional importance.	Y
	Common ringed plover	BoCCI 4: Amber list (qualifying criteria: Irish population represents 25% of wintering European population); ROI population: 10,545 wintering individuals ((2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 1,045 breeding pairs (2008: (NPWS, 2022)).	County / Regional (breeding)	The breeding peak count (N=2) is not significant in the context of the ROI population (0.14%) but it is in the context of the County Offaly population (5.04%). This species was not recorded during the non-breeding season. On this basis, it is likely that the breeding population is of county / regional importance only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Baseline surveys: 300 wintering individuals (inferred) and 30 breeding pairs (inferred); Flight activity surveys: breeding peak count of three birds (breeding 2022). Breeding wader surveys: none recorded.			
	Common snipe	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 50% over short time period and 78% over longer time period); ROI population: 550 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 4,275 breeding pairs (2008: (NPWS, 2022)). The winter population estimate is likely to be a massive underestimate due to the winter I-WeBS survey methodology, which is notoriously poor at detecting this cryptic species. Consequently, we have assumed that the true winter population is likely to be the same as the breeding population i.e. 8,550 individuals; County Offaly population: 1 – 243 individuals (lower estimate is IweBS counts and upper estimate is inferred)	County / Regional (non-breeding)	The breeding peak count (N=2) is not significant in the context of the ROI population (0.02%) or the County Offaly population (0.82%). The non-breeding peak count (N=7) is not significant within the context of the ROI population (0.08%) but it is within the context of the County Offaly population (2.88 – 700%, depending on whether the county population is based on IweBS data or inferred). On this basis, the non-breeding population is of county / regional importance but the breeding population is likely of local importance only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Woodville Woods pNHA population: no information given in site synopsis; Lough Nahinch (Tipperary) pNHA population: no information given in site synopsis; Baseline surveys: Flight activity surveys: breeding peak count of two birds (breeding 2022) and wintering peak count of seven birds (non-breeding 2021/22); Breeding wader surveys: no probable or confirmed breeding was recorded.			
	Eurasian curlew	BoCCI 4: Red list (qualifying criteria: global conservation concern; severe decline in breeding population of 86% and 98% over shorter and longer time periods, respectively; severe decline in non-breeding population of 65% over longer time period; severe decline in breeding range of 73% and 78% over longer and shorter time periods, respectively); ROI population: 14,994 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 98 breeding pairs (2008: (NPWS, 2022));	County / Regional (breeding)	The peak breeding count (N=2) is significant in the context of the ROI population (1.02%); however, the species was not recorded breeding. It is therefore likely that this is an overestimate of their importance. On this basis, the breeding population is of national importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		County Offaly population: 79 – 427 wintering individuals (lower count is IweBS data and upper count is inferred) and 3 breeding pairs (inferred); Baseline surveys: Flight activity surveys: none recorded. Breeding wader surveys: peak count of two birds seen c. 200 m from turbine T3 during 2022 survey. No evidence of breeding recorded.			
	Eurasian teal	BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding range of 46% over longer time period); ROI population: 23,671 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 531 breeding pairs (2008: (NPWS, 2022)); County Offaly population: 674 – 1,923 wintering individuals (lower estimate is inferred and upper estimate is IweBS counts); River Little Brosna Callows SPA / NHA winter population: 1,899 (IweBS 5-year mean peak count 2016/17 – 2020/21) – 2,683 individuals (site synopsis 4-year mean peak count 1995/96 –	County / Regional (non-breeding).	The non-breeding peak count (N=42) is not significant in the context of the ROI population (0.178%) but it is for the County Offaly population (2.18 – 6.23%), regardless of whether the county population is derived from IweBS counts or is inferred. This species was not recorded during the breeding season. The wintering season peak count represents 2.2% - 1.57% of the River Little Brosna Callows SPA population, depending on whether the population is based upon the IweBS or site synopsis data. On this basis, the non-breeding population is of county / regional importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		1999/20); Pallas Lough pNHA population: no information given in site synopsis. Baseline surveys: Flight activity surveys: wintering peak count of 42 individuals (non-breeding 2022/23).			
	Eurasian wigeon	BoCCI 4: Amber list (qualifying criteria: moderate decline in non-breeding population of 38% and 44% over shorter and longer time periods, respectively; rare breeder; localized non-breeding populations); ROI population: 41,504 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)); County Offaly population: 1,182 – 4,563 wintering individuals (lower estimate is inferred and upper estimate is IweBS counts); River Little Brosna Callows SPA / NHA winter population: 4,281 (IweBS 5-year mean peak count 2016/17 – 2020/21) – 8,116 individuals (site synopsis 4-year mean peak count 1995/96 – 1999/20); Middle Shannon Callows SPA	Local	The peak winter count (N=13) is not significant in the context of the ROI population (0.03%) or the County Offaly population (0.28%) if IweBS counts are used to derive the county population. This species was not recorded in the breeding season. The wintering season peak count represents 0.16% - 0.42% of the River Little Brosna Callows SPA population, depending on whether the population is based upon the IweBS or site synopsis data. The wintering season peak count represents 0.42% of the Middle Shannon Callows SPA population. The wintering season peak count represents 0.96% - 0.4% of the River Suck Callows SPA / Suck River Callows NHA population, depending on whether the population is based upon the IWeBS or site synopsis data. On this basis, the population is likely to be of local importance during the non-breeding season only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		winter population: 3,059 individuals (site synopsis 4-year mean peak count 1995/96 – 1999/20; no IweBS data available); River Suck Callows SPA / Suck River Callows NHA winter population: 1,355 (IweBS 5-year mean peak count 2016/17 – 2020/21) – 3,232 individuals (site synopsis 5-year mean peak count 2001/02 – 2005/06); Pallas Lough pNHA population: no information given in site synopsis. Baseline surveys: Flight activity surveys: wintering peak count of 13 individuals (non-breeding 2022/23).			
	Eurasian woodcock	BoCCI 4: Red list (qualifying criteria: severe decline in breeding range of 73% over longer time period); ROI population: no reliable estimates are available (Fitzgerald, Burke, & Lewis, 2021; Lewis, et al., 2019; NPWS, 2022); County Offaly population: no reliable estimates are available; Baseline surveys: Flight activity surveys: none	Local (breeding)	It is impossible to calculate the importance of the breeding peak count (N=1) quantitatively due to a lack of population data. It is likely that there is one breeding territory near turbine T3. On this basis, the breeding population is likely of local importance only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		were recorded; Breeding wader surveys: none were recorded. Incidental: a single roding bird was recorded during bat surveys c. 500 m from turbine T3.			
	European golden plover	Annex I Birds Directive; BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 84% over longer time period); ROI population: 70,726 wintering individuals (2016/17; (Fitzgerald, Burke, & Lewis, 2021)) and 134 – 156 pairs (2002-2004; (NPWS, 2022)); County Offaly population: 2,014 – 5,613 wintering individuals (lower estimate is inferred and upper estimate is IWeBS counts) and four breeding pairs (inferred). River Little Brosna Callows SPA / NHA winter population: 5,110 (IWeBS 5-year mean peak count 2016/17 – 2020/21) – 10,577 individuals (site synopsis 3-year mean peak count 1995/96 – 1999/20); Middle Shannon Callows SPA winter population: 4,113 individuals (site synopsis 4-year mean peak count	National (non-breeding)	The breeding peak count (N=5) is significant in the context of the ROI population (1.87%) but no breeding was detected and it is likely the observation was of birds from the winter population on passage, despite being detected in the breeding season (see below). The non-breeding peak count (N=3,500) is significant within the context of the ROI population (4.95%). On this basis, the non-breeding population is of national importance. The wintering season peak count represents 68.49% - 33.09% of the River Little Brosna Callows SPA population, depending on whether the population is based upon the IWeBS or site synopsis data. The wintering season peak count represents 85.1% of the Middle Shannon Callows SPA population. The wintering season peak count represents 335.57% - 156.18% of the River Suck Callows SPA / Suck River Callows NHA population, depending on whether the population is based upon the IWeBS or site synopsis data.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		1995/96 – 1999/20; no IWeBS data available); River Suck Callows SPA / Suck River Callows NHA winter population: 1,043 (IWeBS 5-year mean peak count 2016/17 – 2020/21) – 2,241 individuals (site synopsis 5-year mean peak count 2001/02 – 2005/06); Baseline surveys Flight activity surveys: wintering peak count of 3,500 birds (non-breeding 2022/23) and breeding peak count of five birds (breeding 2021), although birds were recorded in April and were likely actually part of the winter population on passage. Breeding wader surveys: no probable or confirmed breeding detected. Nocturnal golden plover surveys: no nocturnal foraging detected.			
	Great cormorant	BoCCI 4: Amber list (qualifying criteria: localised breeder with >50% breeding population in 10 or fewer sites); ROI population; 2,987 wintering individuals (2016/16: (Fitzgerald, Burke, & Lewis, 2021)) and 4,366 breeding	County / Regional (non-breeding)	The wintering peak count (N=1) is not significant within the context of the ROI population (0.03%). However, it is for the County Offaly population regardless of whether the IweBS (1.18%) or inferred (16.67%) county population estimate is used. The wintering season peak count represents 1.1% of the Lough Derg (Shannon) SPA population. This species was not recorded during the breeding season.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		pairs (2012: (NPWS, 2022)); County Offaly population: 6 – 85 wintering individuals (lower estimate is IweBS counts and upper estimate is inferred) and 249 breeding individuals (inferred). Lough Derg (Shannon) SPA population: 90 (site synopsis 5-year mean peak count 19959/96 – 1999/20; no IweBS data) wintering individuals and 167 breeding pairs (site synopsis, 2005 survey). Baseline surveys: Flight activity surveys: wintering peak count one bird (non-breeding 2022/23).		On this basis, the non-breeding population is of county / regional importance only.	
	Great white-egret	Annex I Birds Directive; BoCCI 4: no assessment given; ROI population: no estimate available; County Offaly population: no estimates possible; Baseline surveys: Flight activity surveys: winter peak count of one bird (non-breeding 2022/23); Breeding wader surveys: no probable or confirmed breeding.	Local (non-breeding)	As there are no ROI or County Offaly population estimates, it is impossible to quantify the importance of the non-breeding peak count (N=1). As this species if listed under Annex I of the Birds Directive, it is precautionary to list its non-breeding population as being of local importance.	Y
	Greylag goose	BoCCI4: Baseline surveys: Amber list (qualifying criteria: >50% of	County / Regional (non-breeding)	The peak winter count (N=3) is not significant within the context of the ROI population (0.15%) but it is for the County Offaly population	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		wintering population found at 10 or fewer sites); ROI population: 1,954 wintering individuals; County Offaly population: 18 – 56 wintering individuals (lower estimate is IweBS counts and upper estimate is inferred) Flight activity surveys: Feeding distribution surveys: peak wintering count of three individuals (non-breeding 2022/23); Feeding distribution surveys: none recorded.		regardless of whether the population is derived from IweBS (16.67%) or inferred (5.39%). There were no observations within the breeding season. On this basis, this species is of county / regional importance for the non-breeding population only.	
	Hen harrier	Annex I Birds Directive; BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding population of 29% over longer time period); ROI population: 108 – 157 breeding pairs (Ruddock, et al., 2016) and 219 – 313 resident individuals (NPWS, 2021); County Offaly population: 6 resident individuals (inferred); Slieve Bloom Mountain SPA permanent population: eight pairs (site synopsis, survey in 2005) – 11 to 12 pairs (Ruddock, et al., 2016); Baseline surveys: Flight activity surveys: peak	County / Regional (non-breeding)	The peak winter count (N=1) was not significant in the context of the ROI population (0.46%) but it was for the County Offaly population (16.03%). The wintering season peak count represents 4.55% of the Slieve Bloom Mountain SPA population. This species was not recorded during the breeding season. On this basis, the population is of county / regional importance for the wintering population only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		count of single bird (non-breeding 2020/21, 2021/22 and 2022/23 seasons); Breeding raptor surveys: no breeding was recorded; Hen harrier winter roost surveys: no evidence of roosting was recorded.			
	Herring gull	BoCCI4: Amber list (qualifying criteria: unfavourable conservation status in Europe with global population concentrated in Europe; moderate decline of 29% and 50% in breeding population over short and longer time periods) ROI population: 9,734 wintering individuals and 2,319 pairs (NPWS, 2021; County Offaly population: 277 wintering individuals (inferred – no IweBS counts available) and 132 breeding individuals (inferred). Baseline surveys: Flight activity surveys: peak breeding count 8 birds (breeding 2022).	County / Regional (breeding)	The peak breeding count (N=8) is not significant within the context of the ROI population (0.17%) but it is for the County Offaly population (6.06%). This species was not recorded in winter. On this basis, the population is of county / regional importance for the breeding population only.	Y
	Lesser black-backed gull	BoCCI 4: Amber list (qualifying criteria: localised breeder with >50% breeding population in 10 or fewer sites); ROI population; 3,644	County / Regional (breeding)	The breeding peak count (N=4) is not significant in the context of the ROI population (0.05%) but it is for the County Offaly population (1.67%). This species was not recorded during the winter. On this basis, the population is of county / regional importance for the breeding season only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 4,239 breeding pairs (2012: (NPWS, 2022)); County Offaly population: 241 breeding individuals (inferred) and 104 wintering individuals (inferred; IweBS count of 1 like a gross underestimate); Baseline surveys: Flight activity surveys: breeding peak count 4 (breeding 2021).			
	Little egret	Annex I Birds Directive; BoCCI4: Green list; ROI population: 1,274 wintering individuals (2016/17: (Fitzgerald)). County Offaly population: 36 wintering individuals (inferred). Baseline surveys: Flight activity surveys: peak wintering count of two birds (non-breeding 2022/23); Breeding wader surveys: no breeding recorded.	County / Regional (non-breeding)	The peak winter count (N=2) is not significant within the context of the ROI population (0.17%) but it is in the context of the County Offaly population (5.5%). This species was not recorded during the breeding season. On this basis, the population is significant at the county / regional level for the wintering population only.	Y
	Mallard	BoCCI 4: Amber list (qualifying criteria: moderate decline of winter population of 41% over short time period); ROI population; 8,098 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 15,400 breeding	County / Regional (non-breeding)	The peak winter count (N=5) is not significant in the context of the ROI population (0.06%) but it is in the context of the County Offaly population regardless of whether the IweBS counts (10.64%) or the inferred (2.17%) county population is used. This species was not recorded during the breeding season. On this basis, the population is of county / regional	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		pairs (2008-2011; (NPWS, 2022)); County Offaly population: 47 – 231 (IweBS and inferred) wintering individuals and 877 breeding individuals (inferred); Pallas Lough pNHA population: no information given in site synopsis. Baseline surveys: Flight activity surveys: peak count of five individuals (non-breeding 2022/23).		importance for the winter period only.	
	Merlin	Annex I Birds Directive; BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding range of 40% over longer time period); ROI population: 11 territorial pairs (Wilson-Parr & O'Brien, 2019) but this is likely to represent a massive underestimate as the Article 12 report (NPWS, 2022) estimates an ROI population of 200 – 400 pairs, so 200 pairs have been assumed here; County Offaly population: 6 pairs (estimated); Baseline surveys: Flight activity surveys: peak winter count of one bird (non-breeding 2022/23); Breeding raptor surveys: no	County / Regional (non-breeding)	The peak winter count (N=1) is not significant in the context of the ROI population (0.25%) but it is for the County Offaly population (8.3%). This species was not recorded during the breeding season. On this basis, the population is of county / regional importance for the winter only.	Annex I Birds Directive; BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding range of 40% over longer time period); ROI population: 11 territorial pairs (Wilson-Parr & O'Brien, 2019) but this is likely to represent a massive underestimate as the Article 12 report (NPWS,

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		breeding was recorded. Hen harrier roost surveys: no roosting was recorded.			2022) estimates an ROI population of 200 – 400 pairs, so 200 pairs have been assumed here; County Offaly population: 6 pairs (estimated); Baseline surveys: Flight activity surveys: peak winter count of one bird (non-breeding 2022/23); Breeding raptor surveys: no breeding was recorded. Hen harrier roost surveys: no roosting was recorded.
	Mute swan	BoCCI 4: Red list (qualifying criteria: Irish population represents 100% of European population in non-breeding season); ROI population: 3,839 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 7,120 breeding individuals (2008-2011; (NPWS, 2022));	Site	None recorded nearby, so no local population to evaluate importance.	N

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		County Offaly population: 159 wintering individuals (inferred) and 405 breeding individuals (estimated); Baseline surveys: Flight activity surveys: none recorded. Feeding distribution surveys: none within 2 km from the project.			
	Northern lapwing	BoCCI 4: Red list (qualifying criteria: of global conservation concern; severe decline in breeding population of 74% over short time period and 95% over longer time period; severe decline in winter population of 67% over short time period and 58% over longer time period); ROI: 42,514 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 2,000 breeding pairs (2008: (NPWS, 2022)); County Offaly population: 3,778 (IweBS) wintering individuals and 57 breeding pairs (estimated); River Little Brosna Callows SPA / NHA winter population: 3,258 (IweBS 5-year mean peak count 2016/17 – 2020/21) – 6,552 individuals	County / Regional	The peak breeding count (N=13) is not significant in the context of the ROI population (0.325%) but it is in the context of the County Offaly population (11.41%). The peak winter count (N=250) is not significant in the context of the ROI population (0.588%) but it is in the context of the County Offaly population (6.62%). The wintering season peak count represents 7.67% - 3.82% of the River Little Brosna Callows SPA population, depending on whether the population is based upon the IweBS or site synopsis data. The wintering season peak count represents 1.89% of the Middle Shannon Callows SPA population. The breeding season peak count represents 10.3% of the same SPA population. The wintering season peak count represents 14.06% - 6.4% of the River Suck Callows SPA / Suck River Callows NHA population, depending on whether the population is based upon the IWeBS or site synopsis data. On this basis, the population is of county / regional importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		(site synopsis 3-year mean peak count 1995/96 – 1999/20); Middle Shannon Callows SPA population: 13,240 wintering individuals (site synopsis 4-year mean peak count 1995/96 – 1999/20; no IweBS data available) and 63 breeding pairs (site synopsis 2002 data); River Suck Callows SPA / Suck River Callows NHA winter population: 1,778 (IweBS 5-year mean peak count 2016/17 – 2020/21) – 3,906 individuals (site synopsis 5-year mean peak count 2001/02 – 2005/06); Baseline surveys: Flight activity surveys: peak breeding count of 13 birds (breeding 2022) and peak wintering count of 250 birds (non-breeding 2022/23); Breeding wader surveys: one confirmed pair breeding c. 410m from turbine T8 (breeding 2021 and 2022); Nocturnal golden plover surveys: c. 10 birds foraging c. 300 m from turbine T7 (non-breeding 2022/23).			
	Peregrine falcon	Annex I Birds Directive: BoCCI 4: Green list;	County / Regional	Peak breeding and non-breeding count (N=1) is not significant in the context of the ROI population	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		ROI population: 89 territorial pairs (Wilson-Parr & O'Brien, 2019) but this is likely to represent a massive underestimate as the Article 12 report (NPWS, 2022) estimates an ROI population of 515 pairs, so this has been assumed here; County Offaly population: 15 pairs (inferred); Baseline surveys: Flight activity surveys: peak breeding and non-breeding count of single bird (non-breeding 2021/22 and breeding 2022). Breeding raptor surveys: probable breeding c. 1.3km from turbine T7.		(0.1%) but it is in the context of the County Offaly population (3.3%). On this basis, the population is of county / regional importance.	
	Sandwich tern	Annex I Birds Directive; BoCCI 4: Amber list (qualifying criteria: localized breeding population found in 10 or fewer sites); ROI population: 2727 breeding pairs (NPWS, 2022); County Offaly population: no known breeding aggregations; Baseline surveys: Flight activity surveys: none recorded; Incidental: single bird heard during breeding raptor survey	Site	Peak count (N=1) is not significant in the context of the ROI (0.02%) or County Offaly population (there are no known breeding aggregations). The bird was likely passing through the area. On this basis, the population is of site importance.	N

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		(breeding 2022).			
	Whooper swan	Annex I Birds Directive; BoCCI 4: Amber list (qualifying criteria: rare breeder; localized non-breeding population; Irish population represents 45% of European non-breeding population); ROI population: 14,467 wintering individuals (Burke et al., 2021); County Offaly population: 410 wintering individuals (IweBS); River Little Brosna Callows SPA / NHA winter population: 303 (IweBS 5-year mean peak count 2016/17 – 2020/21) – 122 individuals (site synopsis 4-year mean peak count 1995/96 – 1999/20); Middle Shannon Callows SPA winter population: 305 individuals (site synopsis 5-year mean peak count 1995/96 – 1999/20; no IweBS data available); River Suck Callows SPA / Suck River Callows NHA population: 209 (IweBS 5-year mean peak count 2016/17 – 2020/21) – 164 individuals (site synopsis 5-year mean peak count 2001/02 – 2005/06); Baseline surveys:	County / Regional (non-breeding)	The peak winter count (N=12) is not significant within the context of the ROI population (0.08%) but it is in the context of the County Offaly population (2.93%). The wintering season peak count represents 3.9% - 9.84% of the River Little Brosna Callows SPA population, depending on whether the population is based upon the IweBS or site synopsis data. The wintering season peak count represents 3.93% of the Middle Shannon Callows SPA population. The wintering season peak count represents 5.74% - 7.32% of the River Suck Callows SPA / Suck River Callows NHA population, depending on whether the population is based upon the IWeBS or site synopsis data. On this basis, the population is of county / regional importance for the winter season.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Flight activity surveys: peak count of 12 individuals (non-breeding 2021/22). Feeding distribution surveys: none recorded nearby.			
Terrestrial Mammals (Excluding Bats)	Badger	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 84,000 individuals (Marnell, Looney, & Lawton, 2019); County Offaly population: 2,391 individuals (estimated); Baseline surveys: A suspected badger sett was recorded 32m from the grid connection. No badger setts were recorded within 100 m of any other proposed infrastructure. A latrine was recorded NW of T4 along a forestry track, and along the L30033 road.	Local	A suspected badger sett was recorded c. 32m from the grid connection No other badger setts were recorded within 100m of any proposed infrastructure. Assuming a typical badger family size of 3.8 per sett (Byrne et al., 2012), there are approximately 3.8 badgers present, which is not significant in the context of the ROI population (0.005%) or is in the context of the County Offaly population (0.16%). Badger droppings were also recorded at the side of the L30033 road adjacent to the grid connection, and ca. 93m north-east of T4. Badger activity therefore appears to be higher in the western part of the project site. This species has the best possible conservation status i.e. it is common and widespread. Based on the above, the population within the study area is of local importance.	Y
	Pine marten	Annex V Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern;	County / Regional	No pine marten dens were recorded near any proposed infrastructure; however, this species is present within the study area and uses the woodland habitats, which are widespread and	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		ROI population: 3,000 individuals (Marnell, Looney, & Lawton, 2019) but thought to be significantly underestimated; County Offaly population: 224 individuals (but likely underestimated); Baseline surveys: no dens were recorded within 100 m of any proposed infrastructure. Three pine marten were recorded within woodland c. 79m north-west of T2. It is likely that they forage within the woodland habitats.		common. This species has the best possible conservation status i.e. is common and widespread. Assuming a local population of three individuals (based on the number recorded), then the population is not of national importance (0.10%); however, it is likely of regional / county importance (1.34%). Based on the above, the population within the study area is of regional / county importance.	
	Red squirrel	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 40,000 individuals (Marnell, Looney, & Lawton, 2019); County Offaly population: 1,139 individuals; Baseline surveys: no dreys were recorded within 100 m of proposed infrastructure. Desktop records and suitable habitat present.	Local	No red squirrel dreys or signs were recorded near any proposed infrastructure. This species has the best possible conservation status i.e. is common and widespread. Based on the above, the population within the study area is of local importance.	Y
	Eurasian otter	Annex II and IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern;	County / Regional importance (population near project – no	Otters are a QI species for the River Shannon Callows SAC, and River Shannon Callows pNHA, and it is likely that ex-situ populations are present Rapemills river. Otter spraints were recorded at site B1 & B3 along the Rapemills river, 114m and 164m	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		ROI population: 16,000-22,000 individuals (Marnell, Looney, & Lawton, 2019); County Offaly population: 780–1072 individuals (estimated); River Shannon Callows SAC population: no information available; River Shannon Callows pNHA population: no information available; Baseline surveys: Otter spraint was recorded at N=5 sites on the Rapemills River (B1 & B3), River Brosna (D6) and Blackwater River (D7). An old otter spraint site (not regularly used) was also recorded on the Little Brosna River at site A3. No breeding (holts) areas were identified in the 150 m vicinity of any of the survey sites. No otter holts, couches or latrines were recorded near any proposed infrastructure.	downstream populations recorded)	from the project boundary respectively. If the number of aquatic survey sites with otter signs represents a likely estimate of the population at the project (N=5), then this population is not significant in the context of the ROI population (0.02-0.03%) or the County Offaly population (0.47-0.64%). No otters were recorded at any downstream survey sites, so no estimates of downstream populations are possible.	
	Irish hare	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 223,000 individuals (Marnell, Looney, & Lawton, 2019); County Offaly population:	Local	None recorded during surveys. Suitable foraging and breeding habitat is present within the study area in the form of wetter areas of grassland with rushes and scrub present. Much of this habitat is also present within the wider landscape. This species has the best possible conservation status i.e. is common and widespread.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		12,071 individuals (estimated); Baseline surveys: None recorded during surveys, but both desktop records and suitable habitat present.		Based on the above, the population within the study area is of local importance.	
	West European hedgehog	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: there is no population estimate available (Marnell, Looney, & Lawton, 2019); County Offaly population: no estimate available; Baseline surveys: none recorded but desktop records and suitable habitat present.	Local	While no hedgehogs were recorded during surveys, there are desktop records available and suitable habitat (e.g. hedgerows and woodland edges) is present within the study area. These habitats are widespread and common in the wider area. This species has the best possible conservation status i.e. is common and widespread. Based on the above, the population within the study area is of local importance.	Y
	Fallow deer	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: there is no population estimate available (Marnell, Looney, & Lawton, 2019); County Offaly population: no estimate available; Baseline surveys: none recorded but desktop records and suitable habitat present.	Local	Suitable habitat (e.g. hedgerows and woodland edges) is present within the study area, and observed just west of the project site. These habitats are widespread and common in the wider area. This species has the best possible conservation status i.e. is common and widespread. Based on the above, the population within the study area is of local importance.	Y
	All other mammal species	Not protected under Wildlife Act (1976 and as amended 2000)	Site	Afforded no legal protection and/or have best possible conservation status – widespread and common, so do not require further assessment	N
Bats	Common pipistrelle	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000);	Local	Moderate levels of activity within the study area and evidence that linear habitats were used for foraging and commuting. No roosts within the	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Red list: Least Concern; ROI population: 1 – 2 million individuals (Marnell, Looney, & Lawton, 2019)); County Offaly population: 55965 - 111929 individuals (estimated); Baseline surveys: recorded during transect surveys during every season (peak count of 73 and 19 calls at northern and southern transects, respectively). Tree line, forest edge and field edge habitats are used for foraging. Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night across all turbine locations was 775, 340 and 112 for spring, summer, and autumn, respectively. The species was also recorded during round 1 and 2 of the at-height detector survey. No roosts were recorded for this species.		works footprint. Based on the above, the population within the study area is of local importance.	
	Soprano pipistrelle	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 0.54 – 1.2 million individuals (Marnell,	Local	Moderate levels of activity within the study area and evidence that linear habitats were used for foraging and commuting. Two minor day roosts are present within the wider area. Based on the above, the population within the study area is of local importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Looney, & Lawton, 2019)); County Offaly population: 28500 63333 individuals (estimated); Baseline surveys: recorded during transect surveys during every season (peak count of 94 and 17 calls at the northern and southern transects in autumn, respectively). Tree line, hedgerows and field edge habitats are used for foraging. Farm buildings and ruins are used for foraging and commuting. Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night across all turbine locations was 369, 378 and 110 for spring, summer, and autumn, respectively. The species was also recorded during all three rounds of the at-height detector surveys. No roosts were recorded for this species.			
	Leisler's bat	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 81,000 –	Local	Moderate levels of activity within the study area and evidence that linear habitats were used for foraging and commuting. Two minor day roosts are present within the wider area. Based on the above, the population within the	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		103,000 individuals (Marnell, Looney, & Lawton, 2019)); County Offaly population: 3784 – 7027 individuals (estimated); Baseline surveys: recorded during all transect surveys, with a peak count of 19 in the northern transect in summer, and 28 in the southern transect. This species was recorded foraging low along hedgerows which is unusual for this typically high-flying species. Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night across all turbine locations was 360, 160 and 9 for spring, summer, and autumn, respectively. The species was also recorded by the at-height detector during all three rounds. No roosts were recorded.		study area is of local importance.	
	Nathusius's pipistrelle	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 10,000 – 18,000 individuals (Marnell, Looney, & Lawton, 2019) or 100 x 1 km^2 cells (NPWS, 2019);	County / Regional	Very low levels of activity within study area. No evidence linear habitats were used for foraging or commuting. No roosts recorded. Number of grid cells species likely present in is reasonably low. Based on the above, the population within the study area is of county / regional importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		County Offaly population: 3784 – 7027 individuals (estimated) Baseline surveys: this species was not recorded during transect surveys. Recorded by ground-level detectors for across all seasons but not all turbine locations. The mean bat passes/night across all turbine locations was 12 for spring, and <1 for summer and autumn. The species was also infrequently recorded once during round 2 of the at-height detector surveys. No roosts were recorded.			
	Brown-long eared bat	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 64,000 – 115,000 individuals (Marnell, Looney, & Lawton, 2019); County Offaly population: 2239 – 4023 individuals (estimated); Baseline surveys: Recorded during the autumn transect survey only. Recorded by ground-level detectors across all turbine locations and seasons. The	Local	Very low levels of activity within the study area and no evidence the habitats represent important foraging or commuting features for this species. Based on the above, the population within the study area is of local importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		mean bat passes/night never exceeded <10 across all turbine locations and seasons. The species was also infrequently recorded by the at-height detector across all three rounds. No roosts were recorded.			
	Daubenton's bat	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 81,000 – 103,000 individuals (Marnell, Looney, & Lawton, 2019); County Offaly population: 4023 – 5116 individuals (estimated); Baseline surveys: Recorded during the spring ransect survey only. Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night never exceeded <10 across all turbine locations and seasons. The species was recorded infrequently during the at-height detector for round 3 only. No roosts were recorded.	Local	Very low levels of activity within the study area – no evidence the habitats represent important foraging or commuting features for this species. Based on the above, the population within the study area is of local importance.	Y
	Natterer's bat	Annex IV Habitats Directive;	Local	Very low levels of activity within the study area	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 5000 (Marnell, Looney, & Lawton, 2019)); County Offaly population: 290 (estimated); Baseline surveys: not recorded during transect surveys. Recorded by ground-level detectors across all seasons but only for some turbine locations. The mean bat passes/night never exceeded <10 across all turbine locations and seasons. The species was not recorded by the at-height detector survey. No roosts were recorded.		and no evidence the habitats represent important foraging or commuting features for this species. Based on the above, the population within the study area is of local importance.	
	Whiskered bat	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 5000 (NPWS, 2019); County Offaly population: 160 (estimated); Baseline surveys: Recorded across all three transect survey seasons. Recorded by ground-level detectors across all seasons but only for some turbine	County / Regional	Very low levels of activity within the study area, with no evidence the habitats represent important foraging or commuting features for this species. No roosts recorded. Based on the above, and the rarity of this species, the population within the study area is of county / regional importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		locations. The mean bat passes/night never exceeded <50 across all turbine locations and seasons. The species was not recorded by the at-height detector. No roosts were recorded.			
Other protected fauna	Common lizard	Annex V Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: None available. County Offaly population: None available. Baseline surveys: not recorded during surveys; however, there was some suitability for frogs at drainage ditches and wet grassland habitats.	Local	While no common lizard were recorded during surveys, it is likely damp habitats afford breeding and foraging opportunities for this species throughout the project. This species has the best possible conservation status. Based on the above, the population within the study area is of local importance.	Y
	Common frog	Annex V Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 150,000,000 (King, et al., 2011); County Offaly population: 7,843,137; Baseline surveys: not recorded during surveys; however, there was some suitability for frogs at drainage ditches and wet grassland habitats.	Local	While no frogs were recorded during surveys, it is likely damp habitats afford breeding and foraging opportunities for this species throughout the project. This species has the best possible conservation status. Based on the above, the population within the study area is of local importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Smooth newt	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: no estimates available but thought to be stable (King, et al., 2011); County Offaly population: no estimates available; Baseline surveys: not recorded during surveys. eDNA samples tested negative for evidence of smooth newt.	Local	Not recorded during surveys. However, it is likely suitable foraging and breeding habitat is available within the study area in the form of damp grassland, drainage ditches and ephemeral puddles. Much of this habitat is also available within the wider landscape. This species has the best possible conservation status i.e. it is common and widespread. Based on the above, the population within the study area is of local importance.	Y
	Marsh fritillary	Annex II Habitats Directive; Annex II Berne Convention; Red list: Vulnerable; ROI population: 248 x 1 km^2 grid squares (NPWS, 2019). County Offaly population: 6 x 1 km^2 grid squares (estimated). Baseline surveys: Single butterfly recorded during bird surveys in 2021. No suitable habitat recorded during targeted survey in 2022.	County / Regional	While any population of this species is of high value, there was no suitable habitat within the Project Site.	N
	All other invertebrate species.	Not protected under Wildlife Act (1976 and as amended 2000)	Site	Threatened and near threatened Irish odonate species are associated with habitats not recorded within the study area. The species recorded are afforded no legal protection and/or have best possible conservation status. They are widespread and common, so do not require further assessment.	N
Fisheries and Aquatic	Atlantic salmon	Annex II and V of Habitats Directive;	Local	If the number of aquatic survey sites with salmon presence downstream represents a likely estimate	N

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
Ecology		Red list status: Vulnerable; ROI population: 250,000 individuals (King, et al., 2011). County Offaly population: 7270 individuals (estimated); Baseline surveys: recorded in low densities at sites A3 and E2. Neither of the watercourses where the Atlantic Salmon was recorded are downstream of or hydrologically connected to the project.		of the downstream population (N=0), then the downstream salmon population is also not significant in the context of the ROI population (0%) or the County Offaly population (0%). Based on the above, the project population within the study area and the population downstream are both of county / regional importance.	
	Brown trout	Red list status: Least Concern; ROI population: no estimates available (King, et al., 2011); County Offaly population: no estimate available; Baseline surveys: recorded in the highest density at site A3. Recorded in lower densities at sites B1, B3, B4, B8, B13, B12, D5, E1, and E2. Site E2 and B1, and B3 provide good nursery habitat. Sites B4, B8, and B13 are downstream of the project.	Site	This species has the best possible conservation status. Brown trout also act as host species for pearl mussel species. However, there are no pearl mussels recorded in the catchment. Based on the above, the population within the study area is of site importance only.	N
	Brook lamprey	Annex II of Habitats Directive; Red list status: Least Concern; ROI population: no estimates available (King, et al., 2011); County Offaly population: no estimate available; Baseline surveys: *Lampetra*	County / Regional (project and downstream populations)	Brook lamprey were not recorded downstream of the project site. However, considering their legal and conservation status, of the species is considered to be of county/regional importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		ammocetes recorded in moderate densities at sites B3, B1, D5 and D7. None of the site are downstream of the project.			
	European eel	Red list status: Critically Endangered; ROI population: no estimates available (King, et al., 2011); County Offaly population: no estimate available; Baseline surveys: recorded in low densities at sites A3, B10, B13, and D5. Sites B10, and B13 are downstream of the project.	County / Regional (project) and downstream population)	This species has a very poor conservation status and is found near the project and downstream of it also. Given that the project is located at considerable distance from the coast, it is unlikely that eel populations are of greater importance than county / regional level. Based on the above, the project population within the study area and the population downstream are both of county / regional importance.	Y
	White-clawed crayfish	Annex II and V of Habitats Directive; Wildlife Act (1976 and as amended, 2000); ROI population: 860 x 1 km^2 grid cells (NPWS, 2019); County Offaly population: 39 x 1 km^2 grid cells (estimated); Baseline surveys: Live individuals recorded at sites B9 and B12; remains found in spraint at sites A3, B1, B3, D7; a predated adult recorded at site B5; eDNA samples tested positive at sites A3 and D4. Sites B9 and B12 are downstream of the project.	County/Regional (downstream population only)	If the number of aquatic survey sites with crayfish presence represents a likely estimate of the downstream population (N=2), then the downstream crayfish population is not significant in the context of the ROI population (0.23%) but it is for the County Offaly population (5.19%). Based on the above, the population downstream is of county/regional importance.	Y
	Three-spined stickleback,	Red-list status for three-spined stickleback and minnow are	Site	Afforded no legal protection and/or have best possible conservation status – widespread and	N

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	stone loach and minnow	of 'Least Concern' and stone loach is a non-native.		common, so do not require further assessment.	

Table 5.10: Evaluation of Ecological Features within ZoI

5.5 Potential Effects on Biodiversity

5.5.1 'Do-Nothing' Scenario

The project encompasses commercial conifer forestry plantation, cutover bog, and agricultural lands that are currently managed through a combination of intensively managed agroforestry, private/domestic peat harvesting and agricultural practices. If the project does not proceed, the area is likely to continue to be used for similar activities.

There are also areas of broadleaved woodland. If the project does not proceed, the area is likely to remain intact.

Taking the above into account, the likely significant effects are described in the following sections.

5.5.2 Potential Construction Phase Effects

The construction phase will mainly result in habitat loss/disturbance to facilitate construction of turbines and associated infrastructure, including excavation of cabling trenches during the installation of the underground grid connection. Felling of vegetation will also be undertaken to implement turbulence buffers and bat mitigation buffers around turbines.

Timing of construction works affects the level and type of impact, especially if undertaken during a critical life stage or season for an ecological feature.

The duration of any construction effects for non-habitat features is likely to be no greater than short-term as the construction phase is anticipated to take 15-18 months.

Likely sources of direct and indirect effects during construction phase are as follows.

Sources of direct effects:

- Clearance of vegetation, soil and rock for access roads, hardstands and turbine bases;
- Clearance of woodland, treelines and hedgerows to facilitate site infrastructure and turbulence/bat mitigation buffers;
- Creation of temporary infrastructure e.g. site compound, blade set-down areas and crane pads;
- Excavation of trenches for cable ducting; and,
- Placement of materials required for infrastructure works.

Sources of indirect effects:

- Stockpiling of materials on-site;
- Dust and changes in air quality;
- Collection/drainage of surface water runoff;
- Pollution and changes in hydrology;
- Spreading non-native/invasive plants; and,
- Construction activity (including noise, light and the presence of construction workers) disturbing birds and mammals.

5.5.2.1 Designated Sites & Ramsar Sites

SACs (both cSAC and full) and SPAs are considered fully in the NIS. The NIS concludes that, with mitigation measures, the project, either alone or in combination with the other projects assessed as part of the NIS process, would not undermine the

conservation objectives or have an adverse effect on the integrity of any European site. It follows that there is no significant effect on European sites in EIA terms either. As outlined in **Table 5.5** there is no hydrological connection to designated sites to the project site. There is a potential ecological connection via breeding hen harrier. As such, it is considered under the NIS.

None of the NHAs or pNHAs that overlap with SACs or SPAs are partially located outside those site boundaries, and there are no additional qualifying features. Therefore, the pNHAs have been indirectly but fully considered within the NIS, with same conclusion as for the European Sites (see **Section 5.3.1.2**).

The impact assessment in this chapter is therefore restricted to NHAs or pNHAs that do not overlap with SACs or SPAs. Those with connectivity to the project, and which therefore require consideration, are:

- Woodville Woods pNHA 000927
- Birr (Domestic Dwelling No. 2, Occupied) pNHA 000569
- Birr (Domestic Dwelling No.1, Occupied) pNHA 002058
- Lough Nahinch (Tipperary) pNHA 000936
- Pallas Lough pNHA 000916

Direct Effects

The project is not located within any nationally designated site (NHA or pNHA). Dovegrove Callows pNHA is located adjacent to the grid connection. **Table 5.6** outlines there will be no significant effects on this pNHA. Therefore, construction works will not directly impact on any of these sites designated for nature conservation.

Indirect Effects

Woodville Woods pNHA 000927 has an ecological connection via snipe. However, as there are not predicted to be any significant effects on this species population (see section on Birds below), there are no significant effects predicted for Woodville Woods pNHA.

Birr (Domestic Dwelling No. 2, Occupied) pNHA 000569 has an ecological connection via Leisler's bat. However, as there are not predicted to be any significant effects on this species population (see **Section 5.5.2.5** on Bats below), there are no significant effects predicted for Birr (Domestic Dwelling No. 2, Occupied) pNHA.

Birr (Domestic Dwelling No.1, Occupied) pNHA 002058 has an ecological connection via Leisler's bat. However, as there are not predicted to be any significant effects on this species population (see section on Bats below), there are no significant effects predicted for Birr (Domestic Dwelling No. 1, Occupied) pNHA.

Lough Nahinch (Tipperary) pNHA 000936 has an ecological connection via snipe. However, as there are not predicted to be any significant effects on this species population (see **Section 5.5.2.5** on Birds below), there are no significant effects predicted for Lough Nahinch (Tipperary) pNHA.

Pallas Lough pNHA 000916 has an ecological connection via mallard, teal and wigeon. However, as there are not predicted to be any significant effects on these species (see **Section 5.5.2.5** on Birds below), there are no significant effects predicted for Pallas Lough pNHA.

5.5.2.2 Habitats & Flora

Direct Effects

Construction of project infrastructure will result in direct habitat loss that is considered permanent (35-year lifespan of project). Some habitats will also be temporarily lost due to the construction of infrastructure e.g., site compounds. For details of habitat loss pertaining to habitats, see **Table 5.11**.

There will be no loss of Annex I habitats. There are no rare or threatened plant species within the study area and so none are predicted to be lost.

There will be no permanent loss of amenity grassland GA2, buildings and artificial surfaces BL3, cutover bog x scrub matrix PB4 x WS1, drainage ditches FW4, scrub WS1, scrub x hedgerow matrix WS1 x WL1, scrub x Immature woodland WS1 X WS2, stone walls and other stonework BL1, treeline WL2, or depositing/lowland rivers FW2.

Most of the terrestrial habitats projected to be lost either temporarily are of lower value and are common in the wider landscape. These include habitats such as amenity grassland GA2, buildings and artificial surfaces BL3, improved agricultural grassland GA1, and recolonising bare ground ED3.

Other habitats have higher biodiversity value, either due to their natural or semi-natural nature, plus ability to provide important habitat for animals. In the absence of mitigation, enhancement or compensation, the loss of (mixed) broadleaved woodland WD1, bog woodland WN7, mixed broadleaved/conifer woodland WD2, treelines WL1, hedgerows WL2, hedgerow x treeline WL1 x WL2, hedgerow x treeline x dense bracken WL1 x WL2 x HD1, hedgerow x treeline x dry meadows and grassy verges WL1 x WL2 x GS1habitats will have a significant negative effect at the local scale.

The loss of lower-value commercial conifer plantation WD4 could provide a positive benefit to biodiversity, as other habitats that are of greater value to biodiversity will be created in its place. Thus, the loss of conifer plantation WD4 and creation of open habitats is likely to have a significant, positive permanent effect at the local scale.

No riparian (FW2 or FW4) habitats will be lost. Likely effects on ecology relating to water quality within watercourses are detailed below (**Section 5.3.7**).

The overwhelming majority of habitats within the project site occur as large, contiguous areas that are also part of the wider landscape. Therefore, the project is not likely to significantly affect any habitats which could be acting as ecological stepping-stones or corridors for mobile species, given their widespread abundance both inside and outside the project footprint. The exceptions are linear hedgerows, treelines (and hedgerow x treeline mosaics) and watercourses, all of which act as ecological corridors. Without compensation, the loss of these linear hedgerow and treeline ecological corridors, will have a significant negative effect at the local scale, and could be contrary to Article 10 of the Habitats Directive. There will be no loss of riparian habitats and so there will be no effect on riparian habitats acting as ecological corridors.

Fossitt Code	Fossitt Name	Potential EU Annex I or PAW Affiliation?	Area (ha) / Length (m)			Where Loss Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	
WD1	(Mixed) Broadleaved Woodland	No	1.03 ha	-0.011 ha	0	Within the project site to accommodate bat-felling buffers, roads and hardstanding.
GA2	Amenity Grassland	No	0.14ha	0	-0.14ha	There will be a temporary loss to accommodate the installation of the grid connection route, but this will be immediately reinstated.
WN7	Bog Woodland	No	17.21 ha	-3.814 ha	0	Within project site to accommodate bat-felling buffers around T2 and access.
BL3	Buildings And Artificial Surfaces	No	2.97ha	0	-0.529 ha	Along the existing road network to accommodate the installation of the grid connection. However, this will be immediately reinstated.
			4970.63m	0	-4970.63m	
WD4	Conifer Plantation	No	37.54 ha	-9.982 ha	0	Within the project site.
PB4	Cutover Bog	No	30.31 ha	-0.805 ha	-15.953 ha	Within project site to accommodate roads. Temporary loss for site compound and spoil deposition.
PB4 x WS5	Cutover Bog X Recently-Felled Woodland	No	6.73 ha	-0.407 ha	0	Within the eastern section of the project site to accommodate roads.
PB4 x WS1	Cutover Bog X Scrub	No	0.57 ha	0	0	No loss.
HD1	Dense Bracken	No	1.41 ha	-0.397 ha	0	Within project site to accommodate roads.
			261.26m	-41.40m	0	
FW2	Depositing Lowland River	No	3359.95m	0	0	No loss.
FL4	Drainage Ditch	No	11914.54m	0	0	No loss
GS2	Dry Meadows and Grassy Verges	No	0.11ha	-0.0003 ha	0	Within project site to accommodate roads.
			1364.02m	0	0	

Fossitt Code	Fossitt Name	Potential EU Annex I or PAW Affiliation?	Area (ha) / Length (m)			Where Loss Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	
WL1	Hedgerow	No	9,362.46m	-48.73m	-58.73	Within project site to accommodate roads and bat felling buffers. Temporary loss to accommodate turning area.
WL1 x WL2	Hedgerow X Treeline	No	5,525.81m	-374.77m	-10m	Within project site to accommodate roads and bat felling buffers. Temporary loss to accommodate grid connection route.
WL1 x WL2 x HD1	Hedgerow X Treeline X Dense Bracken	No	210.23m	-206.72m	0	Within the project site to accommodate roads and bat felling buffers.
WL1 x WL2 x GS1	Hedgerow X Treeline X Dry Meadows and Grassy Verges	No	755.12m	-434.18m	0	Within project site to accommodate roads and bat felling buffers.
GA1	Improved Agricultural Grassland	No	94.26ha	-2.759 ha	-0.18 ha	Within project site to accommodate roads and substation. Temporary loss to accommodate site compound and turning area.
GA1 x PB4	Improved Agricultural Grassland X Cutover Bog	No	14.95 ha	-0.669 ha	0	Within project site to accommodate roads.
GA1 x HD1	Improved Agricultural Grassland X Dense Bracken	No	1377.80m	-1249.21m	0	No loss.
GA1 x WS1	Improved Agricultural Grassland X Scrub	No	5.90 ha	-0.003 ha	0	Within project site to accommodate roads.
WD2	Mixed Broadleaved/Conifer Woodland	No	70.17 ha	-9.193 ha	0	Within project site to accommodate roads and bat felling buffers.
ED3	Recolonising Bare Ground	No	2.37 ha	-0.74 ha	-1.171 ha	Within project site to accommodate roads. Temporary loss to accommodate substation, spoil deposition, and grid connection installation.
WD5	Scattered Trees and Parkland	No	0.946 ha	-0.035 ha	0	Within project site to accommodate roads.
WS1	Scrub	No	0.09ha	0	0	No loss.

Fossitt Code	Fossitt Name	Potential EU Annex I or PAW Affiliation?	Area (ha) / Length (m)			Where Loss Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	
WS1 x WL1	Scrub X Hedgerow	No	0.03 ha	0	0	No loss.
WS1 x WS2	Scrub X Immature Woodland	No	0.07 ha	0	0	No loss.
ED2	Spoil And Bare Ground	No	0.002 ha	-0.002	0	Within project site to accommodate roads
BL1	Stone Walls and Other Stonework	No	5,007.16m	0	0	No loss.
WL2	Treeline	No	1,000.09m	0	0	No loss.
GS4	Wet Grassland	No	6.32 ha	-0.192 ha	0	Within project site to accommodate roads.

Table 5.11: Habitat Loss

Indirect Effects

Potential indirect effects on habitats include smothering due to sediment wash-out from cleared areas, deposition areas or dewatering of excavations. The effects of this on water quality of aquatic habitats is considered below under 'Fisheries and Aquatic Ecology' at **Section 5.5.2.7**.

Compaction and excavation of soil adjacent to hedgerows WL1/treelines WL2 (including matrices of same) habitats has potential to cause damage and disease of plants. Dust can also smother photosynthetic activity, although it is unlikely dust production will reach levels that will have a discernible effect on plant growth. Without mitigation such as root protection areas, compaction and excavation could have significant negative effects at the local scale on hedgerow WL1 and treeline WL2 habitats.

Although none were recorded at the project site, without biosecurity measures, invasive or non-native plants could spread to the project site via plant machinery and vehicles, which could have a negative effect on sensitive habitats.

5.5.2.3 Birds

Direct Effects

Potential direct construction effects include nest damage or destruction, habitat loss and disturbance/displacement.

Nest Damage or Destruction

No nests for IEF bird species were recorded by surveys. However, it is possible that these and other bird species could start nesting within the project footprint prior to construction. Damage or destruction to active bird nests of any species could contravene Section 22 of the Wildlife Acts (1976 and as amended, 2000). However, good practice measures will avoid the likelihood of damage, destruction or disturbance to occupied bird nests during the construction phase, if confirmed breeding.

Habitat Loss

Construction of the project will lead to a total loss of 43.47ha of habitats. Most of the habitats to be lost are commercial conifer plantation WD4 (9.982ha) and mixed broadleaved/conifer woodland WD2 (9.193ha) habitats, which are generally of lower value to biodiversity.

As the grid connection will be almost entirely buried underground within the existing road network, there will be no permanent habitat loss. At the proposed substation site, only low value improved agricultural grassland GA1 There is not predicted to be any permanent habitat loss at the haul route, consisting almost entirely of road widening (on amenity grassland GA2), temporary removal of urban trees, and/or temporary removal of street furniture.

Based on the results of the surveys between May 2020 and March 2023 none of the habitats due to be lost are of particular importance for sensitive IEF bird groups such as raptors, waders or wintering wildfowl because:-

- No aggregations of swans or geese were recorded within 500m of the project site;
- No nocturnal foraging plovers (European golden plover or northern lapwing) were consistently recorded using the habitats within 500m of the project site;
- No breeding colonies of gull species recorded;
- Other wildfowl, wader and raptor species were generally recorded in low numbers, preferring to use other habitat available in the wider area, and which in any case do not occur in mature conifer plantation and other woodland, the main habitats on site, with the exception of woodcock;
- No hen harrier, or merlin were recorded roosting during surveys;
- No barn owl nests or roosts were recorded; and,
- No evidence was recorded of breeding raptors, waders or wildfowl near proposed infrastructure, with the exception of the below.

There was evidence of confirmed or probable breeding for the following sensitive IEF bird species:

- Northern lapwing have been recorded breeding c. 410m northwest of turbine T8 in 2021 and 2022 (one adult and two chicks; outside of the project site);
- Peregrine falcon were suspected to breed within [redacted] c. 1.3km southeast of turbine T7 in 2022 (outside of the project site); and,
- Eurasian woodcock are thought to have at least one possible but unconfirmed breeding territory c. 500m southeast of turbine T3 in 2022 (within the project site).
- Therefore, the only IEF species close enough to the project footprint that could suffer direct habitat loss are breeding Eurasian woodcock (loss of mixed broadleaved/conifer woodland). Thus, in the absence of mitgatory compensation, the loss of breeding habitat could have a significant, long-term effect on breeding Eurasian woodcock at the local scale. However, as no confirmed breeding was detected over three years of surveys, this is considered unlikely.

The loss of woodland could result in the loss of woodland bird territories. While not recorded during surveys, there are desktop records of amber-listed willow warbler and goldcrest. They are amber-listed on the basis of having an unfavourable conservation status in Europe, although they have a favourable conservation status in Ireland. Therefore, the loss of breeding territories would not have a perceptible effect on populations beyond the project.

Northern lapwing and peregrine falcon do not breed within the project site and it is unlikely that the habitats present comprise an important part of their foraging areas, for example neither species occurs in woodland (although peregrine may hunt over it).

No significant habitat loss effects during construction are predicted for IEFs barn owl, black-headed gull, common gull, common kestrel, common kingfisher, common ringed plover, common snipe, Eurasian curlew, Eurasian teal, Eurasian wigeon, European golden plover, great cormorant, great white egret, greylag goose, hen harrier, herring gull, lesser black-backed gull, little egret, mallard, merlin, mute swan, northern lapwing, peregrine falcon, sandwich tern and whooper swan.

Disturbance/Displacement

Potential effects of noise and visual disturbance could lead to temporary displacement or disruption of foraging/roosting/breeding birds. The significance of the effect depends on the timing of potentially disturbing activities, the extent of spatial/temporal displacement and the availability of suitable displacement habitats in the surrounding area. Behavioural sensitivity to disturbance also varies between species.

Significant disturbance/displacement effects are unlikely to occur along the grid connection or substation, with underground cables proposed to be buried within or immediately adjacent to existing roads or heavily modified cultivated habitats (e.g. agricultural grasslands), and the substation to be located in agricultural grassland. Any disturbance/displacement from construction activities while the cable is being buried within the road is unlikely to be significantly greater than that from typical traffic levels. The grid connection does not pass through any national nature conservation sites designated for their ornithological interest but runs immediately adjacent to Dovegrove Callows pNHA. However, the grid connection will be confined to the existing road network, and construction of same will not be undertaken during the winter season to ensure that disturbance/displacement of Greenland white-fronted goose is avoided.

Potential effects due to the project itself are likely to be greatest during the breeding season (predominantly between March and August, depending on the species under consideration). However, significant effects for most IEF bird species are unlikely. This is because they were not recorded breeding (or probably breeding) within the relevant ZoI, all were recorded in low numbers and all the habitats found within the project occur frequently in the wider area. Exceptions are outlined below.

To avoid disturbing the following bird species, buffers are required:-

- Eurasian woodcock: no published buffer exists, but a 500m separation distance is likely sufficient as the maximum buffer required for other wader species is 500m (Goodship & Furness, 2022);
- Northern lapwing: a buffer of up to 108m is required (Hötker et al., 2006); and,
- Peregrine falcon: a buffer up to 750m is required (Goodship & Furness, 2022).

Thus, disturbance/displacement of breeding Eurasian woodcock, northern lapwing, and peregrine falcon is unlikely to occur as breeding activity was already located beyond the buffers required to avoid disturbance from construction activities for each of these species.

Disturbance to foraging and roosting wintering birds is considered even less likely due to the low numbers of sensitive birds recorded within and surrounding the project (e.g. no swans or geese were seen within 500m of the project over three years of surveys, no roosting hen harrier or merlin were recorded within 2km of the project and only a small number of nocturnally foraging northern lapwing were recorded within 500m of the project on a single occasion) and so no significant effects are likely.

Surveys did not search for swans or geese along the grid connection and so there is the potential for disturbance/displacement effects on the Dovegrove Callows SPA, which is discussed in the NIS.

Many of the IEF species not named above are in any event, not vulnerable to construction related disturbance in the winter, either due to low sensitivity to

disturbance or due to lack of sensitive areas, such as roosts or important foraging areas (barn owl, black-headed gull, common gull, common kestrel, common kingfisher, common ringed plover, common snipe, Eurasian curlew, Eurasian teal, Eurasian wigeon, Eurasian woodcock, great cormorant, great white egret, herring gull, lesser black-backed gull, little egret, mallard and peregrine falcon) or do not occur in Ireland in the winter (sandwich tern).

The potential effects associated with construction activities are only likely to occur for as long as the construction phase continues and are thus generally short-term in nature. The exception is if the local population becomes extinct during the period of disturbance and replacement through recruitment or re-colonisation does not occur. None of the species recorded with breeding populations are rare enough for this to be a risk.

Based on the above, unmitigated disturbance/displacement effects during construction are unlikely to be significant for the following IEF bird species: barn owl, black-headed gull, common gull, common kestrel, common kingfisher, common ringed plover, common snipe, Eurasian curlew, Eurasian teal, Eurasian wigeon, Eurasian woodcock, European golden plover, great cormorant, great white egret, greylag goose, hen harrier, herring gull, lesser black-backed gull, little egret, mallard, merlin, mute swan, northern lapwing, peregrine falcon, sandwich tern and whooper swan.

Even though significant effects are not likely, the risk of construction disturbance will be further mitigated by avoiding sensitive areas through the implementation of appropriately defined buffer zones and by timing construction activities to avoid periods where sensitive species are present (if and where possible), such as the breeding season. A range of good practice measures have therefore been proposed to mitigate for potential construction disturbance effects (see **Section 5.5.2**).

Indirect Effects

If the construction of the project led to pollution of wetland habitats and/or dewatering of groundwater-dependent habitats within nearby designated sites for birds, it could result in indirect habitat loss for qualifying bird species. The same is true for wetland sites that could be used by bird species from nearby designated sites, even if those wetland sites are not designated themselves.

5.5.2.4 Terrestrial Mammals (Excluding Bats)

Direct Effects

Potential direct effects on mammals during construction include effects on dwellings (resting, hibernating or breeding sites), where the dwelling could be destroyed and/or both adults and juveniles could be killed or injured. Tree/vegetation removal could affect arboreal species (e.g. pine marten and red squirrel) and ground works such as excavation or piling could affect ground-dwelling species (e.g. badger and hedgehog).

A suspected badger sett was recorded c. 32m from the grid connection. No mammal dwellings were recorded within the vicinity of the works footprint, so there is unlikely to be disturbance during sensitive periods. The ZoI for significant effects is 50m for red squirrel dreys (NatureScot, 2020), 100 m for pine marten dens (VWT, 2015), 50m for badger setts during the breeding season and 30m outside of the breeding season.

Therefore, there are no likely direct effects through the loss of dwelling places for badger, red squirrel or pine marten.

Fallow deer prefer diverse woodland habitats such as those near pasture land. Herds tend to have one or more favoured core areas which they move between. They like quiet areas of dense cover for resting where they can remain undisturbed. As construction will be undertaken during daylight hours, the risk of disturbance is limited to physical disturbance of the young, rather than adult deer. As deer can move freely, it is unlikely they will suffer mortality from construction activities. Direct effects on fallow deer are assessed as not significant.

Irish hares do not inhabit single dwellings, but rest in 'forms' (VWT, 2023). Young hares hide in long grass in the day and are fed at dusk. As construction will be undertaken during daylight hours, the risk of disturbance is limited to physical disturbance of the young, rather than the mother. As young hares can move freely, it is unlikely they will suffer mortality from construction activities. Direct effects on Irish hare are assessed as not significant.

Hedgehogs hibernate under whatever materials and hiding places they can find, using dead leaves, twigs, feathers and log piles (VWT, 2023). During hibernation, hedgehogs enter a state of torpor from October/November to March/April. This immobility makes them very vulnerable to disturbance. Significant direct effects to hedgehogs could occur at the local scale via destruction of hibernacula and direct mortality, if construction takes place during the winter months (i.e. in the absence of mitigation).

Indirect Effects

Indirect effects on mammals during construction could result in the loss of potential foraging, commuting and sheltering habitat.

Tree removal may reduce habitat availability for arboreal pine marten and red squirrels but could offer new foraging opportunities for badger, Irish hare and hedgehog. It is unlikely that the loss of conifer plantation and broadleaved woodland will result in significant effects on pine marten and red squirrel. Pine marten hunt over a large area and there are abundant displacement habitats available both within and outside the study area. There are also abundant woodland habitats for red squirrel as well. The removal of any other habitats used by badger, hedgehog and Irish hare are also widespread and common in both the study area and wider landscape. Therefore, no significant indirect effects due to the loss of potential foraging, commuting and sheltering habitat are likely.

Disturbance from noise, vibration, machinery movement and increased human presence could also displace foraging individuals or cause breeding mammals to abandon natal sites.

No badger, pine marten and red squirrel dwellings were recorded within 100m of the project site (wind farm) footprint. There are also abundant displacement foraging habitats for these species in the wider area. As explained in the previous section under direct effects, breeding Irish hares are unlikely to suffer any significant effects due to disturbance from construction activities.

Hibernating hedgehogs could be disturbed by construction activities, causing them to wake from hibernation prematurely. This could cause mortality, especially if sufficient food is unavailable. For hedgehog, in the absence of mitigation, there could

be significant indirect effects due to disturbance at the local scale. For badger, pine marten, red squirrel and Irish hare, no significant effects are likely.

5.5.2.5 Bats

Direct Effects

Direct effects on bats during construction of the project include vegetation removal or removal/modification of existing structures, which could result in a loss of potential roost sites.

No confirmed bat roosts were recorded within the project within the works footprint. Thus, no direct effects on potential bat roosts are likely.

Along the grid connection, cables will be laid within the existing road network, with only an area of recolonising bare ground and amenity grassland outside of this (both of which are of negligible roosting value). Where cables will go over bridges, there is the potential for bats to be disturbed at aquatic surveys sites; however, no roosts were identified and so no direct effects on potential bat roosts are likely. No other potential bat roosts are located within the works footprint along the grid connection.

Along the haul route, the only accommodation works that could potentially affect bat roosts is the trimming of trees. No structures with bat roost potential will be affected. There are no trees requiring trimming along the haul route that were classed as having potential bat roost features. Again, no direct effects on bat roosts are likely.

Indirect Effects

Indirect effects could include the loss of foraging/commuting habitats or features. If lighting is used for night-time working, this could also disturb roosting and foraging bats. However, no night-time working is proposed as part of embedded mitigation measures, so no disturbance is likely (see **Section 5.6.1.7**). Further, of the species utilising the project site, most (common pipistrelle, soprano pipistrelle and Leisler's bat) are less sensitive to light pollution than the less commonly recorded species including brown long-eared bat and *Myotis* species.

Surveys confirmed that linear features such as forest edges, hedgerows, treelines and watercourses were used by commuting and foraging bats, but they were only used regularly by common pipistrelle, Leisler's bat and soprano pipistrelle. The removal of such features could disrupt connectivity significantly throughout the project.

In the absence of mitigation/compensation, vegetation removal has the potential for significant indirect effects on common pipistrelle, Leisler's bat and soprano pipistrelle at the local scale.

5.5.2.6 Other Protected Fauna

Direct Effects

Direct effects on amphibians such as common frog and smooth newt could include destruction of breeding sites and mortality from construction activities.

Spawning common frog could be affected where breeding opportunistically in wet habitats. In the absence of mitigation, significant negative effects for spawning common frog could occur at the local scale as a result of mortality at temporary breeding sites. It is unlikely there will be significant mortality effects for adult smooth

newt as the species can quickly colonise new waterbodies.

Indirect Effects

Indirect effects on amphibians could include loss of foraging habitats.For amphibians, habitats that could be used for foraging include drainage ditches (FW4), and wetter parts of improved agricultural grassland (GA1) and wet grassland (GS4). All these habitats are widely available in the study area and wider landscape. The habitat loss is small relative to the available habitat and not in proximity to a breeding site for these species.

Therefore, it is unlikely that any significant adverse effects will occur for common frog or smooth newt.

5.5.2.7 Fisheries & Aquatic Ecology

Direct Effects

Potential direct effects could include the loss of natural watercourses due to watercourse crossings and the placement of culverts, water quality degradation, the diversion of natural watercourses, increased suspended solids/hydrocarbons/cement leachate within watercourses inside the project site and the loss of freshwater habitats due to removal or blockage of watercourses.

There are no IEF aquatic features located within the project boundary and so direct effects on brown trout, European eel and white-clawed crayfish are unlikely.

There are no otter holts within 150 m of any aquatic survey site, so no significant direct effects of disturbance to breeding/resting otters are likely.

Indirect Effects

Indirect effects include the release of suspended solids (which could be acidic due to presence of conifer plantation), hydrocarbons or cerement leachate, which could reach downstream receptors such as brown trout and white-clawed crayfish via hydrological connections. This could reduce the water quality, which could have negative effects on aquatic receptors.

Salmonids require very high levels of water quality to complete their life cycles. High levels of suspended solids can increase turbidity (inhibits respiration) and siltation (affects riverbed substrate composition, reducing spawning and fry survival). Suspended solids typically contain phosphorous or hydrocarbons that can lead to eutrophication and reduced oxygen levels (a cause of death for all salmonid and lamprey life stages). The release of even small amounts of hydrocarbons (e.g. fuel spills) can reduce oxygen levels, affecting salmonid and lamprey populations. Acidification of streams because of conifer plantations and associated forestry operations (Ormerod, Donald and Brown 1989) can also result in the reduction of invertebrate (Ormerod, Rundle, et al. 1993) and fish populations (Harrison, et al. 2014).

Habitat availability and quality are linked with survival rates of salmon fry and parr (Kalleberg, 1958), with small amounts of debris entering a watercourse important for vulnerable life stages of salmon and lamprey potentially leading to negative effects on juvenile survival and habitat use.

Accidental fuel spills, which could occur during construction, can release hydrocarbons, which can bioaccumulate in salmonids (McCain, et al., 1990), leading

to loss of condition. As salmonids are known to avoid areas containing hydrocarbons (Maynard & Weber, 1981), fuel spills can lead to effective loss of habitat and/or migration routes. Fuel spills are unlikely to occur ate all, and even if one did occur, it is unlikely to be a scale which would have an appreciable effect on salmonid habitats. However, this risk cannot be completely discounted and needs to be considered when designing mitigation for the project.

Acidification of watercourses could also occur if felling of conifer plantation occurs near watercourses. Changes in pH could lead to fish kills and a reduction in recruitment, leading to population declines.

A decrease in fish stocks can also lead to reduced prey availability to otter and kingfisher.

Unmitigated secondary effects are therefore likely to be significant at the county/regional scale for brown trout, white-clawed crayfish, European eel, and otter.

5.5.3 Potential Operational Phase Effects

Direct effects are likely to occur due to the operation of the turbines, hardstands, access tracks and substation only. Some mitigation measures will also act as sources of operational phase effects. This includes bat mitigation buffers, where the area surrounding certain turbines must be kept free from any forestry/woodland/ hedgerows/treelines throughout the entire operational phase.

The grid connection will be buried underground and avoids sensitive IEFs.Once installed, there are no likely significant operational effects from the grid connection.

The proposed lifespan of the project is 35-years and so operational effects will be long-term.

Potential effects resulting from the operational phase are as follows.

Direct effects:

- Collision with turbines and barotrauma for bats; and,
- Collision with turbines for birds.

Indirect effects:

- Collection/drainage of surface water runoff;
- Operational activities and servicing (a few visits per year with a small number of human personnel);
- Displacement effect of operating turbines; and,
- Displacement effects of substation lighting.

5.5.3.1 Designated Sites

SACs and SPAs are considered fully in the NIS) . No adverse effects on the integrity of SACs and SPAs or any other European site were identified and therefore, in an EIA sense, there are no likely significant effects on these designated sites (**Section 5.3.1.1**).

Nationally designated sites (not included within an SAC and SAC) that are within the ZoI with connectivity are Woodville Woods pNHA, Birr (Domestic Dwelling No. 2, Occupied) pNHA, Birr (Domestic Dwelling No.1, Occupied) pNHA, Lough Nahinch (Tipperary) pNHA, and Pallas Lough pNHA.

Direct Effects

The project is not located within any NHAs or pNHAs, so no significant direct effects are likely.

Birr (Domestic Dwelling No. 2, Occupied) pNHA and Birr (Domestic Dwelling No.1, Occupied) pNHA are within the core foraging distance for Leisler's bats, the species for which these are designated. As such, there could be significant effects due to collision with turbines.

Woodville Woods pNHA and Lough Nahinch (Tipperary) pNHA are designated for birds, so there could be significant effects due to collision with turbines for common snipe. The same is true with Pallas Lough pNHA so there could be significant effects due to collision with turbines for common mallard, teal and wigeon.

For snipe the number of predicted collisions per year is 0.4485.As there is no information on the populations of snipe present at Woodville Woods pNHA or Lough Nahinch (Tipperary) pNHA a quantitative assessment of the effects of collision risk on the snipe population of these pNHAs is not possible.

For mallard, teal and wigeon, the number of predicted collisions per year is 0.0957, 1.566 and 0.025 respectively. As there is no information on the populations of mallard, teal and wigeon present at Pallas Lough pNHA, a quantitative assessment of the effects of collision risk on the duck populations of the pNHA is not possible.

In absence of any quantitative data to suggest otherwise, without mitigation, and assuming that the birds observed at the project form part of the pNHA populations, there could be significant, negative, long-term effects on Woodville Woods pNHA, Lough Nahinch (Tipperary) pNHA, and Pallas Lough pNHA at the national scale due to collision of snipe, mallard, teal and wigeon with wind turbines.

Indirect Effects

No significant direct effects on otters are predicted (see **Section 5.5.3.4** on Mammals below) and so therefore there can be no effects on Royal Canal pNHA.

As there are no NHAs or pNHAs hydrologically connected to the project, significant indirect effects are not considered likely.

5.5.3.2 Habitats and Flora

Direct Effects

Potential direct effects relate to the clearance of vegetation to mitigate for collision effects on bat species. These effects have already been assessed under construction phase effects.

Indirect Effects

There will be no significant, indirect, operational effects on any habitats during the operational phase.

5.5.3.3 Birds

Direct Effects

Potential direct effects include:

- Disturbance / displacement and barrier effects; and,
- Collision with wind turbines.

There is no statistical model available for the assessment of collision mortality of birds with guyed meteorological (met) masts. However, as there is only a single met mast within the project and low avian flight activity levels, the turbines themselves are likely to represent the key source of collision mortality for birds. No operational effects are likely for the grid connection, which will be buried underground and located almost entirely within or immediately adjacent to the existing road network. The substation will also be a low, stationery object and so is considered to present a negligible source of collision to birds. The remaining project elements are considered in further detail below.

Disturbance/Displacement & Barrier Effects

The operation of wind turbines and associated human activities for maintenance purposes (including maintenance of vegetation-free areas surrounding turbines as part of bat mitigation) both have the potential to cause disturbance and displace birds from the project site. Disturbance effects during the operational phase may be less than during the construction phase, as species may become habituated to wind turbines and disturbance due to human activities would be considerably reduced.

Studies have shown that, in general, species are not disturbed beyond 500m to 800m from wind turbines (e.g. (Drewitt & Langston, 2006; Goodship & Furness, 2022), and references therein; (Pearce-Higgins, Stephen, Langston, Bainbridge, & Bullman, 2009; Hötker, Thomsen, & Jeromin, 2006)) and, in some cases, birds do not appear to have been disturbed at all (e.g. Devereux, Denny, & Whittingham, 2008; Douglas, Bellamy, & Pearce-Higgins, 2011; Fielding & Haworth, 2013; Whitfield, Green, & Fielding, 2010).

Individual turbines, or the wind farm as a whole, may present a barrier to the movement of birds, restricting or displacing birds from much larger areas. The effect this would have on a population, if affected, could be subtle, and may be difficult to predict. If birds regularly must fly over or around obstacles or are forced into suboptimal habitats, this may result in greater energy expenditure. By implication, this will reduce the efficiency with which they accumulate reserves, potentially affecting their survival or breeding success. However, logically, barrier effects can only be possible if there is clear evidence birds are regularly flying through a site, or regularly using the habitats within a site, which are optimal for foraging, breeding or roosting.

Disturbance/displacement and barrier effects during operation may affect species in the breeding season or roosting and foraging species outside of the breeding season, within the relevant parts of the study area, i.e. close to the proposed wind turbines. Disturbance relating to the substation and access tracks is less likely to be significant during operation.

As such, the assessment concentrates on Eurasian woodcock, which may possibly breed within the project site. Whilst other IEF bird species may suffer some disturbance from wind turbines whilst foraging, effects are not likely to be significant given the wide availability of more optimal, alternative foraging habitats located outside the project site and the lack of breeding and/or communal roosting within or nearby the project (see **Section 5.5.2.3**).

Other species (barn owl, black-headed gull, common gull, common kestrel, common kingfisher, common ringed plover, common snipe, Eurasian curlew, Eurasian teal,

Eurasian wigeon, European golden plover, great cormorant, great white egret, greylag goose, hen harrier, herring gull, lesser black-backed gull, little egret, mallard, merlin, mute swan, northern lapwing, peregrine falcon, sandwich tern and whooper swan) are therefore not considered in further detail here.

Eurasian Woodcock

In the absence of mitigation/compensation, there could be significant, negative, long-term disturbance/displacement effects at the local scale for foraging Eurasian woodcock. This is a precautionary assumption, as even though displacement habitats in the wider landscape are widely available, they may be less suitable than those within the project site and could already be at carrying capacity.

Also of importance are the potential effects of disturbance/displacement on nesting Eurasian woodcock.

While no confirmed nests were recorded during surveys, Eurasian woodcock are thought to have at least one possible breeding territory c. 500 m southeast of turbine T3.

As mentioned before, no published disturbance-free buffer exists for breeding Eurasian woodcock, but a 500m separation distance is likely sufficient, as the maximum buffer required for other wader species is 500m (Goodship & Furness, 2022). Thus, disturbance/displacement of breeding Eurasian woodcock is unlikely to occur, as breeding activity was located at 500m from proposed operational activities. Similarly, this species was only observed once over three years of dedicated bird surveys and was categorised as 'possibly breeding'.

Hötker et al. (2006) found that ten out of 13 no. wind farm studies assessed had evidence for a barrier effect on wader movements, although this was statistically non-significant. No flight lines were recorded for Eurasian woodcock at the project site . Consequently, this species does not seem to be making regular flights across the Project, suggesting that it is unlikely that barrier effects will occur. If these species start breeding elsewhere within the project, then barrier effects could occur, although they are likely to be only negligible and at the local scale, as there is plenty of suitable breeding and foraging habitat within and outside of the project site.

Whilst acknowledging that there are knowledge gaps regarding disturbance/displacement and barrier effects in the scientific community generally, considering the habitats present and the concentration of flights within one area of the project site, it is likely that any barrier effects on Eurasian woodcock during the operation of the Project will not be significant.

Collision with Wind Turbines

Collision of a bird with turbine rotors is almost certain to result in the death of the bird. In low density populations (e.g. raptors) this could have a greater negative effect on the local population than in higher density populations (e.g. passerines) because a higher proportion of the local population would be affected in a low-density population (Beston, Diffendorfer, Loss, & Johnson, 2016). Larger birds such as raptors also live longer and have much slower reproductive rates than passerines, which can also increase the significance of the impact of collisions on the relevant population. The frequency and likelihood of a collision occurring depends on several factors which include aspects of the size and behaviour of the bird (including their use of a site), the nature of the surrounding environment, and the structure and layout of the wind

turbines.

Collision risk is perceived to be higher for birds that spend much of the time in the air, such as foraging raptors and those that have regular flight paths between feeding and breeding/roosting grounds (e.g. wildfowl). The risk of bird collisions at wind farms is greatest in areas where large concentrations of birds are present (such as on major migration routes), and in poor flying conditions, such as rain, fog, strong winds that affect birds' ability to control flight manoeuvres, or on dark nights when visibility is reduced (Langston & Pullan, 2003; Drewitt & Langston, 2006,and references therein). Birds may also be more susceptible if the wind farm is in an area of high prey density. For diurnal foraging raptors, the proximity of structures on which to perch can increase the likelihood of collision with wind turbines (e.g. Percival, 2005, and references therein).

It should be noted that operational disturbance and collision risk effects are mutually exclusive in a spatial sense i.e. a bird that avoids the wind farm area due to disturbance cannot be at risk of collision with the turbine rotors at the same time. However, they are not mutually exclusive in a temporal sense i.e. a bird may initially avoid the wind farm but habituate to it, and would then be at risk of collision.

It is also recognised that habitat changes due to the project and ongoing forestry management can change levels of risk e.g. birds of open ground may colonise recently felled areas and birds which favour old growth forests will colonise if there is no felling.

Passerines nesting within a wind farm site would be expected to be regularly flying between wind turbines and could therefore be expected to be most at risk of collision. However, passerines tend to fly below Potential Collision Height (PCH) and evidence suggests that the species of passerines present within the locality of the project collide with wind turbines relatively infrequently. Moreover, most of the species concerned are of low or negligible conservation value or have relatively large populations and high reproductive rates. Collision is therefore mainly considered in relation to species of high sensitivity, e.g. target raptor species and species not particularly manoeuvrable in flight, such as geese and swans.

Species with sufficient data (minimum of five flights and/or minimum of 10 no. birds per season) to undertake CRM are considered at risk of collision with the proposed wind turbines at the site. IEF bird species that were subject to CRM are as follows:-

- black-headed gull;
- common kestrel;
- common snipe;
- European golden plover;
- Eurasian teal;
- Eurasian wigeon;
- great cormorant
- hen harrier;
- northern lapwing;
- mallard;
- peregrine falcon; and
- whooper swan.

For all other primary target species (great white egret, greylag goose, little egret, merlin and ringed plover), the number of flights within the Collision Risk Zone (CRZ), i.e.

flights through the Wind Farm Polygon (WP) at PCH, was so low that CRM was not warranted and collision risk is considered negligible i.e the effect of collision will be not significant for these species.

Due to the lack of regular flight lines across the viewsheds a random (bird occupancy method) CRM was considered suitable and used for all IEF birds subject to modelling.

The results of the CRM are described below for each of the species modelled, along with an assessment of whether predicted collision rates are likely to be significant. Further information about predicted collision rates is provided in the avian CRM report (**Annex 5.7**).

Rationale for Prediction of Effect

Without application of methods such as Population Viability Analysis (PVA) it is not known to what extent the populations of target species can sustain additional levels of mortality. Historically, guidance from Percival (2003) stated that any impact not increasing adult mortality by more than 1% of the existing background mortality rate is insignificant. However, it should be noted that this method is highly precautionary when applied to non-breeding populations, as it uses the highest survival rates (i.e., for adult birds) for context. Where survival rates are high, a smaller number of collisions with turbines are needed for the excess mortality to be >1% of the background levels, i.e., the threshold for a potentially significant effect. Using adult survival rates (which are higher than juvenile survival rates), makes it more likely to identify a potentially significant effect of turbine collisions on the avian population under consideration. Similarly, all flight lines within 500m of the turbines are considered for modelling, which is likely to produce an overestimate of the true collision risk. Avoidance rates used are highly precautionary and the default 98% avoidance rate used (see **Annex 5.7**) is not based on empirical evidence. The 98% figure comes from the fact that "in the majority of cases where avoidance rates have been derived from empirical data, the avoidance rates are higher than 95%" (NatureScot, 2010). Again, this is likely to produce an overestimate of true collision risk. Therefore, as Percival (2003) has been superseded by NatureScot (2018), which does not use the 1% criterion to determine the significance of collision effects, it has not been relied upon in this assessment. Instead, the % increase has been presented on existing background mortality rates and greater reliance has been placed on the ecology of the species, current status and trends, as well as empirically documented cases of collision. Significant negative effects are only likely where the number of predicted deaths due to the project are likely to result in appreciable differences to projected rates of population decline or recovery.

Black-headed Gull

777 no. black-headed gull collisions have been reported at European wind farms between 2002-2023 (Dürr, 2023), with 12 no. in Great Britain (GB) and none in Ireland. Although there may be other unpublished reports of collisions of this species, it seems that collision is relatively common within Europe but less so within GB and Ireland.

Collision risk analysis has been carried out on flight activity data using data from the 2021 breeding season, 2021/22 non-breeding season, 2022 breeding season and 2022/23 non-breeding season. Based on these data, 101 no. flight lines (involving 258 no. flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 1.1463 (approximately one collision every 0.87 years and 40 collisions over the 35-year

lifespan of the project) predicted. This has been assessed in the context of the Republic of Ireland (ROI) and county/regional population.

For information on the populations see **Table 5.10.** There are no nationally designated nature conservation sites for black-headed gull.

The predicted annual mortality has been put in the context of background annual mortality for adults (10% for adults, (BTO, Bird Facts, 2023)).

Based on the current population trends for breeding black-headed gull (-58% over the last 25 years; Gilbert et al., 2021), the ROI population and county / regional populations could be smaller by tens of thousands and hundreds of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 1.1463 no. birds per year would result in the following:-

- ROI population: 0.06% increase on background mortality for breeding and wintering populations, respectively; and,
- County/regional population: 2.16% and 4.23-1.99% increase on background mortality for breeding and wintering (IWeBS and inferred winter population shown) populations, respectively.

Therefore, superficially, collision could have a significant effect at the county/regional scale for the breeding and wintering populations. However, this is likely to represent an overestimate of true collision risk, as the collision risk modelling is based on several precautionary assumptions. For example, background mortality has been based on adult survival rates, which are a lot higher than juvenile survival rates. Most adults tend to have a much greater survival rate than juveniles, as they are more experienced and can avoid sources of mortality, such as predators more effectively. Consequently, the number of deaths predicted by collisions with turbines will be higher relative to background mortality for adults vs. juveniles. When juvenile survival rates are used, there is a 0.39% and 0.76-0.36% increase on background mortality for breeding and wintering (IWeBS and inferred winter population shown) populations, respectively.

As the populations are likely to contain a mixture of adults and juveniles, the true effect of collision could still likely be a significant effect at the county/regional scale for the breeding and wintering populations, depending on the precise ratio of adults to juveniles in the population. If there are more juveniles in a population, it is much more likely that the true effects of collision will be much lower. Therefore, the realised effect of collision is unlikely to be significant for the ROI population and is unlikely to be significant for the county / regional population either.

Also, the likely maximum number of deaths due to the project would only result in a marginal increase in the rate of population decline for the ROI or county / regional winter population.

Common Kestrel

Eight hundred and sixty-seven common kestrel collisions have been reported at European wind farms between 2002-2023 (Dürr, 2023), with two in GB (both in Scotland). There is only evidence of two birds being killed by wind turbine strike in Ireland between 2007 and 2019 (NPWS, 2019). Although there may be other, unpublished reports of collisions of this species, it seems that kestrel collisions in Ireland at least, are relatively uncommon events.

Collision risk analysis has been carried out on flight activity data using data from the breeding 2021,non-breeding 2021/22, breeding 2022 and non-breeding 2022/23 seasons. Based on these data, 62 no. kestrel flight lines (involving 62 no. flights) were recorded at PCH within the CRZ during surveys.

Assuming a 95% avoidance rate, there was a mean annual collision rate of 0.6692 (approximately one collision every 1.49 years and 23 over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI and county/regional population. There are no nationally designated nature conservation sites for common kestrel.

The predicted annual mortality has been put in the context of background annual mortality for adults (31% for adults, (BTO, Bird Facts, 2023)).

Based on the current population trends for common kestrel (-53% over the last 25 years; Gilbert et al., 2021), the ROI population and county / regional populations could be smaller by tens of thousands and hundreds of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 0.6692 no. birds per year would result in the following:

- ROI population: 0.02% increase on background mortality for breeding/wintering population; and,
- county/regional population: 0.56% increase on background mortality for breeding/wintering population.

The likely maximum number of deaths due to the project would only result in a marginal increase in the rate of population decline for the ROI or county / regional winter population.

Therefore, collision is unlikely to have a significant effect at the ROI or county/regional scale for the breeding and wintering populations.

Common Snipe

Nineteen common snipe collisions have been reported at European wind farms between 2002-2023 (Dürr, 2023), with one in GB (Wales) and none in Ireland. Although there may be other, unpublished reports of collisions of this species, it seems that common snipe collisions are relatively uncommon events.

Collision risk analysis has been carried out on flight activity data using data from the breeding 2021, non-breeding 2021/22, breeding 2022 and non-breeding 2022/23 seasons. Based on these data, 26 no. snipe flight lines (involving 40 no. flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.4485 (approximately one collision every 1.49 years or 15.7 collisions over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI and county/regional population. For information on the populations see **Table 5.10**. There are no nationally designated nature conservation sites for common snipe with population level information.

The predicted annual mortality has been put in the context of background annual mortality for adults (52% for adults, (BTO, Bird Facts, 2023)).

Based on the current population trends for breeding black-headed gull (-50% over the last 25 years; Gilbert et al., 2021), the ROI population and county / regional

populations could be smaller by thousands and hundreds of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 0.4485 no. birds per year would result in the following:

- ROI population: 0.01% increase on background mortality for breeding/wintering population; and,
- county/regional population: 0.36% increase on background mortality for breeding/wintering population.

The likely maximum number of deaths due to the project would only result in a marginal increase in the rate of population decline for the ROI or county / regional winter population.

Therefore, collision is unlikely to have a significant effect at the county/regional scale for the breeding and wintering populations.

European Golden Plover

47 no. European golden plover collisions have been reported at European wind farms between 2002-2023, none of which were in the GB or Ireland (Dürr, 2023). Although there may be other, unpublished reports of collisions of this species, European golden plover collisions nevertheless appear to be a relatively uncommon event.

Collision risk analysis has been carried out on flight activity data from the 2021 breeding, 2021/22 non-breeding and 2022/23 non-breeding seasons. Based on these data, 16 no. European golden plover flight lines (involving 6,526 flights) were recorded at PCH within the CRZ during surveys.

Assuming an avoidance rate of 99.8%, there was a mean annual collision rate of 7.74 collisions (approximately one collision every 0.1 years and 271 collisions over the 35-year lifespan of the project) predicted. As outlined in **Annex 5.7**, a 99.8% avoidance rate has been applied, which reflects the empirical evidence from four UK wind farms. This evidence shows the default 98% avoidance rate is likely to be too low for European golden plover, so we have assessed significance using the 99.8% avoidance rate below.

This has been assessed in the context of the ROI and county/regional population (there are no designated sites within the ZoI for European golden plover). For information on the populations see **Table 5.10**.

The predicted annual mortality has been put in the context of background annual mortality (27%, (BTO, Bird Facts, 2023)). This has been undertaken for wintering populations, as no European golden plover were recorded from the breeding season population.

Based on the current population trends for wintering golden plover (-17.5% over the last five years; Kennedy et al., 2023), the ROI population and county / regional population could be smaller by tens of thousands and thousands of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 7.74 no. birds per year would result in the following:

- ROI population: 0.067% increase on background mortality for wintering population; and,

- county/regional population: 0.759% increase on background mortality for wintering population.

The likely maximum number of deaths due to the project would only result in a marginal increase in the rate of population decline for the ROI or county / regional winter population.

Therefore, collision is not likely to be significant at the national or county/regional scale if the empirical avoidance rate is used, which is considered to be more realistic than the default rate used by NatureScot (2017) guidance.

Eurasian Teal

Twelve Eurasian teal collisions have been reported at European wind farms between 2002-2023, none of which were in GB or Ireland (Dürr, 2023). Although there may be other, unpublished reports of collisions of this species, Eurasian teal collisions nevertheless appear to be an uncommon event.

Collision risk analysis has been carried out on flight activity data using data from the 2022/23 non-breeding season. Based on these data, a single Eurasian teal flight line (involving 42 no. flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 1.5662 (approximately one collision every 0.64 years or 126 collisions over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI and county/regional population. For information on the populations see **Table 5.10**. There are no nationally designated nature conservation sites for Eurasian teal with population level information.

The predicted annual mortality has been put in the context of background annual mortality (47%, (BTO, Bird Facts, 2023)).

Based on the current population trends for wintering teal (+1.8% over the last five years; Kennedy et al., 2023), the ROI population and county / regional population could be bigger by thousands and hundreds of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 1.5662 no. birds per year would result in the following:

- ROI population: 0.01% increase on background mortality for wintering population; and,
- county/regional population: 0.49 to 0.17% increase on background mortality for wintering population depending on whether the population is based on IWeBS counts or inferred.

As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale.

Therefore, collision is not likely to be significant at the national or county/regional scale.

Eurasian Wigeon

7 no. Eurasian wigeon collisions have been reported at European wind farms between 2002-2023, none of which were in GB or Ireland (Dürr, 2023). Although there may be

other, unpublished reports of collisions of this species, Eurasian wigeon collisions nevertheless appear to be an uncommon event.

Collision risk analysis has been carried out on flight activity data using data from the 2022/23 non-breeding season. Based on these data, a single Eurasian wigeon flight line (involving 13 no. flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.025 (approximately one collision every 40-years or 0.0875 collisions over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI and county/regional population. For information on the populations see **Table 5.10**. For nationally designated sites (Suck River Callows NHA), a precautionary assumption has been made that all birds flying through the project site are from the relevant designated site population.

The predicted annual mortality has been put in the context of background annual mortality (47%, (BTO, Bird Facts, 2023)).

Based on the current population trends for wintering teal (+0.9% over the last five years; Kennedy et al., 2023), the ROI population and county / regional population could be bigger by thousands and hundreds of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 0.025 no. birds per year would result in the following:

- Suck River Callows NHA: 0.039 to 0.016% increase on background mortality for wintering population depending on whether recent IWeBS counts or the site synopsis is used to define the population;
- ROI population: <0.0001% increase on background mortality for wintering population; and,
- county/regional population: 0.0045 to 0.001% increase on background mortality for wintering population depending on whether the population is based on IWeBS counts or inferred.

As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale, and also within the Suck River Callows NHA.

Therefore, collision is not likely to be significant at the national or county/regional scale or for the Suck River Callows NHA population.

Great Cormorant

Thirty-one great cormorant collisions have been reported at European wind farms between 2002-2023, and of these, only one in GB (Dürr, 2023). Although there may be other, unpublished reports of collisions of this species, great cormorant collisions nevertheless appear to be an uncommon event.

Collision risk analysis has been carried out on flight activity data using data from the 2022/23 non-breeding season. Based on these data, nine great cormorant flight lines (involving nine flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.0964 (approximately one collision every 10.37 years or 3.3 collisions over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI and

county/regional population. For information on the populations see **Table 5.10.** There are no nationally designated nature conservation sites for great cormorant.

The predicted annual mortality has been put in the context of background annual mortality (12%, (BTO, Bird Facts, 2023)).

Based on the current population trends for wintering cormorant (+38.5% over the last five years; Kennedy et al., 2023), the ROI population and county / regional population could be bigger by tens of thousands and hundreds of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 0.0964 no. birds per year would result in the following:

- ROI population: 0.027% increase on background mortality for wintering population; and,
- county/regional population: 13.39 to 0.95% increase on background mortality for wintering population depending on whether the population is based on IWeBS counts or inferred (the IWeBS counts are likely a gross underestimate and so the inferred count is likely more accurate, which suggests the effects of collision are not likely to be significant).
- As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale.

Therefore, collision is not likely to be significant at the national or county/regional scale.

Hen Harrier

27 no. hen harrier collisions have been reported at European wind farms between 2002-2023, and of these, five in Britain and one in Northern Ireland (Dürr, 2023). There is only evidence of one bird being killed by wind turbine strike in Ireland between 2007 and 2019 (NPWS, 2019). Although there may be other, unpublished reports of collisions of this species, hen harrier collisions nevertheless appear to be an uncommon event.

Collision risk analysis has been carried out on flight activity data using data from the 2020/21, 2021/22 and 2022/23 non-breeding seasons. Based on these data, seven hen harrier flight lines (involving seven flights) were recorded at PCH within the CRZ during surveys.

Assuming a 99% avoidance rate, there was a mean annual collision rate of 0.0092 (approximately one collision every 108.7 years or 0.322 collisions over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI and county/regional population. For information on the populations see **Table 5.10**. There are no nationally designated nature conservation sites for hen harrier.

The predicted annual mortality has been put in the context of background annual mortality (19%, (BTO, Bird Facts, 2023)).

Based on the current population trends for hen harrier (-11.7% over the 2010-2015 period; Ruddock et al., 2016), the ROI population and county / regional population could be smaller by hundreds and individual birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 0.0092 no. birds per year would

result in the following:

- ROI population: 0.022% increase on background mortality for resident population; and,
- county/regional population: 0.4% increase on background mortality for resident population.

The likely maximum number of deaths due to the project would only result in a marginal increase in the rate of population decline for the ROI or county / regional population.

Therefore, collision is not likely to be significant at the national or county/regional scale.

Mallard

405 no. mallard collisions have bene reported at European wind farms between 2002-2023, none of which were in GB or Ireland (Dürr, 2023). Although there may be other, unpublished reports of collisions of this species, it seems that mallard collisions in Ireland at least, are relatively uncommon events.

Collision risk analysis has been carried out on flight activity data using data from the 2021/22 non-breeding and 2022/23 non-breeding seasons. Based on these data, 7 no. mallard flight lines (involving 17 no. flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.0957 (approximately one collision every 10.4493 years or three collisions over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI and county/regional population. There are no national designated sites for mallard with population data. For information on the populations see **Table 5.10**.

The predicted annual mortality has been put in the context of background annual mortality for adults (37.3% for adults, (BTO, Bird Facts, 2023)).

Based on the current population trends for wintering mallard (-11.3% over the last five years; Kennedy et al., 2023), the ROI population and county / regional population could be smaller by thousands and hundreds of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 0.0957 no. birds per year would result in the following:

- ROI population: 0.003% increase on background mortality for wintering population; and,
- county/regional population: 0.546% and 0.11% increase on background mortality for wintering population depending on whether the population is based on IWeBS counts or inferred respectively.

The likely maximum number of deaths due to the project would only result in a marginal increase in the rate of population decline for the ROI or county / regional population. Therefore, collision is unlikely to have a significant effect at the county/regional scale for the breeding and wintering populations.

Northern Lapwing

31 no. northern lapwing collisions have been reported at European wind farms between 2002-2023, none of which were in GB or Ireland (Dürr, 2023). Although there

may be other, unpublished reports of collisions of this species, northern lapwing collisions nevertheless appear to be an uncommon event.

Collision risk analysis has been carried out on flight activity data using data from the 2020 breeding, 2020/21 non-breeding, 2021 breeding, 2021/22 non-breeding, 2022 breeding and 2022/23 non-breeding seasons. Based on these data, 53 no. northern lapwing flight lines (involving 740 no. flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 4.9768 (approximately one collision every 4.36 years or 174 collisions over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI, county/regional population. For information on the populations see **Table 5.10.**

The predicted annual mortality has been put in the context of background annual mortality (29.5%, (BTO, Bird Facts, 2023)).

Based on the current population trends for wintering (-6.5% over the last five years; Kennedy et al., 2023) and breeding northern lapwing (-74% decline over the last 25 years; Gilbert et al., 2021), the ROI population could be smaller by tens of thousands (winter population) and thousands (breeding population) over the next 35 years under a 'do nothing' scenario i.e. without the project. By the same token, the county / regional population could be smaller by hundreds of birds by the end of the same period for both wintering and breeding populations.

It is likely that, if realised, the predicted collision rate of 4.9768 no. birds per year would result in the following:

- ROI population: 0.04% increase on background mortality for wintering population and 0.422% increase for breeding population; and,
- county/regional population: 0.45% increase on background mortality for wintering population and 14.8% increase for breeding population.

Therefore, collision is unlikely to have a significant effect for the winter population but superficially, could have a significant effect on the breeding population at the county/regional scale.

This is likely to represent an overestimate of true collision risk, as the collision risk modelling is based on several precautionary assumptions (see **section 5.5.3.3**). Similarly, there are no documented collisions in GB and Ireland.

The likely maximum number of deaths due to the project would only result in a marginal increase in the rate of population decline for the ROI or county / regional population (both wintering and breeding).

The realised effect of collision is likely to be much lower than predicted and is unlikely to be significant at the county/regional scale for the breeding population.

Peregrine Falcon

46 no. peregrine collisions have been reported at European wind farms between 2002-2023, one of which was in GB (in Scotland) (Dürr, 2023). There is no evidence of this species being killed by wind turbine strike in Ireland between 2007 and 2019 (NPWS, 2019). Although there may be other, unpublished reports of collisions of this species, peregrine falcon collisions nevertheless appear to be an uncommon event.

Collision risk analysis has been carried out on flight activity data using data from the 2021/22 non-breeding, 2022 breeding and 2022/23 non-breeding seasons. Based on

these data, 5 no. peregrine flight lines (involving 5 no. flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.0392 (approximately one collision every 25.5102 years or 1.37 collisions over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI and county/regional population. There are no national designated sites for peregrine. For information on the populations see **Table 5.10**.

The predicted annual mortality has been put in the context of background annual mortality for adults (19%, (BTO, Bird Facts, 2023)).

Based on the current population trends for wintering (+32% between 2002-2012; NPWS, 2022), the ROI and county / regional population could be bigger by thousands of birds and scores of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 0.00392 no. birds per year would result in the following:

- ROI population: 0.02% increase on background mortality for breeding/wintering population; and,
- county/regional population: 0.69% increase on background mortality for breeding/wintering population.

As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale.

Therefore, collision is unlikely to have a significant effect at the county/regional scale for the breeding and wintering populations.

Whooper Swan

10 no. whooper swan collisions have been reported at European wind farms between 2002-2023, with none in GB or Ireland (Dürr, 2023).

Collision risk analysis has been carried out on flight activity data using data from the 2020/21, 2021/22 and 2022/23 non-breeding seasons. Based on these data, 5 no. whooper swan flight line (involving 34 no. flights) were recorded at PCH within the CRZ during surveys.

Assuming a 99.5% avoidance rate, there was a mean annual collision rate of 0.0971 (approximately one collision every 3.64 years or 3.4 collisions over the 35-year lifespan of the project) predicted. This has been assessed in the context of the ROI and county/regional population. For information on the populations see **Table 5.10.**

The predicted annual mortality has been put in the context of background annual mortality for adults (19.9% for adults, (BTO, Bird Facts, 2023)).

Based on the current population trends for wintering (+24.9% over the last five years; Burke et al., 2021), the ROI and county / regional population could be bigger by tens of thousands of birds and thouands of birds, respectively, over the next 35 years under a 'do nothing' scenario i.e. without the project.

It is likely that, if realised, the predicted collision rate of 0.0971 no. birds per year would result in the following:

- ROI population: 0.00337% increase on background mortality for wintering population; and,
- county/regional population: 0.12% increase on background mortality for wintering population.

As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale.

Therefore, the effect of collision is unlikely to be significant for whooper swan at the county/regional scale.

Indirect Effects

If hydrocarbon spills during the operation of the project led to pollution of wetland habitats and/or dewatering of groundwater-dependent habitats within nearby designated sites for birds, it could result in indirect habitat loss for qualifying bird species. The same is true for wetland sites that could be used by bird species from nearby designated sites, even if those wetland sites are not designated themselves.

As concluded by **Chapter 7**, with embedded mitigation measures in place there will be no significant effects on any wetland site and so there can be no significant indirect effects on any bird species as a result.

5.5.3.4 Terrestrial Mammals (Excluding bats)

Direct Effects

Inappropriately timed vegetation removal to maintain bat mitigation buffers could result in direct effects on breeding or resting sites for arboreal (red squirrel and pine marten) or ground-dwelling mammals (badger and hedgehog). As shown in **Section 5.3.4**, there were no mammal breeding or resting sites recorded during the surveys within or in any proximity to the bat mitigation buffers. If vegetation within the buffers requires removal (e.g. re-vegetation of Sitka spruce saplings), then it is unlikely that it will be suitable for breeding Irish hare, which prefer grassland or bracken habitats.

Therefore, it is unlikely there will be any significant direct effects on badger, red squirrel, pine marten or hedgehog.

Inappropriately timed vegetation removal could cause significant effects on hedgehog at the local scale if it destroys occupied hibernacula in the absence of mitigation.

Indirect Effects

Generally, mammals including badgers are thought to be tolerant of operational wind farms, with little disturbance/displacement from the turbines themselves or personnel.

Of more importance is vegetation removal for bat mitigation buffers, which could result in short-term displacement of foraging, commuting, or sheltering mammals in any adjacent areas. However, given the abundance of suitable displacement habitats in the wider area, this is unlikely to occur.

Hibernating hedgehogs could be disturbed by vegetation removal activities, causing

them to wake from hibernation prematurely. This could cause mortality, especially if sufficient food is unavailable. For hedgehog, there could be significant indirect effects due to disturbance at the local scale. For badger, pine marten, red squirrel and Irish hare, no significant effects are likely.

5.5.3.5 Bats

Direct Effects

Potential direct effects include:

- collision with wind turbines; and,
- barotrauma (injuries to internal air cavities and blood vessels caused by sudden changes in air pressure behind a moving blade).

Bat species likely to be at risk from these two effects relates to the likelihood that the species will fly at PCHs in an open landscape. The probability of directs effects is higher when a turbine is located near a habitat feature such as a hedgerow, treeline or forest edge. NatureScot (2021) guidance requires that vegetation is cleared to reduce the proximity of such habitat features to operational wind turbines, reducing the probability of direct effects on bats. The potential for any likely effects must be considered within the context of this 'good-practice' mitigation. The extent of bat mitigation felling areas is shown in **Figure 9, Annex 5.1**. Felling will take place in the construction phase (see **Section 5.5.2.5** for effects on bats), with smaller scale vegetation removal required throughout the operational phase (see **Section 5.5.3.5** below for indirect effects on bats).

In the absence of Ecobat (refer to **Annex 5.3** for further detail), the overall risk presented to each species by collision was calculated by adapting Table 3b from NatureScot (2021) guidance, substituting Ecobat activity category for vulnerability of bat species populations. This is acceptable, with the guidance stating that an equivalent justification instead of Ecobat category can be used.

An assessment of direct effects is provided for each bat species recorded during surveys below.

Common & Soprano Pipistrelle

Common pipistrelle and soprano pipistrelle populations are thought to be at high risk of direct effects from operational turbines (NatureScot, 2021). Both species typically use woodland/plantation edge, scrub, treelines and hedgerows for foraging and commuting. Some of the proposed infrastructure is close to these features. In Europe, 3,401 and 494 no. fatalities were recorded for common pipistrelle and soprano pipistrelle, respectively (Dürr, 2023). Mathews et al. (2016) found that both pipistrelle species were most recorded as fatalities at operational wind farms in the UK.

The overall risk was calculated based on species' population vulnerability to wind farms and the site risk level (based on habitat features present and the size of the project).

Overall, common pipistrelle and soprano pipistrelle populations are classified as having 'medium vulnerability' to wind farm developments, which is assumed to be equivalent to Ecobat activity category of 'moderate – 3'. Combined with a site risk level of 'medium - 3', this gave an overall risk assessment of 'medium - 9' for common pipistrelle and soprano pipistrelle.

Some of the infrastructure proposed for the project is close to features used for foraging and commuting.

Across all turbines, the season with the highest common and soprano pipistrelle activity levels was spring and summer, respectively. Turbines T2 and T4 had the highest common pipistrelle activity but turbines T7 and T8 had lower common pipistrelle activity. Turbine T2 had the highest soprano pipistrelle activity but turbines T7 and T8 had lower soprano pipistrelle activity. There was also a low level of 'at-height' flight activity.

Without mitigation, operational phase effects are likely to have significant effects on common and soprano pipistrelle populations at the local level.

Nathusius' Pipistrelle

Nathusius' pipistrelle populations are thought to be at high risk of direct effects from operational turbines (NatureScot, 2021).This species regularly flies in the open at height, especially during migration. In Europe, 1,792 no. fatalities were recorded (Dürr, 2023). Rydell et al. (2010) found that the species made up 13% of fatalities at operational wind farms in the UK.

The overall risk was calculated based on species' population vulnerability to wind farms and the site risk level (based on habitat features present and the size of the project).

Overall, Nathusius' pipistrelle populations are classified as having 'high vulnerability' to wind farm developments, which is assumed to be equivalent to Ecobat activity category of 'high – 5. Combined with a site risk level of 'medium - 3', this gave an overall risk assessment of 'high - 15' for Nathusius' pipistrelle.

There was no evidence this species used any vegetation features near the project site for commuting and foraging.

Across all turbines, the season with the highest Nathusius' pipistrelle activity levels was spring, although activity was very low. Turbines T1 and T6 had the highest activity and all other turbines had lower activity. There was also a very low level of 'at-height' flight activity.

Without mitigation, operational phase effects are unlikely to have significant effects on Nathusius' pipistrelle populations, given the very low levels of flight activity at the project.

Leisler's Bat

Leisler's bat populations are thought to be at high risk of direct effects from operational turbines (NatureScot, 2021). This species regularly flies over open habitats at height. In Europe, 813 no. fatalities were recorded (Dürr, 2023). Mathews et al. (2016) found common noctule bats were among the most recorded bat fatalities at operational wind farms in the UK. While this is a different species to Leisler's bat, they exhibit similar patterns of flight behaviour to Leisler's bat and so collision risk is also likely to be similar.

The overall risk was calculated based on species' population vulnerability to wind farms and the site risk level (based on habitat features present and the size of the project).

Overall, Leisler's bat populations are classified as having 'high vulnerability' to wind farm developments, which is assumed to be equivalent to Ecobat activity category

of 'moderate-high – 4'. Combined with a site risk level of 'medium - 3', this gave an overall risk assessment of 'moderate - 12' for Leisler's bat.

Proposed project infrastructure is generally not close to any features used by foraging or commuting Leisler's bats. There is also a high level of 'at-height' activity.

Across all turbines, the season with the highest Leisler's bat activity levels was spring. Turbine T1 had the highest activity and T7 and T8 had lower activity.

Without mitigation, operational phase effects are likely to have significant effects on Leisler's bat populations at the local level.

Daubenton's Bat, Natterer's Bat & Whiskered Bat

Populations of bats within the *Myotis* genus are thought to be at low risk of direct effects from operational turbines (NatureScot, 2021). In Europe, 12, 6 and 8 no. fatalities were recorded for Daubenton's bat, Natterer's bat and whiskered bat, respectively (Dürr, 2023). Mathews et al. (2016) found Myotis species were among the least recorded bat fatalities at operational wind farms in the UK. Most *Myotis* bat species fly at heights of 20-30 m, prefer cluttered habitats and have high levels of manoeuvrability (Mathews et al., 2016; Rydell, et al., 2010).

Activity for these three species was very low across all turbine locations and seasons. Therefore, even without mitigation, operational phase effects are unlikely to have significant effects on Daubenton's bat, Natterer's bat and whiskered bat populations.

Brown Long-eared Bat

Populations of brown long-eared bat are thought to be at low risk of direct effects from operational turbines (NatureScot, 2021). This species typically flies at low heights and close to vegetation. In Europe, 9 no. fatalities were recorded (Dürr, 2023). Mathews et al. (2016) found brown long-eared bats were among the least recorded bat fatalities at operational wind farms in the UK.

Activity for brown long-eared bat was very low across all turbine locations and seasons. Therefore, even without mitigation, operational phase effects are unlikely to have significant effects on brown long-eared bat populations.

Indirect Effects

Indirect effects due to operational lighting could disturb or displace roosting or foraging bats.However, the installation of additional lighting on the turbines themselves is to be minimal. There may be additional lighting at the substation, which could displace light-sensitive bat species.

Leisler's bat, and common and soprano pipistrelle, are less sensitive to light disturbance than the other species of bat recorded at the project site (Nathusius' pipistrelle, Natterer's bat, Daubenton's bat, whiskered bat and brown long-eared bat). These three species were the most frequently recorded bats. Overall, indirect effects on bats are unlikely to be significant.

5.5.3.6 Other Protected Fauna

Direct Effects

No direct effects on common frog or smooth newt are predicted during the operational phase.

Indirect Effects

No indirect effects on common frog or smooth newt are predicted during the operational phase.

5.5.3.7 Fisheries and Aquatic Ecology

Direct Effects

No IEF aquatic habitats or species are located within the project site therefore it is unlikely there will be any significant direct effects during the operational phase.

Indirect Effects

Potential indirect effects include release of suspended solids or hydrocarbons (from vehicles) into watercourses as described in **Section 5.5.2.7**, which could travel downstream to IEFs including brown trout, brook lamprey, European eel, white-clawed crayfish and otter. The same secondary effects therefore apply as described for the construction phase.

In the absence of mitigation, there could be significant effects on brown trout, white-clawed crayfish, European eel, and otter at the county/regional scale.

5.5.4 Potential Decommissioning Phase Effects

Some effects are predicted to be similar to the effects described for the construction e.g. disturbance displacement to IEF birds, bats and mammals via increased noise levels/light levels/presence of construction workers, ground clearance works and reinstatement. This is due to similar activities taking place as for the construction phase. Surface water quality could also be affected via ground disturbance, refuelling and accidental release of hazardous materials stored onsite, which could affect IEF designated sites and fish/aquatic ecology.

Other effects are also predicted to be similar to the construction phase (as similar activities will take place) but of slightly lower magnitude e.g. excavation of turbine foundations, which will be left in situ and covered with soil for reinstatement, which will result in less habitats being lost. Building materials will not be required and access tracks will also remain.

For brevity, a full list of effects is given in **Section 5.5.2** for the construction phase and it can be assumed that the same effects will occur for the decommissioning phase.

5.5.5 Cumulative Impact Assessment

Wind farms and other projects within 20 km of the project are shown in **Table 5.12** below. This 20 km search distance is recommended by IWEA (2012) guidelines.

Development Type	Name	Distance (km) / Direction	Details	Hydro – or Hydrogeological Connection between project site and development?
Wind Farm	Leabeg Wind Farm	11km (NE)	Planning reference: 10/130 and 14/95. Operational.	No downstream hydrological or hydrogeological connectivity.
	Derrinlough Wind Farm	3km (N)	Planning reference:	No downstream hydrological or

Development Type	Name	Distance (km) / Direction	Details	Hydro – or Hydrogeological Connection between project site and development?
			PA19.306706. Under construction.	hydrogeological connectivity.
	Cloghan Wind Farm	4km (N)	Planning reference: 19/404. Operational.	No downstream hydrological or hydrogeological connectivity.
	Meenwaun Wind Farm	2km (NE)	Planning reference: 15/44. Operational.	No downstream hydrological connectivity. Within the same groundwater body so potential hydrogeological connectivity.
	Carrig and Skehanagh Wind Farm	13km (S/SW)	Planning reference: 5123495 and 5123496. Operational.	No downstream hydrological or hydrogeological connectivity.
	Carrig Renewables Wind Farm	10km (SW)	Planning Reference (Tipperary County Council): 23/60763. Proposed.	No downstream hydrological or hydrogeological connectivity.
Other	Temporary Meterological mast	Within main Project Site	Constructed	No downstream hydrological or hydrogeological connectivity.

Table 5.12: Other Developments within 20 km of the Project

5.5.5.1 Potential Construction Phase Cumulative Effects

Likely cumulative effects resulting from the construction phase are limited to water quality changes to watercourses draining the project. Thus, other existing or projects could have an additive or incremental effect on water quality over the short term. In the absence of mitigation, these effects have the potential to be significant for both downstream nature conservation sites and aquatic receptors (e.g. brown trout, European eel, white clawed-crayfish and otter).

Significant negative cumulative effects to water quality could occur if any consented or projects are constructed at the same time as the project and without mitigation.

There are no operational, consented or proposed projects with hydrological connections to the project (see **Table 5.12**). While Meenwaun Wind Farm is within the same groundwater body as the project, this wind farm is already constructed and thus it is unlikely to have any impact on groundwater.

Significant negative cumulative effects to water quality could occur if consented or projects are constructed at the same time as the project and without mitigation.

The projects considered most likely to be constructed at the same time as the project are those in the planning system that are not yet consented.

Similarly, the Offaly County Development Plan provides a framework for land use developments and activities with potential for construction and operation source effects throughout the county.

In terms of water quality, None of the 20 no. sites sampled achieved target good status (≥Q4) biological water quality. All sites were ≤Q3-4 (moderate status).

There are no Section 4 discharges to water linked to the watercourses that drain from the project Site within a 40km instream distance.

There the same is also true for sites with an Industrial Emissions (IE) licence.

Overall, considering the existing effects of diffuse water pollution and in the absence of mitigation, secondary cumulative effects on freshwater ecology are likely to be significant for brown trout, European eel, white-clawed crayfish and otter at the county / regional scale.

European sites are considered fully in the NIS accompanying this planning application. The conclusion of the NIS was that, with mitigation, there would not be an adverse effect on the integrity of any European Sites because of the project, in combination with all other projects and plans (**Section 5.3.1.1**). In EIA terms, this means there are no likely significant cumulative effects on European sites.

5.5.5.2 Potential Operational Phase Cumulative Effects

Operational effects will occur as a result of the turbines, hardstands, access track and substation. As the grid connection will be located underground, there will be no operational effects due to underground cabling/ducting.

The proposed lifespan of the project is 35-years, therefore for ornithology and bat receptors, the duration of effects is likely to be long-term. As the footprint of the project is within a landscape largely modified by agriculture and forestry, any effects due to habitat loss are fully reversible.

In the absence of mitigation, possible cumulative effects include:

- deterioration of water quality within the catchment with potential for downstream effects on QI species and habitats within the River Shannon Callows SAC 000216, Lough Derg, North-east Shore SAC 002241, and Middle Shannon Callows SPA 004096;
- collision risk and barrier effects on sensitive bird populations;
- local habitat loss/indirect disturbance effects on birds and bats; and,
- collision risk effects on bat populations.

<u>Birds</u>

Likely significant cumulative effects on birds are limited to those occurring due to the Project and other wind farms. These effects are:

- displacement;
- collision; and,
- barrier effect.

There are 6 no. wind farm developments located within 20km proximity to the Project (see **Table 5.12**); however only some have details of collision risk assessments undertaken, as summarised below.

Meenwaun Wind Farm

According to the EIAR written in 2015 by Fehily Timoney and Company, bird surveys carried out to inform the planning application recorded the following target species: whooper swan, Greenland white-fronted goose, European golden plover, common snipe, common kestrel, Eurasian woodcock and common buzzard.

Given the separation distance, there is no realistic potential for significant cumulative barrier effects or operational displacement upon IEF bird species. In terms of collision risk, no quantitative assessment was undertaken, so only a qualitative cumulative collision risk assessment is possible. The significance of effects for bird species recorded at both Cush and Meenwaun were given as:

- Common kestrel – low significance;
- Common snipe – low significance;
- Eurasian woodcock – low significance;
- European golden plover – very low significance; and,
- Whooper swan – low significance;

Therefore, there is only low potential for significant cumulative effects to occur in combination with the Project.

Derrinlough Wind Farm

According to the EcIA written in 2020 by MKO, bird surveys carried out to inform the planning application recorded the following target species: whooper swan, European golden plover, hen harrier, little egret, peregrine falcon, northern lapwing, black-headed gull, Eurasian curlew, common buzzard, Eurasian teal, Eurasian wigeon, black-tailed godwit, northern shoveler, Eurasian sparrowhawk, little egret, ringed plover, merlin, redshank, red-necked phalarope, common kestrel and common snipe.

Given the separation distance, there is no realistic potential for significant cumulative barrier effects or operational displacement upon IEF bird species. In terms of collision risk, quantitative assessment was undertaken, so quantitative cumulative collision risk assessment is possible. The significance of effects for bird species recorded at both Cush and Derrinlough were given as:

- Black-headed gull 1.97/year - low significance;
- Common kestrel 1.62/year – very low significance;
- Common snipe 0.06/year – very low significance;
- Eurasian teal 0/year – no effect;
- Eurasian wigeon 0/year – no effect;
- Eurasian woodcock 0/year – no effect;
- European golden plover 14.9/year – very low significance;
- Hen harrier 0.005/year – very low significance;
- Northern lapwing 1.875/year – very low significance;
- Peregrine falcon 0.07/year – very low significance; and,
- Whooper swan 0.21/year – very low significance;

Therefore, there is potential for significant cumulative effects to occur in combination with the project in the absence of mitigation.

Cloghan Wind Farm

According to the EIAR written in 2014 by EcoFact Environmental Consultants, bird surveys carried out to inform the planning application recorded the following target species: Greenland white-fronted goose. A later EcIA report was submitted as part of an application for modified consent by SLR consultants using data from 2019-19 and

recorded the following target species: common snipe, greylag goose, hen harrier and northern lapwing.

Given the separation distance, there is no realistic potential for significant cumulative barrier effects or operational displacement upon IEF bird species. In terms of collision risk, quantitative assessment was undertaken, so quantitative cumulative collision risk assessment is also possible. The predicted numbers of collisions/year and the significance of effects for bird species recorded at both Cush and Cloghan were given as:

- Common snipe 0.004/year – not significant;
- Hen harrier 0.006/year – not significant; and
- Northern lapwing 0.714/year - not significant.

Therefore, there is potential for significant cumulative effects to occur in combination with the project in the absence of mitigation. .

Leabeg Wind Farm

According to the EIAR written in 2010 by Gaelectric Developments Ltd, bird surveys carried out to inform the planning application recorded the following target species: whooper swan and hen harrier.

Given the separation distance, there is no realistic potential for significant cumulative barrier effects or operational displacement upon IEF bird species. In terms of collision risk, quantitative assessment was undertaken, so quantitative cumulative collision risk assessment is also possible. The predicted numbers of collisions/year and the significance of effects for bird species recorded at both Cush and Leabeg were given as:

- Hen harrier 0/year – not significant; and,
- Whooper swan 0/year - not significant.

Therefore, there is no potential for significant cumulative effects to occur in combination with the project.

Carrig & Skehanagh Wind Farm

No documents relevant to ornithology for Carrig and Skehanagh Wind Farm were available in an online search suggesting it was not assessed given the small size of the schemes and therefore no quantitative assessment of cumulative effects for these projects is possible. Given the separation distances and given that both turbine clusters contain only low numbers of turbines each, significant cumulative effects are very unlikely. This is because the further away two wind farms are from each other, the lower the likelihood that bird populations will be affected by both wind farms. Similarly, the fewer turbines that are present in each wind farm, the lower the additive cumulative collision risk.

Carrig Renewables Wind Farm

According to the EIAR written in 2023 by MKIO, bird surveys caried out to inform the planning application recorded the following target species: European golden plover, hen harrier, merlin, peregrine, whooper swan, northern lapwing, black-headed gull, great cormorant, Eurasian teal, barn owl, Eurasian curlew, common kestrel, common snipe, Eurasian woodcock, common buzzard and Eurasian sparrowhawk.

Given the separation distance, there is no realistic potential for significant cumulative barrier effects or operational displacement upon IEF bird species. In terms of collision

risk, quantitative assessment was undertaken, so quantitative cumulative collision risk assessment is also possible. The predicted numbers of collisions/year and the significance of effects for bird species recorded at both Cush and Carrig Renewables Wind Farm were given as:

- European golden plover (wintering) 2.345/year – slight significance;
- Hen harrier (wintering) 0.005/year – imperceptible;
- Peregrine (all seasons) 0.152/year -slight significance;
- Whooper swan (wintering) 0.326/year – imperceptible;
- Northern lapwing (wintering) 2.941/year – slight significance;
- Black-headed gull (wintering and breeding) 1.296/year and 0.194, respectively – slight and imperceptible significance, respectively;
- Great cormorant (wintering and breeding) 0.015/year and 0.078/year, respectively – imperceptible and slight significance, respectively
- Eurasian teal (wintering) – no effect;
- Common kestrel (all seasons) 1.848/year – slight significance and
- Common snipe (all seasons) 0.166/year – not significant.

Cush Wind Farm Temporary Met Mast

The temporary met mast will be removed prior to the construction of the project. As such, there will be no cumulative effect.

Cumulative collision risk

Where collision risk has been analysed quantitatively, the number of collisions per year can be summed together to obtain an estimate of cumulative collision risk. This is the most usable approach for assessing cumulative collision risk and is recommended by NatureScot (2018) guidance; however, may not reflect biological realism and can leave to individual errors being compounded (Humphreys et al., 2016). This has been undertaken below in **Table 5.13** for IEF birds present at the project where collision risk modelling has been undertaken. It must be acknowledged that these cumulative estimates are likely to over-represent collision risk, as all flights within 500m of the turbines were included for collision risk modelling. Similarly, assessment is based on adult rather than juvenile survival (lower survival rates mean that any deaths due to collision with turbines is likely to have less of an effect on a population) and so the realised risk to avian populations is likely to be less. Avoidance rates used are highly precautionary and the default 98% avoidance rate used (see **Annex 5.7**) is not based on empirical evidence. Again, this is likely to produce an overestimate of true collision risk.

Species	Proposed Project Collision Risk	Number of collisions / years						Cumulative Collision Risk	Cumulative Significance
		Leabeg Wind Farm	Derrinlough Wind Farm	Cloghan Wind Farm	Meenwaun Wind Farm	Carrig and Skehanagh Wind Farm	Carrig Renewables		
Hen harrier	0.0092	0	0.005	0.006/year	N/A	N/A	0.005	0.0252	Unlikely to be significant at national, or county / regional scale. The likely maximum number of deaths due to the Project would only result in a marginal increase in the rate of population decline for this species at both the ROI and county / regional scale and would not hinder any conservation actions undertaken for the recovery of the population.
Whooper Swan	0.0971	0	0.21/year	N/A	Low significance	N/A	0.326	0.6331	Unlikely to be significant at national, or county / regional scale. As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale.
Golden plover	7.74	N/A	14.9/year	N/A	Very low significance	N/A	2.345	24.985	Unlikely to be significant at national or county / regional scale, as no significant effects predicted for project and very low significance predicted for Derrinlough, Meenwaun and Carrig Renewables Wind Farm. Also, this species has very low

Species	Proposed Project Collision Risk	Number of collisions / years						Cumulative Collision Risk	Cumulative Significance
		Leabeg Wind Farm	Derrinlough Wind Farm	Cloghan Wind Farm	Meenwaun Wind Farm	Carrig and Skehanagh Wind Farm	Carrig Renewables		
									empirical collision rates and the maximal cumulative collisions would only result in a marginal increase in the rate of population decline at ROI and county / regional scales.
Black-headed gull	1.1463	N/A	1.97/year	N/A	N/A	N/A	0.745	3.8613	Unlikely to be significant at national, or county / regional scale, as collision risk is likely to be massively overinflated for individual wind farm estimates anyway. The likely maximum number of deaths due to the Project would only result in a marginal increase in the rate of population decline for this species at both the ROI and county / regional scale and would not hinder any conservation actions undertaken for the recovery of the population.
Lapwing	4.9768	N/A	1.875/year (mean)	0.714/year	N/A	N/A	2.941	10.5068	Unlikely to be significant at national or county / regional scale as individual estimates are likely overestimated, no significance predicted in the Cloghan EIAR, very low significance predicted for the Derrinlough and Carrig Renewables Wind Farm EIAR and this species has very low empirical rates of collision.

Species	Proposed Project Collision Risk	Number of collisions / years						Cumulative Collision Risk	Cumulative Significance
		Leabeg Wind Farm	Derrinlough Wind Farm	Cloghan Wind Farm	Meenwaun Wind Farm	Carrig and Skehanagh Wind Farm	Carrig Renewables		
									The likely maximum number of deaths due to the Project would only result in a marginal increase in the rate of population decline for this species at both the ROI and county / regional scale and would not hinder any conservation actions undertaken for the recovery of the population.
Wigeon	0.025	N/A	0/year	N/A	N/A	N/A	N/A	0.025	Unlikely to be significant at national, or county / regional scale. As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale.
Teal	1.5662	N/A	0/year	N/A	N/A	N/A	No effect	1.5662	No collisions predicted for other wind farms, so significance same as for Proposed Project alone i.e. not significant at national or county / regional scale.
Snipe	0.4485	N/A	0.06/year	0.004/year	Low significance	N/A	0.166	0.6745	Unlikely to be significant at national, or county / regional scale. The likely maximum number of deaths due to the Project would only result in a marginal increase in the rate of population decline for this

Species	Proposed Project Collision Risk	Number of collisions / years						Cumulative Collision Risk	Cumulative Significance
		Leabeg Wind Farm	Derrinlough Wind Farm	Cloghan Wind Farm	Meenwaun Wind Farm	Carrig and Skehanagh Wind Farm	Carrig Renewables		
									species at both the ROI and county / regional scale and would not hinder any conservation actions undertaken for the recovery of the population.
Common kestrel	0.6692	N/A	1.62/year	N/A	Low impact	N/A	1.848	4.1372	Unlikely to be significant at national or county / regional scale, as very low significance effects predicted for Derrinlough and Meenwaun, coupled with low numbers of empirical collisions documented in Ireland. The likely maximum number of deaths due to the Project would only result in a marginal increase in the rate of population decline for this species at both the ROI and county / regional scale and would not hinder any conservation actions undertaken for the recovery of the population.
Peregrine falcon	0.0392	N/A	0.07/year	N/A	N/A	N/A	0.152	0.2612	Unlikely to be significant at national, or county / regional scale. As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase for

Species	Proposed Project Collision Risk	Number of collisions / years						Cumulative Collision Risk	Cumulative Significance
		Leabeg Wind Farm	Derrinlough Wind Farm	Cloghan Wind Farm	Meenwaun Wind Farm	Carrig and Skehanagh Wind Farm	Carrig Renewables		
									this species at both the ROI and county / regional scale.
Great cormorant	0.094	N/A	N/A	N/A	N/A	N/A	0.0465 (mean)	0.1045	Unlikely to be significant at national, or county / regional scale. As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale.

Table 5.13: Cumulative Collision Risk

Bats

Likely significant cumulative effects on bats are limited to those occurring due to the Project and other wind farms. These effects are:

- collision; and
- barotrauma.

Potential cumulative operational effects need to be considered in light of bat mitigation buffers, which will be created during the construction phase. This will ensure there is a minimum separation distance of 50m from blade tip to any likely commuting or foraging habitat feature. Bat mitigation buffers will be maintained over the lifespan of the project.

There are 6 no. wind farm developments located within 20km proximity to the project (see **Table 5.12**) with details of collision risk assessments undertaken for each wind farm summarised below.

Meenwaun Wind Farm

According to the EIAR written in 2015 by Fehily Timoney and Company common pipistrelle, soprano pipistrelle, and Leisler's bat were all recorded during surveys. They concluded that, in the absence of mitigation, collision risk to bats had to be considered.

Derrinlough Wind Farm

According to the EIAR written in 2020 by MKO, it was concluded that, in the absence of mitigation, operational effects would be in a long-term effect on Pipistrelle species and Leisler's bat species as a result of mortality due to collision. The magnitude of this effect in the absence of mitigation was classified as moderate on the basis that no significant roosts were identified in the immediate vicinity of the turbines and the median level of activity was considered moderate (on a precautionary basis).

Cloghan Wind Farm

According to the EIAR written in 2019 by IWCM Ltd stated that, in the absence of mitigation, the bat species most commonly recorded (common and soprano pipistrelle) would not be affected by the installation of wind turbines within the site. The effects on Pipistrelle bat species would be slight – imperceptible, and slight negative effects on Leisler's bats.

Leabeg Wind Farm

According to the EIAR prepared in 2010 by Galeectric, no assessment was carried out to determine bat activity levels at the wind farm site.

Carrig & Skehanagh Wind Farm

Assessments for Carrig and Skehanagh Wind Farm were unavailable on the planning portal.

Carrig Renewables Wind Farm

According to the EIAR written in 2023 by MKO, Leisler's bat, common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, *Myotis* spp. and brown long-eared bat were recorded during surveys. It was concluded that, in the absence of mitigation, collision mortality, barotrauma and other injuries cause by bats coming into contact or close proximity to operational turbines were a potential effect of the project. Any increase in artificial lighting at night associated with the project would also have the potential to result in displacement effects on bats. The magnitude of this effect in the absence of mitigation was classified as moderate at the local scale.

Cumulative Collision Risk

Without mitigation, the additive effects of the project in-combination with the other wind farms, are likely to have a cumulative effect on some local bat populations (most likely high-collision risk species such as Leisler's bat and common, soprano and Nathusius' pipistrelle). However, due to the implementation of bat mitigation buffers at the project, any significant cumulative effects from collision risk should be mitigated against. It can be difficult to predict bat behaviour post-construction (Richardson, Lintott, Hosken, Economou, & Mathews, 2021), and so as a precaution, it is predicted that there still may be residual effects of low significance on local populations of high collision-risk species (Leisler's bat and common, soprano and Nathusius' pipistrelle).

5.5.5.3 Potential Decommissioning Phase Cumulative Effects

These will be similar to construction phase and/or of lower magnitude.

5.6 Mitigation Measures

The Developer will be responsible for implementing proposed mitigation and compensation during construction and the operator will be responsible for the same during operation and decommissioning.

5.6.1 Mitigation Measures During Construction Phase

5.6.1.1 Designated Nature Conservation Sites, Fisheries and Aquatic Ecology

Mitigation measures to prevent adverse effects on downstream European Sites during construction are provided in full in the NIS. These will ensure no deterioration in the quality of water entering the River Shannon Callows SAC, Lough Derg North East Shore SAC, and Middle Callows SPA and will ensure there will be no effects on any QI habitats and species. The same is true for IEF non-QI aquatic habitats and species.

These measures are taken from **Chapter 7** and the CEMP (**Annex 3.4)**.

In order to mitigate potential effects during the construction phase, best practice construction methods will be implemented in order to prevent water (surface water and groundwater) pollution. Good practice measures will be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes.

A CEMP (**Annex 3.4**) has been prepared for the project to ensure adequate protection of the water environment. All personnel working on the project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.

During the construction phase, all works associated with the construction of the

project will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015). Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016).

Clear Felling and Surface Water Quality Effects

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:-

- Department of Agricultural, Food and the Marine (2019) *Standards for Felling and Reforestation*;
- Forestry Commission (2004) *Forests and Water Guidelines, Fourth Edition*. Publ. Forestry Commission, Edinburgh;
- Coillte (2009) *Forest Operations and Water Protection Guidelines*;
- Coillte (2009) *Methodology for Clear Felling Harvesting Operations*; and,
- Forest Service (2000: *Forestry and Water Quality Guidelines*. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

Mitigation by Avoidance

There is a requirement in the *Forest Service Code of Practice* and in the *FSC Certification Standard* for the installation of buffer zones adjacent to aquatic zones at planting stage.

During the construction phase, a self-imposed conservative buffer zone of 50m will be maintained for all Rapemills River and West Galros Stream where possible.

Of the 23 ha proposed for felling, only c.2.5ha are located inside the 50m buffer zone.

The large distance between the majority of the felling areas and sensitive aquatic zones means that any poor quality runoff arising from felling areas can be adequately managed and attenuated prior to even reaching the aquatic buffer zone and primary drainage routes. Where tree felling is required in the vicinity of streams, the additional mitigation measures outlined below will be employed.

Mitigation by Design

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods, as follows:-

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- Checking and maintenance of tracks and culverts will be ongoing through any felling operation. No tracking of vehicles through watercourses will occur. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the areas to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be

excavated. Sediment will be carefully disposed of in the spoil disposal areas. All new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion or where felling inside the 50m buffer is required, it will be necessary to install double or triple sediment traps;
- All drainage channels will taper out before entering the 50m buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled;
- Brash or bog mats will be used to support vehicles on soft ground, reducing topsoil and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside the 50m watercourse buffer. Straw bales and check dams will be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low, rainfall in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of roads/tracks and culverts will be ongoing through the felling operation;
- Refuelling or maintenance of machinery will not occur within 50m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted:
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors;
- Trees will be cut manually from along streams and using machinery to extract whole trees; and
- Travel will only be permitted perpendicular to and away from surface water features.

Silt Traps

Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps and drain blocking is to slow water flow, increase residence time and allow settling of silt in a controlled manner.

Drain Inspection & Maintenance

The following items will be carried out during pre-felling inspections and regularly thereafter:-

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual waterlogging or bogging of machines;

- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. Where possible, the pre-felling inspection will be carried out during rainfall;
- Following tree felling, all main drains will be inspected to ensure that they are functioning;
- Extraction tracks within 10m of drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the site, if impeded by silt or debris, will be unblocked; and
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4-weeks of the felling activity commencing, preferably in medium-to-high water flow conditions. The 'during' sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact has been shown).

Details of the proposed surface water quality monitoring programme are outlined in the Water Quality Monitoring Plan (**Annex 3.4**).

The surface water sampling locations used in this EIAR for the project site and grid connection (i.e. SW1 – SW4) will also be used as sampling locations during felling activities.

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be taken daily and kept on site for record and inspection.

<u>Earthworks (Removal of Vegetation Cover, Excavations & Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water</u>

Mitigation by Avoidance

The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas by using a 50m buffer. From the constraints map (**Figure 7.10, Chapter 7** of the EIAR) it is evident that; other than some sections of access tracks, watercourse crossings (4 no.), part of the crane hardstanding of turbine T7, the southern end of the main construction compound and the northern end of the spoil deposition area at turbine T5; the majority of the proposed wind farm infrastructure (including all turbine locations and the spoil deposition areas) is located outside of areas that have been assessed to be hydrologically sensitive. Additional mitigation in the form of double silt fencing will be placed around all infrastructure that encroaches the 50m buffer zone.

Specific mitigation measures, incorporated into the design of the project (embedded mitigation) and through implementation of best practice methodologies (discussed

below) will be employed where work inside buffer zones is proposed.

The generally large setback distance from sensitive hydrological features ensures that sufficient space is provided for the installation of drainage mitigation measures (discussed below) and to ensure their effective operation. The proposed buffer zone will ensure:-

- Avoidance of physical damage to watercourses, and associated release of sediment;
- Avoidance of excavations within close proximity to surface water courses;
- Avoidance of the entry of suspended sediment from earthworks into watercourses; and,
- Avoidance of the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

Mitigation by Prevention

The following section details the measures which will be put in place during the construction phase to ensure that surface water features are protected from the release of silt or sediment and to ensure that all surface water runoff is fully treated and attenuated to avoid the discharge of dirty water.

Source controls to limit the likelihood for 'dirty water' to occur:-

- Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with clean washed gravel, filter fabrics, and other similar/equivalent or appropriate systems;
- Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.

In-Line controls to ensure appropriate management of silt laden water:-

- Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.

Treatment systems to fully attenuate silt laden waters prior to discharge:-

Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.It should be noted for this site that an extensive network of bog and forestry drains already exists, and these will be integrated and enhanced as required and used within the wind farm drainage system. The integration of the existing land drainage network and the proposed wind farm network is common practice in wind energy developments and will also result in benefits to surrounding agricultural lands.

The main elements of interaction with existing drains will be as follows:-

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction and attenuation for flow management) of runoff from the wind farm drainage into the existing site drainage network. This will reduce the likelihood of any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area; and
- Buffered outfalls, which will be numerous over the site, will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site.

Water Treatment Train

While the silt/sediment ponds and lagoons are assessed as providing a sufficient level of protection to avoid any deterioration in downstream water quality; a final line of defence can be provided by a water treatment train such as a 'Siltbuster', if required. If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train [sequence of water treatment processes]) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This water treatment train will apply for the entirety of the construction phase.

Silt Fences

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be emplaced within drains down-gradient of all construction areas inside the 50m hydrological buffer zones to provide an additional layer of protection in these areas.

Silt Bags

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats (sediment entrapment mats, consisting of coir or jute matting) placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

Management of Runoff from the Spoil Deposition Areas

It is proposed that excavated overburden/spoil will be utilised for reinstatement of excavated areas etc. and for landscaping purposes. Excess material, or material which is unsuitable for this purpose, will be stored, permanently, at the dedicated spoil deposition areas.

The main spoil deposition areas are located outside the 50m stream buffer zone (**Figure 7.10, Chapter 7** of the EIAR). A small section of the spoil deposition area at turbine T5 encroaches the 50m buffer zone. Additional mitigation in the form of double silt fencing will be placed around all infrastructure that encroaches the 50m buffer zone.

During the initial placement of spoil in the deposition areas, silt fences, straw bales and biodegradable matting will be used to control surface water runoff. Double silt fencing will be placed along the edge of the bog drain that intercepts the deposition area.

Drainage from the overburden deposition area will ultimately be into to the existing bog drain network where it is proposed that check dams will be installed every 20m or so to create a series of settlement ponds, before being discharged.

Spoil deposition areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised, spoil deposition areas will no longer be a likely source of silt laden runoff. Surface water protection infrastructure will be left in place until the areas have stabilised.

Grid Connection Installation Works

Temporary silt fencing/silt trap arrangements will be placed within existing roadside/field drainage features along the grid connection route to remove any suspended sediments from the works area. The trapped sediment will be removed and disposed of at an appropriate licenced facility. Any bare-ground will be re-seeded/reinstated immediately and silt fencing temporally left in place if necessary.

Pre-emptive Site Drainage Management

The works programme for the initial construction stage of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of soil/subsoil or vegetation stripping will be suspended or scaled back if prolonged or intense rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:-

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3 hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3 hour record is given and is updated every 15 minutes. Radar images are not predictive; and,

- Consultancy Service: Met Eireann provide a 24 hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:-

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:-

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24-hours after heavy events to ensure drainage systems are not overloaded.

Timing of Site Construction Works

The construction of the site drainage system will be carried out, at the respective locations, prior to other activities being commenced. The construction of the drainage system will only be carried out during periods of, where possible, no rainfall, therefore avoiding runoff. This will avoid the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and functional for all subsequent construction works.

Monitoring

Prior to the commencement of project, a detailed Site Drainage Plan and SWMP will be prepared to detail the siting and composition of the surface water management measures. The respective plans, which will form part of a detailed Construction Environmental Management Plan (CEMP), will be prepared prior to the commencement of project.

The CEMP will also include a detailed Water Quality Monitoring Plan for the monitoring of surface waters in the vicinity of the construction site by a designated Environmental Manager. The monitoring programme will comprise field testing and laboratory analysis of a range of agreed parameters. The civil works contractor, who will be responsible for the construction of the site drainage system, and Environmental Manager will undertake regular inspections of the drainage system to ensure that all measures are functioning effectively. The surface water sampling locations used in this EIAR (i.e. SW1 – SW4) will be used during construction activities. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels that may decrease the effectiveness of the drainage feature, will be removed and disposed of in an appropriate manner.

Excavation Dewatering and Effects on Surface Water Quality

The management of excavation dewatering (pumping), particularly in relation to any accumulation of water in foundations or electricity line trenches, and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:-

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations, will be put in place;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters to ensure that Greenfield runoff rates are mimicked;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The pumped water volumes will be discharged via volume and silt/sediment ponds and settlement lagoons adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of wind farm excavations by the Environmental Manager will occur during the construction phase. If high levels of seepage inflow occur, excavation work at this location will cease immediately and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if needed.

Release of Hydrocarbons during Construction and Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compound. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site refuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. No refuelling will be permitted at works locations within the 50m hydrological buffer. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used

during all refuelling operations to avoid any accidental leakages;

- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillages;
- All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works; and
- An outline emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage CEMP (**Annex 3.4**). This emergency plan will be further developed prior to the commencement of project, and will be agreed with the Planning Authority as part of the detailed CEMP.

Groundwater and Surface Water Contamination from Wastewater Disposal

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:-

- Self-contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the site compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and,
- No water will be sourced on the site, nor will any wastewater be discharged to the site.

Release of Cement-Based Products

The following mitigation measures are proposed to ensure that the release of cement-based products is avoided:-

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products will be utilised;
- All watercourse crossings will utilise pre-cast products and the use of wet-cement products within the hydrological buffer will be avoided;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds with waters being stored in the temporary construction compound, removed off site and disposed of at an approved licensed facility. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- Weather forecasting will be used to ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and,
- The concrete pour site will be kept free of standing water and plastic covers

will be ready in case of sudden rainfall event.

Morphological Changes to Surface Water Courses & Drainage Patterns

The following mitigation measures are proposed:-

- All proposed new stream crossings will be clear span bridges (bottomless culverts) and the stream beds will remain undisturbed. No in-stream excavation works at the crossing locations are proposed and therefore there will be no impact on the stream at the proposed crossing location;
- All internal wind farm electrical cabling or grid connection cabling will pass above or below the existing culvert and will not directly interfere with the culvert;
- At the time of construction, all guidance/best practice requirements of the OPW or Inland Fisheries Ireland will be incorporated into the design/construction of the proposed watercourse/culvert crossings;
- As a further precaution, in-stream construction work (if/where required) will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (2016) (i.e., July to September inclusive). This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI);
- During the near stream construction works (i.e. within the 50m buffer zone), double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase;
- The new watercourse crossings at the wind farm site will require a Section 50 license application to the OPW in accordance with the Arterial Drainage Act 1945. The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent; and,
- No instream works are proposed at the grid connection watercourse crossings.

Hydrological Effects on Designated Sites

The proposed mitigation measures for protection of surface water quality, which will include buffer zones and robust drainage control measures (i.e. interceptor drains, swales, silt/settlement ponds, settlement lagoons), will ensure that the quality of runoff from development areas will be very high.

An "*imperceptible, temporary effect*" on local streams and rivers would, if it occurs, be extremely localised and of a very short duration (i.e. hours). Therefore, considering the imperceptible effects on local surface water quality along increased dilution capacity of downstream river waterbodies, significant indirect hydrological or water quality effects on the downstream designated sites will not occur.

Effects on the WFD Status

No additional targeted measures are required or proposed in respect of the WFD

assessment. The strict implementation of the measures set out in the preceding sections will ensure that the status of both surface water and groundwater bodies in the vicinity of the site will be maintained.

With regard to treatment standards, the drainage system has been designed to achieve compliance with surface water Environmental Quality Standards (EQS) in the downstream receiving waters. Details of monitoring proposals, to ensure this compliance, is described in the Planning-Stage SWMP (**Annex 3.4**).

The application of the drainage management as outlined will ensure compliance with EU Surface Water Regulations and WFD requirements while also maintaining the baseline hydrology of the site.

As such, the project is compliant with the requirements of the Water Framework Directive (2000/60/EC) and the Groundwater Directive (2006/118/EC).

5.6.1.2 Habitats

Except for bog woodland WN7, the majority of the project layout does not overlap with high-value terrestrial habitats and is located almost entirely within commercial conifer or broadleaved plantation, and improved grassland. The grid connection are located almost entirely within existing roads and only small lengths will go through improved grassland. Construction for the majority of the proposed access tracks will mainly involve upgrading existing forestry and farm tracks.

Areas requiring felling to implement bat mitigation buffers has been mainly focused on commercial conifer plantation habitats and small amounts of highly modified/non-native mixed broadleaved woodland. There is also 3.81 ha of bog woodland WN7 to be felled. Also, the lengths of trees and hedgerows to be removed has been minimised.

Any treelines or hedgerows removed will be replaced in-situ elsewhere in the project at appropriate locations (i.e. designed to maximise ecological connectivity and outside of bat mitigation buffers). All new treelines or hedgerows will be planted using native species and in a similar composition to treelines or hedgerows lost.

To avoid widespread disturbance to habitats, access within the project will be restricted to the footprint of the proposed works corridor and no access between different parts of the project will be permitted, except via the proposed works corridor. An Ecological Clerk of Works (ECoW) will be employed throughout the construction phase to ensure that construction activities do not encroach, unnecessarily, into any important habitats.

5.6.1.3 Rare Flora

No rare flora were recorded during surveys and so no mitigation measures are required.

5.6.1.4 Invasive Plants

In order to prevent the spread of invasive alien species into the working areas of the project site, the following biosecurity protocol shall be adopted at all times throughout the construction process.

Awareness

- Prior to working on the Site, all contractors will be briefed on invasive species and will be provided with information on identification, and of the need to prevent further spread of invasive species, as well as details of the biosecurity protocol.
- Any additional positive or suspected identification of invasive non-native species during Site works shall be reported to an ecologist for verification, so that appropriate advice can be given.

Machinery

- Cleaning operations will take place in a designated area to prevent further spread.
- Mud and organic debris will not be allowed to accumulate on tracks, tyres or under wheel arches.

Personnel

- Personnel shall check and clean their footwear and tools each day before leaving the area to work on other Sites, or other parts of the Site.

5.6.1.5 Birds

To avoid widespread disturbance to birds, access will be restricted to the footprint of the proposed works corridor. Measures proposed in **Section 5.6.1.1** will prevent deterioration of water quality and adverse effects on birds relying on downstream habitats, such as kingfisher.

The following will be implemented to reduce the possibility of damage and destruction (and disturbance to sensitive species) to occupied bird nests:

- clearance of woodlands and uncultivated vegetation i.e. trees and hedgerows (including vegetation removal for creation/maintenance of bat mitigation buffers), will be undertaken outside the main breeding season from March to September inclusive;
- if other site clearance and construction activities are required to take place during the main breeding bird season, pre-commencement survey work will be undertaken to ensure that nest destruction and disturbance is avoided;
- once vegetation has been removed from the works corridor, these areas will be retained in a condition that limits suitability for nesting birds for the remainder of the construction phase e.g. cover for ground nesting species will be made unsuitable for cutting vegetation or tracking over with an excavator; and
- a suitably experienced Ecologist will be employed for the duration of the construction period to make contractors aware of the ornithological sensitivities of the Project and to undertake surveys for nesting birds throughout the construction period, enforcing exclusion areas as required.

5.6.1.6 Terrestrial Mammals (excluding bats)

Measures proposed in **Section 5.6.1.1** will prevent deterioration of water quality and adverse effects on mammals relying on downstream habitats, such as otter. Habitat features important for mammals will be retained as much as possible (e.g. hedgerows, treelines and scrub). While commercial conifer plantation and mixed/broadleaved woodland will be removed, connectivity between woodland linear habitat features has been retained throughout all phases of the project.

A pre-construction walkover survey of the project will be undertaken. This will search

for mammal resting/breeding places, which could change over time. If any are identified, then appropriate exclusion zone(s) will be implemented and construction activities timed to avoid sensitive periods, such as the breeding season or hibernation, as relevant.

The following will be implemented to reduce the possibility of direct and indirect effects on mammals:

- limiting constructions works to daylight hours;
- providing exit points for any excavations (e.g. escape planks or spoil runs) so mammals do not become trapped; and
- a suitably qualified Ecologist will be employed for the duration of the construction period to make contractors aware of the mammalian sensitivities of the Proposed Project and to undertake surveys for breeding or resting mammals throughout the construction period, enforcing exclusion areas as required. These are 50 m for red squirrel, 100 m for pine marten, 150 m for otter and 50 m for badger. If in the unlikely event that exclusion zones cannot be implemented, advice will be sought from NPWS, and appropriate mitigation and compensation measures will be put in place and an application will be made to NPWS for a derogation licence if required.

5.6.1.7 Bats

All hedgerows and treelines that will be lost due to construction will be replaced within the Proposed Project. This will ensure that there is no net loss of commuting and foraging routes for bats.

Along the grid connection, immediately in advance of construction works, an ecologist will undertake a comprehensive survey of bridges / structures / trees with moderate to high bat roosting potential (see **Annex 5.3**) and emergence surveys will be carried out to determine if bats are present following Collins (2023) guidelines.

No destruction or disturbance of active bat roosts is predicted. However, given that a period of time is likely to elapse prior to the commencement of construction, it is acknowledged that roosting bats could move and occupy new PRFs, such as ivy clad trees with occasional holes/fissures. Therefore, pre-construction roost surveys will be undertaken to identify and protect any bats occupying roosts in vegetation earmarked for removal.

Any trees identified as supporting moderate to high potential roost features within the works corridor will be targeted with further surveys, including emergence/re-entry surveys and/or roost inspections (using endoscopes and thermal imaging cameras). Surveys will determine occupancy, the type of roost (e.g. maternity, hibernation, mating, transitional), species using the roost and the level of occupancy. Surveys will be conducted by appropriately experienced ecologists.

For any newly occupied roost sites, where vegetation removal is proposed, these surveys will inform a derogation license application process from the NPWS to undertake appropriate mitigation actions, as required, to ensure the conservation of bats. Such actions could include measures to exclude bats from potential roost holes prior to vegetation removal and provision of alternative roost sites.

Regarding felling of trees with moderate to high potential roost features, if emergence and roost inspection survey fail to detect bats, then 'soft felling' measures will be

implemented (BCT, 2018). This will be carried out in suitable weather conditions and at appropriate times of year. Briefly, this involves the following:

- removal of the tree in sections, starting with the top branches and working down the trunk avoiding cutting through cavities;
- lowering of any sections with potential roost features with care, positioning them on the ground with potential entrances to roosts facing upwards to allow bats to exist the roost; and
- leaving these sections in place for at least 24 hours in suitable weather.

For occupied roost sites where no vegetation removal is proposed, an exclusion zone will be implemented to avoid disturbance. This exclusion zone will only be implemented according to when and how the roost is used and will be proportional to the disturbance levels from the construction activity. For example, 30 m is an appropriate exclusion zone for piling. In general the following applies:

- maternity roosts: works will be carried out between 1 October to 1 May inclusive;
- summer roost (not a maternity roost): works will be carried out between 1 September to 1 May inclusive;
- hibernation roost: works will be carried out between 1 May to 1 October inclusive; and
- mating/swarming roost: works will be carried out between 1 November to 1 August inclusive.

The following will also be implemented to reduce the possibility of direct and indirect effects on bat species: no night-time lighting will be used during construction.

5.6.1.8 Other Protected Fauna

Pre-construction checks will be undertaken for spawning frogs if construction works are undertaken in February. Adults and spawn will be translocated under NPWS licence to suitable alternative locations if present. Pitfall traps and drift fences will be used to capture adult frogs.

Amphibian-proof fencing close to any ponds/pools will be used to prevent frogs or smooth newts from accessing any parts of the Proposed Project most hazardous to amphibians during the construction phase.

5.6.2 Mitigation Measures During Operational Phase

5.6.2.1 Designated Nature Conservation Sites, Fisheries and Aquatic Ecology

Mitigation measures to protect water quality are shown in **Chapter 7** and in **Annex 3.4** of this EIAR. Maintenance of the wind farm drainage system will ensure the system is operating effectively and will be undertaken following the CIRIA C697 SuDS and Maintenance Manual. A review of the ecological mitigation measures will be required during the operational phase and project specific mitigation will be provided as appropriate where further measures are required to ensure no significant environmental effects on aquatic receptors and designated sites. The following mitigation measures will be implemented and can be added to:

- site access will be restricted by gates to prevent illegal dumping, use by off road vehicles etc; and,
- as during construction, any stockpiled material will be within the proposed site compound or a minimum of 50 m from any surface water drainage.

This will prevent any negative effects on downstream aquatic receptors and designated sites.

5.6.2.2 Birds

Reduction in habitat suitability

The species assessed most likely to move into the newly felled bat mitigation buffer areas putting it at risk of collision with operational turbines was common kestrel.

Mitigation to limit common kestrel foraging activity around turbines will be implemented i.e. this will deter kestrel to ensure no significant effects from collision on this species. This will include the following measures to reduce prey availability in an area of 74.16-110.70m^2 surrounding turbines:

- creation of uniformly short vegetation heights via infrequent mowing or trimming of vegetation;
- removal of timber/brash from felling and chipping of tree stumps to ground level;
- spread and compaction of chipped wood and spoil to create a flat surface to prevent rapid colonisation of new vegetation; and,
- piping/filling over of open field/forestry drains.

Turbine Curtailment

In addition, turbine curtailment for birds may be implemented depending on the results of the proposed monitoring programme (see **Section 5.9.3**).

Curtailment will be implemented via a system of adaptive management. Thus, if bird carcasses are recorded during post-construction monitoring, curtailment will be implemented where appropriate during 'at-risk' time periods and as discussed and agreed with NPWS.

It is important to reiterate that the implementation of curtailment will only be implemented where the results of post-commissioning monitoring demonstrate a notable adverse effect on IEF birds.

5.6.2.3 Bats

Bat mitigation buffers

Bat mitigation buffers refers to the felling of vegetation around turbines to make the environment less attractive to bats.This measure will help avoid collision and barotrauma by removing habitat features used by commuting and foraging bats in proximity of turbines. NatureScot (2021) guidelines state that a 50 m distance from the blade tips of the turbine to the nearest habitat feature must be maintained free of trees and shrubs for the duration of wind farm operation. The following formula is used:

$$\boldsymbol{b = \sqrt{(50 + bl)^2 - (hh - fh)^2}}$$

Where b = buffer radius, bl = blade length, hh = hub height, fh = feature height (all in metres).

Thus, the buffer radius is given as the horizontal distance from the turbine tower and relates to both the habitat feature height, the turbine hub height and the blade

length. Taller habitat features require a larger horizontal buffer radius. Note that feature heights were assumed as the maximum height that could be obtained over the lifespan of the project. For conifer and broadleaved plantation habitats and treelines, this height was assumed to be 20 m based on the heights of the conifer plantation typically felled. For non-plantation broadleaved woodland habitats, this height was assumed to be 35 m based on maximum likely tree height. For hedgerows and scrub, this height was 15 m based on the maximum height of hedgerows being maintained by landowners during surveys.

Details of the buffers required for each turbine are shown below in **Table 5.14** and **Figure 5.10**.

Turbine Number	Habitat Feature	Buffer (m^2)	Area (ha) or length (m) to be removed
T1	Improved agricultural grassland GA1	74.16	0
T2	Hedgerow x Treeline WL1 x WL2	106.96	106.44m
	Hedgerow x Treeline x Dense bracken		106.63m
	Bog woodland WN7		2.66 ha
T3	Cutover Bog PB4	74.16	0
	Recolonising bare ground ED3		0
T4	Dense bracken HD1	106.96	40.12m
	Mixed broadleaved/conifer woodland WD2		3.54 ha
T5	Conifer plantation WD4	74.16	1.70 ha
T6	Cutover Bog x Recently-Felled Woodland PB4 x WS5	74.16	0
	Conifer Plantation WD4		1.29 ha
T7	Conifer Plantation WD4	110.70	0.11 ha
	Improved agricultural grassland GA1		0
T8	Hedgerow x Treeline WL1 x WL2	110.70	39.26m
	Conifer Plantation WD4		0.15 ha
	Cutover Bog x Scrub PB4 x WS1		0.01 ha

Table 5.14: Details of Bat Mitigation Buffers Required for Each Turbine

The area where trees/scrub is cleared to create the bat mitigation buffers will be kept clear over the lifetime of the project and will be made as unfavourable to bats as possible. Felled timber and branches will be removed with stumps brashed to ground level. Excess soil will be deposited over stumps to flatten the ground.

Turbine Curtailment

It is predicted that bat mitigation buffers will limit bat activity near turbines, reducing potential collision risk.

In addition, the following operational mitigation measures for bats may be implemented depending on the results of the proposed monitoring programme (see

Section 5.9):

- **Feathering of Blades:** there is evidence that bat casualties at wind farms is reduced by pitching the blades out of the wind ("feathering") to reduce rotation speeds below 2 rpm. while idling. As such, the feathering of blades to prevent 'idling' during low wind speeds is proposed for all turbines based on the results of the post-construction monitoring programme. Feathering will be implemented via a system of adaptive management. Thus, if bat carcasses are recorded during post-construction monitoring, feathering will be implemented at the relevant turbines during the bat activity season (April-October) or where temperatures are optimal for bat activity; and
- **Curtailment:** this involves raising the cut-in speed with associated loss of power generation. This also involves reducing the blade rotation below the cut-in speed, as above. The curtailment is achieved by feathering/pitching the blade out of the wind (not the actual braking of the turbine) so that the blades continue to rotate slowly (at ~2 r.p.m. or less). Curtailment will be implemented via a system of adaptive management. Thus, if bat carcasses are recorded during post-construction monitoring, cut-in speeds will be increased at the relevant turbines during the bat activity season (April-October) and where temperatures are suitable for bat activity.

It is important to reiterate that the implementation of the above operational phase measures (feathering of blades or curtailment) will only be implemented where the results of post-commissioning monitoring demonstrate a notable adverse effect on bats. It is the conclusion of this assessment that, with the removal of vegetation within the above-referenced buffer zones, that the characteristics of the project, for bats, will be highly altered and the turbine locations are unlikely to be suitable for bat activity. Consequently, it is assessed that the implementation of the buffer zones will ensure the avoidance of significant effects on bats. In the unlikely event of notable fatalities, a further suite of measures will be implemented.

5.6.3 Mitigation Measures During Decommissioning Phase

Mitigation measures for decommissioning will be similar to those for the construction phase; however the magnitude required will be less, as track and turbine installation will not be required.

5.7 Compensation Measures

5.7.1 Replacement Planting

Following DAFM (DAFM, 2017) guidance, 23ha of replacement woodland is expected to be planted ex situ. This will compensate for the loss of woodland habitats permanently felled to accommodate the project.

To compensate for the loss of linear hedgerow habitats (including matrices of same), 1,978.87m of hedgerows will be replaced in-situ. There will also be 914.47m more hedgerow planted than will be needed to replace any due to be lost, which will result in a net gain of hedgerow due to the project. The placement of these will be designed to ensure connectivity between habitat features at the project is maintained and enhanced. The replacement of treelines and hedgerows will also ensure that there is no net loss as a result. The placement of these replacement hedgerows will also be used to help enhance biodiversity (see section below).

5.8 Enhancement Measures

5.8.1 Habitats

Objective 1 Establishment of new hedgerows/treelines

- Plant 914.48m of new hedgerow x treeline habitat using native fruit and seed-bearing species (e.g. hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa*, dog rose *Rosa canina*, guelder rose *Viburnum opulus*, hazel *Corylus avellana*, holly *Ilex aquifolium*, spindle *Euonymus europaeus* and alder buckthorn *Frangula alnus* as hedgerow species, and bird cherry *Prunus padus*, crab apple *Malus sylvestris*, goat willow *Salix caprea*, grey willow *Salix cinerea*, rowan *Sorbus aucuparia*, wild cherry *Prunus avium*, hawthorn, Irish whitebeam *Sorbus hibernica*, sessile oak *Quercus petraea* and pedunculate oak *Quercus robur* for treeline species);
- If planting a new hedgerow that will be topped, the species chosen must tolerate trimming, such as hawthorn and blackthorn;
- Plants must be of Irish Origin or Irish Provenance and purchased from Department of Agriculture, Fishing and the Marine (DAFM) registered professional operators ;
- New planting will be undertaken in the appropriate season, with bareroot stock planted October to December (avoiding periods when the ground is waterlogged or frozen) unless on clay, when planting should be delayed until March due to risk of heave during heavy frost;
- Planting will not be undertaken until the first appropriate season post-construction to avoid damage to whips;
- Cultivate the ground prior to planting and add organic matter if required;
- To ensure new hedgerows are beneficial for biodiversity, there must be six plants per metre in a double-staggered row with >10 species per 30 m section. Overall, no one species will make up more than 70% of the total number of plants;
- Any mix of native hedgerow and tree species can be chosen, with one tree at every 15 m;
- Water during first year to assist with establishment. Frequency of watering to adapt to weather conditions;
- If planting new hedgerows in a grass or tillage field, they must be protected from livestock with an appropriate permanent fence, which can be moved out further as the hedgerow matures and expands;
- Trees will be left to mature without cutting and protected with a tree guard/shelter and fenced off from livestock if present;
- Cut hedgerows annually during establishment phase to encourage sideways growth and canopy closure. Some plants will not be cut / trimmed and allowed to grow into mature hedgerow trees;
- Competing vegetation will be controlled, preferably via mulching with organic matter, and avoiding the of use of chemical herbicides;
- Failed or dead plants (identified during condition assessments) should be replaced the following planting season; and
- Should any newly planted hedgerows require temporary removal to allow for maintenance works to the wind farm, they will be reinstated following the criteria mentioned above.

Objective 2 Enhancing Riparian Zone of Rapemills River

- Erection of fencing along the southern bank of the Rapemills River. This will exclude livestock, allowing for 'passive restoration' of the zone (Fleming et al., 2021), which is a proven technique that has been implemented at the rivers in Ireland by IFI;
- Fencing will be 10 m from the riverbank (IFI, 2020), which will allow the streamside zone to re-vegetate naturally and will prevent erosion/damage from cattle;

Measures of success

Success will be assessed by monitoring the condition of hedgerows/treelines throughout the establishment phase, and, at less frequent intervals, throughout the maintenance phases. Success will also be assessed by monitoring the condition of the riparian vegetation and the river itself, plus the transition mire and quaking bog throughout the lifespan of the wind farm.

- Hedgerows/Treelines
  - Newly created or enhanced hedgerows will be subject to condition assessment following the Hedgerow Appraisal System each year after planting for the first 5 years (the establishment phase), and then every 5 years until (and including) year 20 (the maintenance phase). This will help identify ongoing management actions, such as weed control, gapping up and where fence maintenance is required;
  - By Year 5 after planting, hedgerows should meet the criteria for 'Favourable' under the Hedgerow Appraisal System; and
  - In addition to the condition assessment, the diversity of the tree / shrub / climber component (otherwise described in the Hedgerow Appraisal System as 'canopy' forming species) should be the same, or greater than, that at planting (>10 native species per 30 m length).
- Riparian vegetation
  - The effects of passive restoration on the streamside zone, including the river itself, will be subject to condition assessment each year after fencing for the first 5 years and then every 5 years until (and including) Year 20. This will help ongoing management actions, such as fence maintenance, where required;
  - A series of lateral transects will be used to estimate plant frequency/distribution and physical attributes of the watercourse (depth, flow, and substrate type) following the methodology described by Fleming et al., (2021); and
  - Success will be defined by the presence of pioneer macrophyte species (e.g. *Nasturtium officinale* and *Helosciadium nodiflorum*), increased depth, flow and substrate diversity in Year 1 (stage 1); replacement of pioneers with other macrophyte species (e.g. *Phalaris arundinacea* and *Sparganium erectum*, filling the channel, impeding flow velocities in Years 2-5 (stage 2); and more naturalised channel form, increasing substrate coarseness and higher flow velocities in Years 5, 10, 15 and 20 (stage 3; although this third stage may occur sooner).

5.8.2 Species

5.8.2.1 Bats

Objective 3 Provision of Bat Roosts

- 10 no. bat boxes will be erected in ten mature trees, three boxes per tree. Trees near to known roosts will be preferentially selected, with groups of 3 or more adjacent trees housing the bat boxes in clusters;
- Boxes will be installed at least 4 m above ground level (AGL), each facing in a different (south, south-east or south-west) direction, and sheltered from strong winds;
- Boxes will be positioned such that there is a clear flight path to and from the box entrance (i.e. the box entrance is not obscured by vegetation);
- A mixture of bat boxes suitable for both maternity and hibernation roosting will be used. At least one 'gable end' box (see Pschonny et al., 2022) will be installed in each tree;
- Mature trees will be selected that are outside of bat mitigation buffers and that are located in treelines or along the edge of retained woodland habitat and adjacent to good quality foraging habitat. The locations and access arrangements will be agreed with the relevant landowner;
- Bat boxes will be subject to inspections for bats and maintenance checks once a year during Years 1-5 (post-construction), and then every five years to Year 20;
- Detritus (not including bat droppings) to be cleared from bat boxes during inspections and vegetation trimmed to ensure entrances do not become obstructed; and
- Where boxes have become damaged or are missing, these will be replaced immediately. If there is evidence of human vandalism, an alternative tree in a less prominent position will be identified (and permissions obtained) and three boxes will be reinstalled in the new tree.

Measures of success

- Ten bat boxes available for use every year for 20 years following construction;
- Bat box inspections undertaken in every year post-construction Years 1-5, and then every 5 years to Year 20;
- Evidence of occupation by bats of at least 5 boxes within the first 5 years following construction; and
- All bat roosts records to be submitted to Bat Conservation Ireland online at https://www.batconservationireland.org/in-your-area/sightings.

5.8.2.2 Birds

Objective 4 Provision of Bird Nesting Habitat

- Erection of one swift tower in the south western section of the project site.
    - Erect tower with a gap of 15 m from the nearest major source of obstruction so there is clear access to the nest entrance;
    - Position nest boxes within the tower to they are not exposed to sun and are sheltered from the rain and are at least 7 m from the ground;

- Ensure the nest chamber dimensions, material and construction follows the specifications outlined in Swift Conservation's guidance4 to exclude predators and competitor species.

Measures of Success

- Bird surveys / checks every year during years 1-5 post-construction to ensure that the swift tower is in good condition; and
- This will help to determine whether repairs to the swift tower are required.

5.8.2.3 Hedgehogs

Objective 5 Provision of Hibernacula for Hedgehogs

- Eight no. hibernacula will be constructed for hedgehogs from logs arising from felled trees;
- The hibernacula will be constructed in areas that are south facing, well-drained, undisturbed by humans/vehicles (e.g. paths and roads) adjacent to broad-leaved trees (to provide leaves for nest construction) and act as transitions between habitats (e.g. between scrub and woodland etc);
- The logs will be laid in a hole 0.5 m deep, and at least 2 m wide and 4 m long, with turves of vegetation from the area excavated kept aside to be placed on top of the hibernacula. The hole will be filled to just below ground level with gravel or sand to facilitate drainage, with logs piled on top in a configuration that creates voids within the heap, with access gaps into these voids. Logs will be piled to a height of at least 1m. Soil arising from the hole and the salvaged turves of vegetation will be laid on top of the logs with the aim of establishing a cover of vegetation to provide insulation.
- The locations of the hibernacula will be agreed in conjunction with landowners and the Planning Authority prior to the operation of the project.

Measures of success

- Annual checks in Years 1-5 indicate hibernacula are in suitable condition for use by hedgehogs;
- Evidence of use (droppings, nests) recorded within at least two hibernacula in the first 5 year after construction; and
- All hedgehog records to be submitted to the Irish Hedgehog Survey online at Record sightings | Hedgehog Survey (www.irishhedgehogsurvey.com).

5.8.2.4 Reptiles and amphibians

Objective 6 Provision of Reptile & Amphibian Hibernacula

- Eight no. hibernacula will be constructed for reptiles and amphibians from logs formed from felled trees;
- The hibernacula will be the same as those for hedgehogs;
- The hibernacula will be located in a sunny position, orientated such that a long side faces south and near to watercourses / drainage ditches, within rough grassland or scrub and avoiding areas of intensively managed / grazed land; and
- The locations of the hibernacula will be agreed in conjunction with landowners and the Planning Authority prior to the operation of the project.

Measures of success

Reptile and amphibian species richness and abundance will be measured via physical checks to ensure hibernacula are still present and functional in years 1-5 post-construction.

5.8.2.5 Invertebrates

Objective 7 Provision of Invertebrate Foraging Habitat & Hibernacula

- Maintain 5m rough grassland buffer along access tracks to provide habitat for pollinators;
- Erect insect hotels in the first year of operation. Insect hotels or bee boxes can be created by drilling holes into fence posts or pieces of wood and positioning appropriately. These sites can be created along dry hedgerows, access tracks and other field boundaries;
- Ensure insect hotels are maintained or replaced over the lifespan of the project as required; and
- Locate both insect hotels and bee hotels in sunny, sheltered areas, ideally no more than 300m from areas of food plants.
- The locations of the insect hotels will be agreed in conjunction with landowners and the Planning Authority prior to the operation of the Project.

Measures of success

- At least three insect hotels per 35 ha;
- Maintenance checks to ensure grassland buffer habitats, and insect hotels still present and functional, to be carried out annually in Years 1-5 post-construction.

5.8.3 Implementation

5.8.3.1 Roles & Responsibilities

The implementation of enhancement measures will be overseen by an ecologist with the required experience and expertise, appointed by the project. All management tasks will either be undertaken by the developer, operator or by suitably experienced contractors acting on their behalf, and all ecological monitoring will be undertaken by suitably qualified and experienced ecologists.

5.8.3.2 Reporting & Reviewing

This enhancement measures have been developed using NatureScot (formerly SNH) guidance (SNH, 2016) and following the recommendations of this guidance monitoring is proposed to measure success of the management measures and to identify whether remedial measures are required if objectives are not being met.

Monitoring results will be reported on an annual basis (during years in which monitoring takes place) and if necessary (e.g. if stated objectives were not being met), recommendations made for reasonable changes to management prescriptions, as appropriate. Monitoring reports will be submitted to Planning Authority and any changes proposed to management prescriptions would be discussed with them in the first instance.

5.9 Monitoring

5.9.1 General Pre-Construction Confirmation Surveys

To prevent accidental disturbance to resting places of mammals (badgers, red squirrel, pine marten, otter and hedgehog), an ecological walkover survey will be undertaken prior to any construction activities within the project footprint.

Similarly, trees and structures within the works corridor will be re-assessed for bat roosting potential, with any inspections or emergence surveys carried out as required under licence.

Checks for nesting birds will be required for construction undertaken during the bird breeding season. If nests are recorded, ongoing monitoring and appropriate exclusion zones will be implemented to determine when and where works can proceed. If exclusion zones cannot be implemented, NPWS will be contacted and based on their advice, additional mitigation and compensation will be implemented, with relevant licences applied for, if required.

5.9.2 Water Quality (During and Post-Construction)

Water quality monitoring will be undertaken as outlined in **Chapter 7**. This will check the efficacy of mitigation measures.

5.9.3 Birds (Post-Construction)

Based on current best-practice guidelines (SNH, 2009), a targeted range of flight activity surveys and collision monitoring (carcass searching) will be undertaken during the breeding and non-breeding seasons in years 1, 2 and 3 post construction, to monitor the rate of avian turbine collisions and identify any significant unforeseen adverse effects. Thereafter, if the rate of turbine strikes is as low as predicted by the CRM (which is highly precautionary), the monitoring should no longer be required. If monitoring indicates potentially significant levels of collision mortality for IEF birds, potential mitigation measures will be developed and implemented (including the possibility of turbine curtailment), and further monitoring will also be identified, to ensure there are no significant effects on any IEF birds. Proposed mitigation and monitoring measures will be agreed with the planning authority prior to implementation.

5.9.4 Bats (Post-Construction)

Post-construction monitoring is required in line with commitments made in respect of the project being permitted and should be seen as an opportunity to obtain data on bat/turbine interactions and to allow adaptive management of the proposed mitigation measures.

To reinforce the baseline results and better inform the precise requirements for post-construction monitoring, a year of confirmatory surveys will be undertaken for bats immediately prior to wind farm construction. This will involve three rounds of static detector surveys (spring, summer and autumn) as per the latest NatureScot (2021) guidance. The results of these surveys will be used to provide an updated baseline environment, for bats, and will form the basis of the post-construction monitoring programme. For example, in the event of high levels of activity at certain locations across the project site, post-construction monitoring will be adapted to pay particular attention to this location.

Following this additional year of pre-construction monitoring, the results will be used to

assess the precise requirements for post-construction monitoring, including methods, timing and duration.

The post-construction monitoring programme will consist of:

- **static detector surveys:** these surveys will allow for a valid comparison of bat activity and project site usage with pre-construction levels. Following NatureScot (2021) guidance, the surveys are to be conducted during years 1, 2 and 3 post construction to allow for annual variation and cumulative effects. Reports will be submitted to the competent authority and NPWS following each year of surveys. Surveys will follow baseline survey methods, as outlined in NatureScot (2021) guidance. After three years of post-construction surveys, the monitoring programme may be extended or halted based on the results and following agreement with the competent authority and NPWS.
- **fatality monitoring:** while not currently recommended, if this is determined to be required following the additional year of pre-construction monitoring (i.e. due to high levels of bat activity), this will initially be conducted during years 1, 2 and 3 post construction to allow for annual variation and cumulative effects. The comprehensive fatality monitoring programme for birds as described above will be extended and duplicated to bats for the first three years per the post-construction monitoring requirements recommended by NatureScot (2021). After three years of post-construction surveys, the monitoring programme may be extended or halted following agreement with the competent authority and NPWS.

The results of the post-construction monitoring surveys will be used to determine whether further mitigation measures, such as turbine curtailment, are required.

Bat mitigation buffers will need to be monitored in years 1, 2 and 3 following construction to ensure vegetation clearance and management measures have resulted in the desired habitat conditions. Once these conditions have been achieved, habitats will be maintained in this manner for the duration of the project lifespan. The monitoring programme will help ensure there are no significant adverse effects on bats.

5.10 Residual Effects

A summary of the effects, mitigation and residual effects, taking into account cumulative effects, is set out in **Table 5.16.**

Note that a 'balance-sheet' of habitat losses and gains is also presented in **Table 5.15**.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)					Where and How Compensation / Enhancement Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	Compensation / Enhancement Gain	Net Change	
WD1	(Mixed) broadleaved woodland	No	1.03 ha	-0.011 ha	0	0.011 ha	0	Ex-situ replanting
GA2	Amenity grassland	No	0.14ha	0	-0.14ha	0.14ha	0ha	Temporary loss will be reverted after construction
WN7	Bog Woodland	No	17.21 ha	-3.814 ha	0	3.814 ha	0	Ex-situ replanting
BL3	Buildings and artificial surfaces	No	2.97ha	0	-0.529 ha	0.529 ha	0ha	Temporary loss will be reverted after construction
			4970.63m	0	-4970.63m-	4970.63m	0m	
WD4	Conifer Plantation	No	37.54 ha	9.982 ha	0	9.982 ha	0ha	Ex-situ replanting
PB4	Cutover Bog	No	30.31 ha	-0.805 ha	-15.953 ha	15.953 ha	-0.805 ha	Temporary loss will be reverted after construction
PB4 x WS5	Cutover Bog x Recently-Felled Woodland	No	6.73 ha	-0.407 ha	0	0ha	-0.407 ha	No compensation of permanent loss required as highly modified habitat
PB4 x WS1	Cutover Bog x Scrub	No	0.57 ha	0	0	0ha	0ha	Not required.
HD1	Dense bracken	No	1.41 ha	-0.397 ha	0	0	-0.397 ha	Bracken is a pioneer species which is widespread and re-colonises naturally. As such, this minimal loss will have no negative impact on the
			261.26m	-41.40m	0	0	-41.40m	
FW2	Depositing lowland river	No	3359.95m	0	0	0m	0m	Not required.
FL4	Drainage Ditch	No	11914.54m	0	0	0m	0m	Not required.
GS2	Dry meadows and grassy verges	No	0.11ha	-0.0003 ha	0	0.0003 ha	0ha	In-situ replanting
			1364.02m	0	0	0m	0m	Not required.
WL1	Hedgerow	No	9,362.46m	-48.73m	-58.73	277.35	+228.62m	In-situ replanting.
WL1 x WL2	Hedgerow x Treeline	No	5,525.81m	-374.77m	-10m	603.39	+228.62m	In-situ replanting.
WL1 x WL2 x HD1	Hedgerow x Treeline x Dense Bracken	No	210.23m	-206.72m	0	435.34	+228.62m	In-situ replanting.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)					Where and How Compensation / Enhancement Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	Compensation / Enhancement Gain	Net Change	
WL1 x WL2 x GS1	Hedgerow x Treeline x Dry meadows and grassy verges	No	755.12m	-434.18m	0	662.80	+228.62m	In-situ replanting.
GA1	Improved agricultural grassland	No	94.26ha	-2.759ha	-0.18 ha	0.18 ha	-2.759ha	Temporary loss will be reverted after construction – no compensation of permanent loss required as highly modified habitat
GA1 x PB4	Improved Agricultural Grassland x Cutover Bog	No	14.95 ha	-0.669 ha	0	0	-0.669 ha	No compensation of permanent loss required as highly modified habitat.
GA1 x HD1	Improved agricultural grassland x Dense bracken	No	1377.80m	-1249.21m	0	0	-1249.21m	No compensation of permanent loss required as highly modified habitat. Bracken will quickly re-colonise surrounding areas.
GA1 x WS1	Improved Agricultural Grassland x Scrub	No	5.90 ha	-0.003 ha	0	-0.003 ha	0ha	In-situ planting.
WD2	Mixed broadleaved/conifer woodland	No	70.17 ha	-9.193 ha	0	9.193 ha	0ha	Ex-situ planting
ED3	Recolonising bare ground	No	2.37 ha	-0.74 ha	-1.171 ha	1.171 ha	-0.74 ha	Temporary loss will be reverted after construction – no compensation of permanent loss required as highly modified habitat.
WD5	Scattered trees and parkland	No	0.946 ha	-0.035 ha	0	-0.035 ha	-0.035 ha	In-situ planting.
WS1	Scrub	No	0.09ha	0	0	0ha	0ha	Not required.
WS1 x WL1	Scrub x Hedgerow	No	0.03 ha	0	0	0ha	0ha	Not required.
WS1 x WS2	Scrub x Immature woodland	No	0.07 ha	0	0	0ha	0ha	Not required.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)					Where and How Compensation / Enhancement Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	Compensation / Enhancement Gain	Net Change	
ED2	Spoil and bare ground	No	0.002 ha	-0.002ha	0	0ha	-0.002ha	None – highly modified habitat
BL1	Stone walls and other stonework	No	5,007.16m	0m	0m	0m	0m	Not required.
WL2	Treeline	No	1,000.09m	0	0	0m	0m	Not required.
GS4	Wet grassland	No	6.32 ha	-0.192 ha	0	0.192 ha	0m	Area of grassland currently subject to agriculture adjacent to wet grassland will be fenced to allow it to extend the current area of wet grassland, and allow wet grassland vegetation to recolonise by excluding grazing.

Table 5.15: Habitat Loss

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
Fisheries and Aquatic Ecology						
Brown trout, white-clawed crayfish, European eel, and otter	Construction	Direct: none Indirect: short-term deterioration in water quality due to pollution or suspended solids	Risk slightly increased due to other projects and plans	Significant at the county / regional scale for brown trout, white-clawed crayfish, European eel, and otter.	See **section 5.6.1** based on **Chapter 7** and CEMP in **Annex 3.4** found in Volume III of this EIAR	Not significant
	Operation	Direct: none Indirect: short-term deterioration in water quality due to lag in re-vegetation of bat mitigation buffers / poorly designed engineered, and constructed wind farm, leading to increased run-off and sedimentation	Risk slightly increased due to other projects and plans	significant effects on brown trout, white-clawed crayfish, European eel, and otter at the county/regional scale.	See **section 5.6.1** based on **Chapter 7** and CEMP in **Annex 3.4** found in Volume III of this EIAR	Not significant
	Decommissioning	Direct and indirect: as for construction phase but less excavation and no cement/concrete needed, so potential effects are reduced in magnitude.	Risk slightly increased due to other projects and plans	Significant at the county / regional scale for brown trout, white-clawed crayfish, European eel, and otter.	See **section 5.6.1** based on **Chapter 7** and CEMP in **Annex 3.4** found in Volume III of this EIAR	Not significant
Designated Sites						
European Sites	Considered in NIS and assessed above in Sections 0, and 0. The NIS confirmed that, with mitigation measures, the project, either alone or in combination with any other plan or project, would not undermine the conservation objectives or have an adverse effect on the integrity of any European site					
Woodville Woods pNHA	Construction / decommissioning	No direct or indirect effects.	No elevated risk	Not significant	None	Not significant
	Operation	Direct mortality due to collision for snipe.	Additional mortality could occur to populations due to other	Significant, negative, long-term effect at the national scale	See **section 5.6.2.2.**	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
			wind farms in area			
	Decommissioning	No direct or indirect effects.	No elevated risk	Not significant	None	Not significant
Birr (Domestic Dwelling No. 2, Occupied) pNHA	Construction / decommissioning	No direct or indirect effect.	No elevated risk	Not significant	None	Not significant
	Operation	Direct mortality due to collision for Leisler's bat.	Additional mortality could occur to populations due to other wind farms in area	Significant at local scale.	Embedded mitigation and good practice will avoid effects on bats (**Section 5.6.2.3**)	Not significant
	Decommissioning	No direct or indirect effect.	No elevated risk	Not significant	None	Not significant
Birr (Domestic Dwelling No. 1, Occupied) pNHA	Construction / decommissioning	No direct or indirect effect.	No elevated risk	Not significant	None	Not significant
	Operation	Direct mortality due to collision for Leisler's bat.	Additional mortality could occur to populations due to other wind farms in area	Significant at local scale.	Embedded mitigation and good practice will avoid effects on bats (**Section 5.6.2.3**)	Not significant
	Decommissioning	No direct or indirect effect.	No elevated risk	Not significant	None	Not significant
Lough Nahinch (Tipperary) pNHA	Construction / decommissioning	No direct or indirect effects.	No elevated risk	Not significant	None	Not significant
	Operation	Direct mortality due to collision for snipe.	Additional mortality could occur to populations due to other	Significant, negative, long-term effect at the national scale	See **section 5.6.2.2.**	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
			wind farms in area			
	Decommissioning	No direct or indirect effects.	No elevated risk	Not significant	None	Not significant
Pallas Lough pNHA	Construction	No direct or indirect effects are possible, as the only source-receptor pathway to the pNHAs are ecological	No elevated risk	Not significant	None	Not significant
	Operation	Direct mortality due to collision for Mallard, Eurasian teal, and Eurasian wigeon	Additional mortality could occur to populations due to other wind farms in area	Significant, negative, long-term effect at the national scale	See **section 5.6.2.2.**	Not significant
	Decommissioning	No direct or indirect effects.	No elevated risk	Not significant	None	Not significant
IEF Birds Primary Target Species						
Avian assemblage (primary target species as a collective)	Construction and Decommissioning	Direct nest damage or destruction	Risk unchanged by other wind farms, projects and plans in area	Not significant due to embedded mitigation	As detailed in **section 5.6.1.5** a series of embedded mitigation measures are included to avoid destruction of active nests.	Not significant
		Habitat loss leading to indirect disturbance / displacement.	Risk unchanged other wind farms, projects and plans in area.	Not significant	None	Risk unchanged other wind farms, projects and plans in area.
Black-headed gull	Operation	Direct mortality due to collision	Additional mortality	Not significant at national/ county /	See **section 5.6.2.2.**	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
			could occur to populations due to other wind farms in area	regional population scale.		
Common kestrel	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant
Common snipe	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant
Eurasian curlew	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant
Eurasian teal	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
			wind farms in area			
Eurasian wigeon	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant
Great cormorant	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant
Hen harrier	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant
Mallard	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant
Northern	Operation	Direct mortality due to collision	Additional	Significant effect at	See **section**	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
lapwing			mortality could occur to populations due to other wind farms in area	county/regional scale for breeding population only. Not significant at national/ county / regional population scale for wintering population.	**5.6.2.2.**	
Peregrine falcon	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant
Whooper swan	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national/ county / regional population scale.	See **section 5.6.2.2.**	Not significant
IEF Birds Secondary Target Species						
Common buzzard; Eurasian sparrowhawk; grey heron; and gulls (where not recorded as primary target species).	Construction / decommissioning	Disturbance / displacement due to habitat loss	Risk slightly increased due to proximity of other wind farms, projects and plans in the area	Not significant, as surveys suggest habitats outside the Project are more important for foraging, and a lack of breeding or sensitive roosts sites nearby	None	Not significant
	Operation	Disturbance / displacement and barrier effects	Risk slightly increased	Not significant, as surveys suggest habitats outside	None	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
			due to proximity of other wind farms, projects and plans in the area	the Project are more important for foraging, and a lack of breeding or sensitive roosts sites nearby		
IEF Mammals (Non-Bat)						
Badger	Construction / decommissioning	Direct destruction of setts / mortality	No risk	Not significant as no active setts located within 50 m of proposed infrastructure, and habitat enhancement will also help provide compensatory foraging and sheltering habitat.	See **Section 5.5.2.4.**	Not significant
		Indirect loss of foraging, commuting and sheltering habitat	No risk	Not significant	Replant lands will provide compensatory foraging and sheltering habitat.	Not significant
	Operation	Direct loss breeding / resting sites during vegetation clearance to maintain bat mitigation buffers	No risk	Not significant as no setts within 50 m of felling buffers.	See **Section 5.5.3.4.**	Not significant
		Indirect disturbance/displacement	No risk	Not significant	None	Not significant
Pine marten	Construction / decommissioning	Direct destruction of dens / mortality	No risk	Not significant as no dens located within 100 m of proposed infrastructure and habitat enhancement will also help provide compensatory foraging and sheltering habitat.	See **Section 5.5.2.4.**	Not significant
		Indirect loss of foraging,	No risk	Not significant	Replant lands will	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
		commuting and sheltering habitat			provide compensatory foraging and sheltering habitat.	
	Operation	Direct loss of breeding/resting sites during vegetation clearance to maintain bat mitigation buffers	No risk	Not significant as no dens within 100 m of felling buffers.	See **Section 5.5.3.4.**	Not significant
		Indirect disturbance/displacement	No risk	Not significant	None	Not significant
Red squirrel	Construction / decommissioning	Direct destruction of dreys / mortality	No risk	Not significant as no dreys located within 50 m of proposed infrastructure and habitat enhancement will also help provide compensatory foraging and sheltering habitat.	See **Section 5.5.2.4.**	Not significant
		Indirect loss of foraging, commuting and sheltering habitat	No risk	Not significant	Replant lands will provide compensatory foraging and sheltering habitat.	Not significant
	Operation	Direct loss of breeding/resting sites during vegetation clearance to maintain bat mitigation buffers	No risk	Not significant as no dreys within 50 m of felling buffers.	See **Section 5.5.3.4.**	Not significant
		Indirect disturbance/displacement	No risk	Not significant	None	Not significant
Irish hare	Construction / decommissioning	Direct destruction of forms / mortality	No risk	Not significant as construction will be undertaken in daylight hours	See **Section 5.5.2.4.**	Not significant
	Operation	Direct loss of breeding/resting sites during vegetation clearance to maintain bat	No risk	Not significant as vegetation clearance will be undertaken in	See **Section 5.5.3.4.**	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
		mitigation buffers		daylight hours		
		Indirect disturbance/displacement	No risk	Not significant	None	Not significant
Hedgehog	Construction / decommissioning	Direct destruction of hibernacula / mortality if construction takes place in winter months	No risk	Significant at local scale	See **Section 5.5.2.4.**	Not significant
		Indirect disturbance could cause premature emergence from hibernation and starvation	No risk	Significant at local scale	See **Section 5.5.2.4.**	Not significant
	Operation	Direct loss of breeding/resting sites during vegetation clearance to maintain bat mitigation buffers	No risk	Significant at local scale	See **Section 5.5.3.4.**	Not significant
		Indirect disturbance/displacement could cause premature emergence from hibernation and starvation	No risk	Significant at local scale	See **Section 5.5.3.4.**	Not significant
IEF Bats						
Bat assemblage	Construction / decommissioning	Direct destruction / disturbance of roost sites	No risk	Not significant at no roosts were recorded in works footprint of Project	See **Section 5.5.2.5.**	Not significant
	Operation	Indirect disturbance / displacement due to lighting	No risk	Not significant as most recorded bat species (common and soprano pipistrelle and Leisler's bat) are less sensitive to light disturbance; other species only recorded very infrequently	Embedded mitigation and good practice will avoid effects on bats (**Section 5.5.3.5**)	Not significant
		Indirect loss of foraging / commuting features and disturbance by night-time working	No risk	Significant at local scale for species recorded using foraging/commuting features (common and	No night working is proposed as part of embedded mitigation	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
				soprano pipistrelle, and Leisler's bat)	(**Section 5.5.3.5**). Design of Proposed Project designed to avoid disrupting connectivity to landscape. Compensatory measures (**Section 5.5.3.5**) to offset loss of hedgerows and treelines will ensure like-for-like replanting of linear feature lost.	
Common, Nathusius' and soprano pipistrelle, and Leisler's bat	Operation	Direct collision with turbines or barotrauma	Additional mortality could occur to populations due to other wind farms in area	Significant at local scale for all but Nathusius' pipistrelle, which is not significant	Bat buffers will be implemented to reduce collision risk.	Not significant
Myotis species and brown long-eared bat	Operation	Direct collision with turbines or barotrauma	Additional mortality could occur to populations due to other wind farms in area	Not significant due to low activity and collision risk	Bat buffers will be implemented to reduce collision risk.	Operation
IEF Other Fauna						
Amphibians (common frog and smooth	Construction / decommissioning	Direct effects via accidental destruction of spawn.	No risk	Significant at local scale	See **Section 5.5.2.6.**	Not significant
		Indirect loss of foraging habitats	No risk	Not significant as replant	None required	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
newt)				lands will provide compensatory foraging, commuting and sheltering habitat		

Table 5.16: Summary of Effects

5.11 Conclusion

This chapter comprehensively assesses the project which is described throughout.

A proposed mitigation scheme for the construction, operational and decommissioning phases is described in this chapter and these mitigation measures will be implemented in full for the project.

Assuming that the mitigation measures in this Chapter are adopted in full, there are not likely to be any residual significant effects on important ecological features.

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